THE AYURVEDIC PHARMACOPOEIA OF INDIA

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THE AYURVEDIC PHARMACOPOEIA OF INDIA

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LEGAL NOTICES

In India there are laws dealing with drugs that are the subject of monographs which follow. These monographs should be read subject to the restrictions imposed by these laws wherever they are applicable.

It is expedient that enquiry be made in each case in order to ensure that the provisions of the law are being complied with.

In general, the Drugs & Cosmetics Act, 1940 (subsequently amended in 1964 and 1982), the Dangerous Drugs Act, 1930 and the Poisons Act, 1919 and the rules framed thereunder should be consulted.

Under the Drugs & Cosmetics Act, the Ayurvedic Pharmacopoeia of India (A.P.I.), Part-I, Vol.VI, is the book of standards for compound drugs included therein and the standards prescribed in the Ayurvedic Pharmacopoeia of India, Part-I, Vol.VI, would be official. If considered necessary these standards can be amended and the Chairman of the Ayurvedic Pharmacopoeia Committee authorised to issue such amendments. Whenever such amendments are issued the Ayurvedic Pharmacopoeia of India, Part-I, Vol. VI, would be deemed to have been amended accordingly.

GENERAL NOTICES

Title - The title of the book is "Ayurvedic Pharmacopoeia of India". Wherever the abbreviation A.P.I. is used, it may be presumed to stand for the same and the supplements thereto.

Name of the Drugs - The name given on the top of each monograph of the drug is in Sanskrit as mentioned in the Ayurvedic classics and/or in the Ayurvedic Formulary of India, Part-I and Part-II will be considered official. These names have been arranged in English alphabetical order. The Latin name (taxonomical nomenclature) of each drug as found in authentic scientific literature has been provided in the monograph in the introductory paragraph. The official name will be the main title of the drug and its scientific name will also be considered as legal name.

Introductory Para - Each monograph begins with an introductory paragraph indicating the part, scientific name of the drug in Latin with short description about its habit, distribution and method of collection, if any.

Synonyms - Synonyms of each drug appearing in each monograph in Sanskrit, English, Hindi, Urdu and other Indian regional languages have been mentioned as found in the classical texts, Ayurvedic Formulary of India, Part-I and Part-II as procured from the experts, scholars of Ayurveda and officials in the field from different states.

Italics - Italic type has been used for scientific name of the drug appearing in the introductory paragraph of each monograph as also for chemicals and reagents, substances or processes described in Appendix.

Odour and Taste - Wherever a specific odour has been found it has been mentioned but the description as 'odourless' or 'no odour' has in many cases been avoided in the description, as large numbers of drugs have got no specific odour. The "odour" is examined by directly smelling 25 g of the powdered drug contained in a package or freshly powdered. If the odour is discernible the sample is rapidly transferred to an open container and re-examined after 15 minutes. If the odour persists to be discernible, it is described as having odour.

The "Taste" of a drug is examined by taking a small quantity of 85 mesh powder by a tip of moist glass rod and applying it on tongue previously rinsed with water. This may not be done in case if poisonous drugs, indicated in monograph.

Mesh Number - Wherever the powdering of the drug has been required the sieve "Mesh Number 85" has been used. This will not apply for drugs containing much oily substance.

Weights and Measures - The metric system of weights and measures is employed. Weights are given in multiples or fractions of a gramme (g) or of a milligram (mg). Fluid measures are given in multiples or fractions of millilitre (ml).

When the term "drop" is used, the measurement is to be made by means of a tube, which delivers in 20 drops 1 gram of distilled water at 15^{O}C.

Metric measures are required by the Pharmacopoeia to be graduated at 20^{O}C and all measurements involved in the analytical operations of the Pharmacopoeia are intended, unless otherwise stated to be made at that temperature.

Identity, Purity and Strength - Under the heading "Identification" tests are provided as an aid to identification and are described in their respective monographs.

The term “Foreign Matter” is used to designate any matter, which does not form part of the drug as defined in the monograph. Vegetable drugs used as such or in formulations, should be duly identified and authenticated and be free from insects, pests, fungi, micro-organisms, pesticides, and other animal matter including animal excreta, be within the permitted and specified limits for lead, arsenic and heavy metals, and show no abnormal odour, colour, sliminess, mould or other evidence of deterioration.

The quantitative tests e.g. total ash, acid-insoluble ash, water-soluble ash, alcohol-soluble extractive, water- soluble extractive, ether-soluble extractive, moisture content, volatile oil content and assays are the methods upon which the standards of Pharmacopoeia depend. The methods for assays are described in their respective monographs and for other quantitative tests, methods are not repeated in the text of monographs but only the corresponding reference of appropriate appendix is given. The analyst is not precluded from employing an alternate method in any instance if he is satisfied that the method, which he uses, will give the same result as the Pharmacopoeial Method. In suitable instances the methods of microanalysis, if of equivalent accuracy, may be substituted for the tests and assays described. However, in the event of doubt or dispute the methods of analysis of the Pharmacopoeia are alone authoritative.

Standards - For statutory purpose, statements appearing in the API, Part-I, Vol. V, under Description, those of definition of the part and source plants, and Identity, Purity and Strength, shall constitute standards.

Thin Layer Chromatography (T.L.C.) - Under this head, wherever given, the number of spots and Rf values of the spots with their colour have been mentioned as a guide for identification of the drug and not as Pharmacopoeial requirement. However, the analyst may use any other solvent system and detecting reagent in any instance if he is satisfied that the method which he uses, even by applying known reference standards, will give better result to establish the identity of any particular chemical constituent reported to be present in the drug.

Quantities to be Weighed for Assays and Tests - In all description quantity of the substance to be taken for testing is indicated. The amount stated is approximate but the quantity actually used must be accurately weighed and must not deviate by more than 10 per cent from the one stated.

Constant Weight - the term “Constant Weight” when it refers to drying or ignition means that two consecutive weighings do not differ by more than 1.0 mg per g of the substance taken for the determination, the second weighing following an additional hour of drying on further ignition.

Constituents - Under this head only the names of important chemical constituents, groups of constituents reported in research publications have been mentioned as a guide and not as pharmacopoeial requirement.

Percentage of Solutions - In defining standards, the expression per cent (%), is used, according to circumstances, with one of the four meanings given below.

Per cent w/w (percentage weight in weight) expresses the number of grammes of active substance, in 100 grammes of product.

Per cent w/v (Percentage weight in volume) expresses the number of grammes of active substance in 100 millilitres of product.

Per cent v/v (percentage volume in volume) expresses the number of millilitres of active substance in 100 millilitres of product.

Per cent v/w (percentage volume in weight) expresses the number of millilitres of active substance in 100 grammes of product.

Percentage of alcohol - All statements of percentage of alcohol (C_2H_5OH) refer to percentage by volume at 15.56 ^oC.

Temperature - Unless otherwise specified all temperatures refer to centigrade (celsius), thermometric scale.

Solutions - Unless otherwise specified in the individual monograph, all solutions are prepared with purified water.

Reagents and Solutions - The chemicals and reagents required for the test in Pharmacopoeia are described in Appendices.

Solubility - When stating the solubilities of Chemical substances the term "Soluble" is necessarily sometimes used in a general sense irrespective of concomitant chemical changes.

Statements of solubilities, which are expressed as a precise relation of weights of dissolved substance of volume of solvent, at a stated temperature, are intended to apply at that temperature. Statements of approximate solubilities for which no figures are given, are intended to apply at ordinary room temperature.

Pharmacopoeial chemicals when dissolved may show slight physical impurities, such as fragment of filter papers, fibres, and dust particles, unless excluded by definite tests in the individual monographs.

When the expression "parts" is used in defining the solubility of a substance, it is to be understood to mean that 1 gramme of a solid or 1 millilitre of a liquid is soluble in that number of millilitres of the solvent represented by the stated number of parts.

When the exact solubility of pharmacopoeial substance is not known, a descriptive term is used to indicate its solubility.

The following table indicates the meaning of such terms :-

Descriptive terms	***Relative quantities of solvent***
Very soluble	Less than 1 part.
Freely soluble	From 1 to 10 parts.
Soluble	From 10 to 30 parts.
Sparingly soluble	From 30 to 100 parts.
Slightly soluble	From 100 to 1000 parts.
Very slightly soluble	From 1000 to 10,000 parts.
Practically insoluble	More than 10,000 parts.

Therapeutic Uses and Important Formulations – Therapeutic uses and important formulations mentioned in this Pharmacopoeia are, as provided in the recognised Ayurvedic classics and in the Ayurvedic Formulary of India, Part –I and Part-II.

Doses – The doses mentioned in each monograph are in metric system of weights, which are the approximate conversions from classical weights mentioned in Ayurvedic texts. A conversion table is appended giving classical weights of Ayurvedic System of Medicine with their metric equivalents. Doses mentioned in the Ayurvedic Pharmacopoeia of India (A.P.I.) are intended merely for general guidance and represent, unless otherwise stated, the average range of quantities per dose which is generally regarded suitable by clinicians for adults only when administered orally.

It is to be noted that the relation between doses in metric and Ayurvedic systems set forth in the text is of approximate equivalence. These quantities are for convenience of prescriber and sufficiently accurate for pharmaceutical purposes.

Abbreviations of Technical Terms – **The abbreviations commonly employed are as follows:**

m	Metre
l	Litre
mm.	Millimetre
cm.	Centimetre
µ	Micron (0.001 mm)
Kg.	Kilogram
g.	Gramme
mg.	Milligram
ml.	Millilitre
IN.	Normal solution
0.5 N	Half-normal solution
0.1 N	Decinormal solution
1M.	Molar solution
Fam.	Family
PS.	Primary Standards
TS.	Transverse Section

Abbreviations Used for Languages

Sansk.	Sanskrit
Assam.	Assamese
Beng.	Bengali
Eng.	English
Guj.	Gujrati
Kan.	Kannada
Kash.	Kashmiri
Mal.	Malayalam
Mar.	Marathi
Ori.	Oriya
Puj.	Punjabi
Tam.	Tamil
Tel.	Telgu

PREFACE

1. India, due to its unique variety of geographical and climatic factors, has a rich and varied flora of medicinal plants since the dawn of civilization. No wonder that out of a total number of over 15,000 plant species in India about 2000 are known to have medicinal properties and some of them are used as home-remedies in the rural and remotest parts of the country.

2. The vastness of the country with its inadequate means of communication and facilities for transport of drugs coupled with diverse regional languages, gave rise to a multitude of synonyms (names in regional languages for one species). Further, Ayurveda, being a dynamic professional science, led to the successful use of several newer drugs with therapeutic values similar to those which were originally equated with the classical Ayurvedic drugs. These later assumed the name of the very same classical drug and continued to be locally collected, sold and used in that name since the main drug was locally unavailable and substitution became a necessity. Later, in the first half of the century, while scientifically identifying the drugs in vogue in different regions, scientists found that there were more than one species, belonging even to different families of plants, claiming the same classical name of the Ayurvedic drug. 'Brahmi' could be cited as a good example. This created an impression that there existed a great controversy about the real identity of Ayurvedic drugs. Such drugs, were stamped as "controversial drugs" without examining their potential as therapeutic equivalents.

3. Ayurveda had never been static. Its practitioners had been innovative and dynamic in therapeutic practice and tried out drugs from the local flora to discoverer newer medicines with the same therapeutic value as the classical drugs. These newer drugs were accepted by the then practising profession as "substitutes". A study of Ayurvedic literature, reveals several references permitting the use a substitute drug when the classical drug is not available. Such recommendations are based on its therapeutic equivalence, clinical efficacy, and on equivalent status of their Rasa, Guna, Virya, Vipaka and Karma.

4. A few classical drugs of Himalayan origin were limited and seasonal in their occurrence. They could not be grown on plains and hence their use was restricted. By the time they were identified their supply had dwindled and commercial substitution started. These drugs are the "Sandigdha Dravyas" (drugs of doubtful identity) one of which is the 'Ashta Varga', consisting of 8 Single Drugs.

5. During the last 100 years of the alien rule social and economic conditions in India changed due to of urbanisation. Ayurvedic physicians took to cities and lost their contact with forests where their drug sources lay. As a consequence of better transport facilities, trade in crude drugs became easier and suppliers came between the Ayurvedic physician and his personal collection of herbs. Commercial manufacture of Ayurvedic Medicines in factories started. These were the inevitable consequences of the socio-economic changes in the country. The new economic set up was such that the Ayurvedic practitioner could no longer process and prepare his own medicines but had to depend on the big pharmaceutical houses and the suppliers of crude drugs to whatever extent he needed them. There was, in a way, a forced division of labour where he had no choice but to purchase his drugs and no means to ascertain the authenticity of the medicines and formulations offered to him by the pharmaceutical houses, nor was there any Governmental control on the manufacture to ensure the quality of the medicines marketed, prescribed and administered to his patient.

6. As an outcome of the first Health Minister's Conference of 1946, a Committee under the Chairmanship of Lt. Col. R.N. Chopra was appointed in 1946 by the Government of India. It was the Chopra Committee that had first gone into the question of need for proper identification of Ayurvedic medicinal plants, control over collection and distribution of crude drugs and made positive recommendation for compilation of an Ayurvedic Pharmacopoeia. Thereafter, the Dave Committee (1955) reiterated the recommendations for compilation of an Ayurvedic Pharmacopoeia.

7. The Government of Bombay, was specially interested in the survey of resources of Ayurvedic Drugs, their collection, cultivation, farming, distribution and standardization. They, therefore had appointed a Committee for Standard and Genuine Ayurvedic Herbs and Drugs in 1955 and subsequently after receiving its report with fresh set of terms of reference, appointed a second committee called the Committee for Standard Ayurvedic Herbs and Drugs in 1957 both under the Chairmanship of Vaidya Bapalal Shah, of which Professor A.N. Namjoshi was the Member Secretary. The Bapalal Committee had very elaborately recommended the compilation of the Ayurvedic Pharmacopoeia as an urgent prerequisite for effective control of Ayurvedic Drugs to ensure quality

assurance. Finally Government of India appointed the "Ayurvedic Research Evaluation Committee", under the Chairmanship of Dr. K.N. Udupa (1958) which had strongly highlighted the urgency of the compilation of an Ayurvedic Pharmacopoeia.

8. In compliance with some of these recommendations, the Union Government as also some of the State Governments had started taking positive steps. The Government of Bombay State established its Board of Research in Ayurveda, Bombay in 1951, which was subsequently reconstituted in 1955 and 1958. The Government of India established CCRIMH in 1969 for research in all aspects including drug standardisation in Indian Medicine & Homoeopathy. This Council was divided into 4 research councils in 1978 and the research work in Ayurveda and Siddha was entrusted to the Central Council for Research in Ayurveda & Siddha. The PLIM, at Ghaziabad was established in 1970 for testing and standardisation of single drugs and compound formulations. Under the auspices of the Central Council for Research in Ayurveda and Siddha, several survey units in different States were established and work of standardisation of single drugs and compound medicines as also composite research work was initiated. The first Ayurvedic Pharmacopoeia Committee was constituted in 1962 under the Chairmanship of Col. Sir Ram Nath Chopra. The Committee was reconstituted in 1972 under the Chairmanship of Prof. A.N. Namjoshi which took over the work of compilation of the Ayurvedic Formulary of India as a pre-requisite for under taking the work of Ayurvedic Pharmacopoeia of India.

9. After publication of the First and the Second part of the Ayurvedic Formulary of India, Part-III of the Formulary is under preparation. A list of single drugs, which enter into the formulations, has been prepared. Collection of data from published material and from experimental work in collaborative laboratories to produce necessary data is being done under the auspices of the Ayurvedic Pharmacopoeia Committee.

10. The First and Second Part of the Ayurvedic Formulary of India comprising of some 444 and 191 formulations respectively cover more than 351 single drugs of plant origin. This is part of about 500 priority drugs of plant origin to come within the ambit of the Ayurvedic Pharmacopoeia of India.

11. While systematic efforts are on to introduce quality control, over the ayurvedic drugs during the post-independence period, it is interesting to note that the great strides made by the western or modern system of medicine, with its formidable armoury of synthetic drugs, chemo-therapeutic agents and antibiotics, are slowing down gradually with the realization of their adverse effects causing damage to the human systems. The western world is coming to accept the value of herbal medicines, appreciate and understand the basic philosophy of Ayurveda, which initially appeared to be rather abstract and difficult to interpret in terms of modern medical sciences.

12. With the introduction of legislative measures for quality control, a process initiated some 50 years ago, there would be some uniformity in the Ayurvedic medicines marketed, in so far as their identity, purity and strength are concerned. The physician and the patient would be assured of the quality of the medicine through proper drug control measures. The efforts to publish an Ayurvedic Formulary of India and to compile the Ayurvedic Pharmacopoeia of India intend to serve the profession and the public through proper quality assurance.

13. The Union Government have brought the Ayurvedic Drugs under the purview of the Drugs and Cosmetic Act 1940 from 15-9-1964. The publication of the Ayurvedic Formulary of India and the Ayurvedic Pharmacopoeia of India strengthens the Government in the enforcement of the Act in respect of standards.

14. The State Government found it difficult to implement the requirements of the Act, in so far as the analytical quality control was concerned, although they had already implemented the administrative requirements, such as manufacturing licenses, qualification of staff, suitability of premises, equipment etc., The fledgling ayurvedic industry could have its own 'in-house' standards, as indeed some had, but it was necessary to subject their products to the vigilance of the Regulatory body.

15. In view of the need of the hour to implement the Drugs and Cosmetics Act, the Ayurvedic Pharmacopoeia Committee has made a modest effort to lay down standards for single drugs relying on experimental data worked out from scratch at the PLIM, Ghaziabad and some of the units of the Central Council for Research in Ayurveda and Siddha. Absence of published scientific literature on the subject hampered their work, and delay was inevitable

16. The Western countries did pass through this phase about 150 years ago and took up the task of preparation for a pharmacopoeia. Endeavor by universities and manufactures in Britain and other European countries resulted in scientific data for drafting the pharmacopoeial monographs for single drugs. Thus, scientific

data was available for compilation of the modern pharmacopoeia, but for compilation of the Ayurvedic Pharmacopoeia little information and published data exists and the Ayurvedic Pharmacopoeia Committee had to initiate basic research.

17. It is worthwhile noting that the principle of quality control for medicines were well known to the Ayurvedic physicians and indeed followed by them in their practice. This is evident from the classical Sanskrt texts, where elaborate instructions are set down with great vision, in an astonishingly rational and scholarly manner, suitable to the conditions then prevalent. The description of Eranda and Guduci in Bhavaprakasa bear witness to this. Modern methods of analysis advocated in the present Ayurvedic pharmacopoeia for identity and purity have benefited greatly from the original texts. What modern medicine has achieved is an explanation of the principles of quality control with greater precision, backing them with experimental evidence to bring about their universal acceptance.

18. The Ayurvedic Pharmacopoeia of India Part–I**,** Vol-I, II, III, IV and V comprises 80, 78, 100, 68 and 92 monographs of Ayurvedic single drugs of plant origin, which go into one or more formulations included in the Ayurvedic Formulary of India Part-I and Part-II. In compiling the monographs, the title of each drug has been given in Sanskrit as present in the Ayurvedic Formularies of India. This is followed by a definition of the drug giving its identity in scientific nomenclature and a very brief information about its source, occurrence, distribution and precautions in collection if any, etc. This is followed by a list of synonyms in Sanskrit and also in the other Indian regional languages. The monographs then record detailed Macroscopic and Microscopic description of the drug having pharmacognostic value in identification, especially when the drug is in powder form. This volume has also included monographs on certain products like ghee, potable water, products of Saccharum officinarum L. like sharkara, jaggery and also natural product like honey. Apart from this, the monographs on exotic but domesticated plants which are in routine uses are also included, like Eucalyptus oil and Peppermint satva (Menthol). Along with 93 single drugs of plant origin, this volume also includes certain other drug substances like animal products, processed or extracted materials, and major adjuvant, vehicles etc., that appear in formulations either as ingredients or as processing adjuvant.

19. The monograph then gives chemical norms and limits under "Identity, Purity and Strength" like tolerance for foreign matter, total ash, acid insoluble ash, alcohol soluble extractive, water soluble extractive, volatile oil contents etc. Some of them have a direct bearing on the purity and strength, while others aid in detecting substitution or adulteration, if any. Where possible and known, Assay of an active constituent or group of constituents like total alkaloids or total volatile oils have been given. However, under the heading 'Constituents' one or more constituents or group of constituents like oleoresins, essential oils, alkaloids have been mentioned which only have an informative value based on published research work in phytochemistry. In all the proximate analytical values set for ash and extractives, only a maximum or minimum value for limit has been attempted. It is worth mentioning that there is always a wide variation in analytical results among crude drugs of plant origin in respect of their chemical contents, due to varied climatic conditions, geographical distribution, source and season of collection and differing methods of storage and preservation. Therefore, variation in results of chemical analysis create a great difficulty in fixing a narrow range of limits for single drugs. However, the data has been fixed on the basis of results from as many samples as possible, procured from different sources.

20. In each of the monographs, classical attributes of respective drugs according to the doctrine of Rasa, Guna, Virya, Vipaka and Karma have been kept intact. They may appear abstract and unsupported by established experimental methods to define them, but are considered a reasonable basis and convenient reference point for a clinical classification. However, since they cannot be validated by modern scientific methods, they are not mandatory.

21. The Legal Notices and General Notices have been given for the attention of the Pharmaceutical suppliers and regulatory authorities. Details about the apparatus, reagents and solutions, tests, methods of preparation of specimens for microscopical examinations have been given in Appendices.

22. The Committee hopes that the publication of the Ayurvedic Pharmacopoeia of India Part I, Vol. VI comprising of 93 single drugs of vegetables origin would add to the requirements under the Drugs and Cosmetics Act. The regular monitoring of the manufactured and marketed ayurvedic drugs, on the basis of the standards prescribed therein would bear evidence of the usefulness of these volumes and help enhance their quality and status in revisions for the future.

23. The Committee urges the Government of India to recommend the adoption of these monographs for the purposes of identity, purity and strength of drugs for use in their Government, Semi-Government and Government aided institutions and voluntary public organisations. The Ayurvedic Pharmacopoeia of India, 2005, Part-I, Vol. V would be added to Rule 168 of the Drugs and Cosmetics Act and be notified by Government as standards to be complied with by the manufacturers for sale or distribution of Ayurvedic drugs. Ayurvedic Pharmacopoeia of India Part-I, Vol. I, II, III, IV and V are already included in the First Schedule of Drugs & Cosmetics Act 1940.

24. The Ayurvedic Pharmacopoeia Committee records the appreciation of the Directors, Officer In-charges, Project Officers and scientific staff of all the contributing laboratories and institutions those were associated with the project work on developing Pharmacopoeial Standards. The present volume of Ayurvedic Pharmacopoeia of India comprises the technical work contributed by these laboratories and institutions.

25. On behalf of the Ayurvedic Pharmacopoeia Committee, I have pleasure in placing on records our sincere thanks and appreciation to the Government of India, State Governments, Institutions, Councils, Scientists and Ayurvedic Scholars for their whole hearted co-operation in preparing the monographs on Single Drugs. I sincerely thank all the members of the Ayurvedic Pharmacopoeia Committee without whose co-operation this volume would not have seen the light of day. My thanks are due Dr. D.R. Lohar, Director I/c, PLIM, Ghaziabad and his colleagues viz., Dr. Rajeev Kr. Sharma, Senior Scientific Officer (Pharmacognosy), Shri N.S. Mahara, R.O. (Phg.), Dr. Jai Prakash, R.O. (Chem.), Shri V. C. Srivastava, Sr. Research Assistant (Chem.), Shri B.B. Prasad, R.A. (Botany), Shri S.K. Gaur, R.A. (Chem.), Shri C. Arunachalam, R.A. (Botany), Shri R.K. Pawar, R.A. (Chem.), Shri Rajendra Singh, Lab. Asstt. (Chem.) and Shri Sanjeev Gupta, Lab. Asstt. (Botany) who deserve my special thanks for this endeavour. My thanks are also due to Dr. M.M. Padhi, Deputy Director (Tech.); Shri K.G. Vasantha Kumar, Asst. Director (Chem.), Dr. Pramila Pant, Research Officer (Chem.), Sri. Ravinder Singh, Research Officer (Chem.), Dr. Chhote Lal, Dr. A.K.S. Bhadoria and Dr.M.N. Rangne, Dr. S.K. Meher, Research Officer (Ayu.), Dr. Bishnu Priya Dhar, Research Officer (Pharmacognosy), Dr. K. Sandhya Rani, S.R.F. (Ayu.) and other associated officers, who contributed a lot in finalizing the volume. My special thanks to Mr. Sandeep Kumar, Mr. Ashish Kumar & Ms. Deepti Anand, D.E.O., who took pains in typing and arranging all the technical data into a final shape.

(DR. G. S. LAVEKAR)
DIRECTOR CCRAS & MEMBER SECRETARY
AYURVEDIC PHARMACOPOEIA COMMITTEE

INTRODUCTION

The Ayurvedic system of medicine is prevalent in India since the Vedic period and as early as the dawn of human civilization. Though Ayurveda has undergone many changes in the course of its long history, it still remains the mainstay of medical relief to a large section of the population of the nation. Due to urbanisaton and dwindling of forests, the Vaidya was no longer self sufficient in collecting and preparing his own medicines as before. He had come to depend on outside agencies for collecting and supplying the crude drugs be required. Others undertaking mass production of medicines in Ayurvedic Pharmacies on commercial scale, took over the role of the Vaidya - Pharmacist also.

2. In view of the such trend in the Ayurvedic field Govt. of India considered it expedient to extend the Drugs and Cosmetics Act, 1940, to the Ayurvedic, Siddha and Unani drugs to a limited measure.

3. The Act was accordingly amended in 1964, to ensure only a limited control over the production and sale of these medicines namely:-

i. The manufacture should be carried under prescribed hygienic conditions, under the supervision of a person having prescribed qualifications;

ii. The raw materials used in the preparation of drugs should be genuine and properly identified; and

iii. The formula or the true list of all the ingredients contained in the drugs should be displayed on the label of every container.

4. To start with, development of standards for the identity, purity and strength of single drugs and formulations at a later stage, assumed importance for the effective enforcement of the provision of the Act. If the raw materials to be used in a medicine and stage-by-stage processes of manufacturers were standardised, the final product namely, the compound formulation could be expected to conform to uniform standards. The requirements that the list of ingredients be displayed on the label will enable analysts in important cases to verify label claims and to that extent will bind the manufacture to a true claim. Arrangements to evolve and lay down physical, chemical and biological tests, wherever necessary, to identify the drugs and ascertain their quality and to detect adulterations are an urgent necessity of the profession. Setting up of Drug Standardisation Units, Research Centres, Drug Testing Institutes and Central Drug Laboratories for Ayurvedic Medicines both at the All-India and Regional levels for this purpose are therefore, essential. The several Committees appointed by the Government of India to assess and evaluate the status and practice of Ayurvedic Medicine have stressed the importance of preparing an Ayurvedic Pharmacopoeia.

5. Having regard to all these considerations, the Central Council of Ayurvedic Research recommended the constitution of Ayurvedic Pharmacopoeia Committee consisting of experts on Ayurveda and other sciences. The Government of India accepted the recommendations of the Central Council of Ayurvedic Research and constituted the First Ayurvedic Pharmacopoeia Committee, vide their letter No. 14-8/62-ISM, dated the 20th September, 1962 for a period of three years with effect from the date of its first meeting under the Chairmanship of Col. Sir R.N. Chopra with the following member :-

1. Col. Sir Ram Nath Chopra, Drugs Research Laboratory, Srinagar. *Chairman*

2. Vaidya B.V. Gokhale, 29/14-15, Erandavane, Deccan Gymkhana, Poona-4. *Member*

3. Vaidya D.A. Kulkarni, Principal, Post Graduate, Training Centre in Ayurveda, Jamnagar. *Member*

4. Kaviraj B.N. Sircar, 779-780, Nicholson Road, Kashmere Gate, Delhi-6. *Member*

5. Shri A.N. Namjoshi, Navyug Mansion, 19-A, Sleater Road, Bombay-7. *Member*

6. Dr. B.B.Gaitonde, Professor of Pharmacology, Grant Medical College, Bombay. *Member*

7. Dr. C.G. Pandit, Director, Indian Council of Medical Research, New Delhi. *Member*

8. Dr. G.K. Karandikar, Dean, Medical College, Aurangabad. *Member*

9. Dr. G.S. Pande, Honorary Director, Indian Drug Research Association, 955-Sadashiv Peth, Lakshmi Road, Poona-2. *Member*

10. Dr. M.V. Venkataraghava, Chellakoti, Nungabakkum, Madras-34. *Member*

11. Ayurvedachara Kaladi K. Parameswaran Pillai, Laksmivilasam Vaidyasala, Vanchiyur, Trivandrum. *Member*

12. Dr. V. Narayanaswamy, 70, Tana Street, Vepeiy, Madras-7. *Member*

13. Vaidya P.V.Dhamankar Shastri, Pardeshi Lane, Panvel, District Kolaba, Bombay. *Member*

14. S.K. Borkar, Drug Controller (India), Directorate General of Health Services, Government of India, New Delhi. *Member*

15. Shri Bapalal G.Vaidya, Principal, O.H. Nazar Ayurveda Mahavidyalaya, Surat. *Member*

16. Kumari Savita Satakopan, Drugs Control Laboratory, Near Polytechnic, National Highway 8, Baroda. *Member*

17. Vaidya Vasudev M. Dwivedi, Director of Ayurveda, Government of Gujrat, Ahmedabad. *Member*

18. Shri P.V. Bhatt, M.Sc., Chemist, The Ayurvedic Rasashala, Deccan Gymkhana, Poona. *Member*

19. Vaidya Ram Sushil Singh, Assistant Director of Ayurveda, Director of MedicalServices, (Ayurveda), Govt. of U.P. *Member*

20. Dr.Y. Kondal Rao,Secretary, Indian Medical Practitioner's Cooperative Pharmacy & Stores Limited, Adyar, Madras-20. *Member*

21. Dr. V. Srinivasan, M.Sc., M.B.B.S., Ph.D., Director, Sarabhai Chemicals Research Institute, Shahibag, Ahmedabad-4. *Member*

22. Dr. C. Dwarakanath, Adviser in Indian System of Medicine, *Member Secretary*
Ministry of Health, New Delhi.

The Committee was assigned the following functions :-

1. To prepare an official Formulary in two parts :-

   (a) Single drugs, of whose identity and therapeutic value there is no doubt; and

   (b) Compound preparations, which are frequently used in Ayurvedic practice throughout the country.

2. To provide standards for drug and medicines of therapeutic usefulness or pharmaceutical necessity commonly used in Ayurvedic practice.

3. To lay down tests for identity, quality and purity.

4. To ensure as far as possible uniformity, physical properties and active constituents; and

5. To provide all other information regarding the distinguishing characteristics, methods of preparation, dosage, method of administration with various anupanas or vehicles and their toxicity.

As a first step in this direction the Ayurvedic Pharmacopoeia Committee started preparing the official Formulary of Ayurveda in two parts as mentioned under the assigned functions of the Committee. Since the work of preparation of Ayurvedic Formulary could not be completed the expiry of first three years, the Government of India extended the term of the Committee by another three years, vide their notification No. F. 20-1/66-RISM, dated 14th January, 1966 and again for a further period of three years vide their notification No. F. 1-1/69-APC, dated 9th January, 1969. During the years that followed, Ayuurvedic Formulary Part-I and II and Ayurvedic Pharmacopoeia of India-Part-I, Volume I-V were published, the former containing the compound formulations from classical Ayurvedic texts prescribed in Schedule-I to the Drug and cosmetic Act and Cosmetics Act, and the latter, laying down standards for single drugs of plant origin. Amendment to the provisions introduced in 1982 further strengthened the ASU system by defining misbranded, adulterated and spurious drugs in the ASU system.

Subsequently under the 10th Five Year Plan a project was initiated by the Department to develop Method of Preparation, Standard Operative Procedures, Pharmacopoeial Standards and Shelf Life of Compound formulations of Ayurveda appearing in Ayurvedic Formulary of India, Parts I & II.

The work of the Ayurvedic Pharmacopoeia Committee was transferred along with some technical staff to Central Council for Research in Ayurveda and Siddha, New Delhi as a secretariat for APC vide letter no. X-19011/6/94-APC (AYUSH), dated 29th March, 2006.

Prof. A.N. Namjoshi (*1972, 1981*, *1988* and *1994*), Vaidya I. Sanjeeva Rao (*1998*) and Dr. P.D. Sethi (*2001*) were Chairmen of reconstituted Ayurvedic Pharmacopoeia Committee during the specified periods.

The present Ayurvedic Pharmacopoeia Committee (APC) was reconstituted under the Deptt. of AYUSH vide letter No.X-19011/6/94-APC (AYUSH) dated 9st March, 2006 consisting of following members.

Ms. Savita Satakopan, M.Sc.
(Former Drug Analyst),
Government of Gujarat,
Seventh Street,
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Prof. S.S. Handa, M. Pharma, Ph.D.,
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522-A, Block 'C',
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Dr. S.K. Sharma, M.D. (Ayu.), Ph.D. — Vice-Chairman
Advisor (Ayurveda),
Department of AYUSH,
Red Cross Society Building,
New Delhi – 110 001.

OFFICIAL MEMBERS

1. Dr. G.S. Lavekar, AVP; Ph.D. — Member-Secretary (Ex-officio)
Director,
Central Council for Research in Ayurveda & Siddha,
61-65, Institutional Area,
D-Block, Janakpuri,
New Delhi – 110 058.

2. Dr. D.R. Lohar, M.Sc.; Ph.D. — Member (Ex-officio)
Director I/C,
Pharmacopoeial Laboratory for Indian Medicine,
Central Govt. Offices Complex,
Kamla Nehru Nagar,
Ghaziabad – 201 002.

3. Managing Director, — Member (Ex-officio)
Indian Medicines Pharmaceutical Corporation Ltd.,
Mohan, Via – Ram Nagar,
Distt.- Almora, Uttranchal.

4. Drugs Controller General (India), — Member (Ex-officio)
Ministry of Health & Family Welfare,
Nirman Bhawan, New Delhi – 110 011.

NON-OFFICIAL MEMBERS

Phytochemistry & Chemistry Sub-Committee

1.	Prof. V.K. Kapoor, M. Pharm., Ph.D. (Former Dean and Chairman, University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh) 1473, Pushpac Complex, 49B, Chandigarh - 160 047.	Chairman
2.	Prof. S.S. Handa, M. Pharm., Ph.D., (Former Director, RRL), 522-A, Block 'C', Sushant Lok, Phase-I, Gurgaon, Haryana – 122 001.	Member
3.	Dr. P.D. Sethi, M. Pharm., Ph.D., (Former Director Central Indian Pharmacopoeial Laboratory) B-140, Shivalik Enclave, New Delhi – 110 017.	Member
4.	Shri J.K. Dhing, M.Sc. Former Chief Manager (Exploration), Hindustan Copper Ltd., SF-8, Sector-5, (Gayatri Nagar) Hiran Magri, Udaipur – 313 002. (Rajasthan).	Member

Pharmacognosy Sub-Committee

1.	Ms. S. Satakopan, M.Sc (Former Drug Analyst), Government of Gujarat, 7/4, Padmam Flats, Seventh Street, Nanganallur, Chennai – 600 061.	Chairman
2.	Dr. (Mrs.) Shanta Mehrotra, M.Sc., Ph.D., Emeritus Scientist, National Botanical Research Institute, Rana Pratap Marg, P.B. No.-436, Lucknow – 226 001 (U.P.).	Member
3.	Dr. M.A. Iyengar, M. Pharma, Ph.D, Prof. of Pharmacognosy (Retd.), 14, HIG, HUDCO, Manipal – 576 119.	Member

4.	Dr. J. Mohanasundraram, M.D., Former Professor of Pharmacology & Deputy Director of Medical Education, Chennai.	Member

Formulary Sub-Committee
(Rasa Shastra / Bhaishajya Kalpana – Ayurvedic Pharmacy)

1.	Prof. S.K. Dixit, A.B.M.S.; D.Ay.M; Ph.D. (Former Head, Deptt. of Rasa Shastra, BHU), B-3/402, Shivala, Varanasi 221 005 (UP.).	Chairman
2.	Dr. B.L. Gaur, Ph.D.; Vice-Chancellor, Jodhpur Ayurvedic University, Jodhpur, Rajasthan,	
3.	Prof. Siddhinandan Mishra, G.B.M.S.; Ph.D. Pharmacy In-charge, SDM Ayurvedic College, P.O. Kuthpady, Udupi – 574 118, (South Karnataka).	Member
4.	Prof. Ved Vrat Sharma, H.P.A. (Former Principal, DAV Ayurvedic College), House No. 65, Sector-8, Panchkula, Haryana.	Member
5.	Dr. P.K. Prajapati, M.D. (Ay.), Ph. D., Reader & Head, Deptt. of Ras Shastra, IPGT & RA, Gujarat Ayurved University, Jamnagar, Gujarat – 361 008.	Member
6.	Dr. Narendra Bhatt, M.D. (Ay.), Chief Executive Officer, Zandu Pharmaceutical Works Ltd., 70, Ghokhle Road (South), Dadar, Mumbai – 400 025.	Member
7.	Shri Ranjit Puranik, General Manager, Shree Dhootapapeshwar Ltd., 135, Nanubhai Desai Road, Khetwadi, Mumbai.	Member

(Single Drugs of Plants, Minerals, Metals, Animal origin)

1.	Prof. V.K. Joshi, M.D. (Ay.), Ph.D. Deptt. Dravyaguna, Institute of Medical Sciences, Banaras Hindu University (BHU), Varanasi – 221 005 (U.P.).	Chairman
2.	Prof. K.C. Chunekar, Ph.D. (Former Reader, Deptt. of Dravyaguna, BHU), 18/7, Ratan Phatak, Varanasi, (U.P.).	Member
3.	Vaidya Devender Triguna, Ayurvedacharya, "PADAM SHREE", 143-Sarai Kale Khan, Nizamuddin East, New Delhi.	Member
4.	Dr. M.R. Uniyal, M.D. (Ay.), Ph.D. (Former Director, CRIA, CCRAS), Director (Drugs), Maharishi Ayurved Products, 17/18, NOIDA Export Processing Zone, NOIDA – 201 305.	Member
5.	Prof. V.V. Prasad, Director, Rashtriya Ayurveda Vidyapeeth, Dhanvantri Bhawan, Road No. 66, Punjabi Bagh (West), New Delhi – 110 026.	Member

1.	Dr. G.V. Satyavathi, Former Director General-ICMR, Prasad-Nilaya, D-55/82, EAST-END (B), Main Road, 9th Block, Jaynagar, Bangalore –500069.
2.	Dr. G.P. Dubey, Ex.Dean, Ayurveda, Project Investigator, Center of Psychosomatic & Biofeedback Medicine, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi – 221 005.

1. The term of the Committee shall be for a period of three years from the date of its first meeting and the members shall hold office for that period.

2. The Chairman of the APC shall have the powers to form sub-committees whenever required and to co-opt experts from outside for such sub-committees.
The Committee shall have the power to frame procedures of functioning.
The functions of the Committee shall be as follows:

(i) To prepare Ayurvedic Pharmacopoeia of India of single and compound drugs.
(ii) To prescribe the working standards for compound Ayurvedic formulations including tests for identity, purity, strength and quality so as to ensure uniformity of the finished formulations.
(iii) Keeping in view the time constraint, to identify such methods, procedures and plan of work as would enable to publish the formulary and standards of all commonly used drugs to be brought out in a phased manner.
(iv) To prepare remaining parts of the official formulary of compound preparations from the classical texts including standardized composition of reputed institution.
(v) To develop and standardize methods of preparations, dosage form, toxicity profile etc.
(vi) To develop quality standards, safety, efficacy profile of intermediates likes extracts of Ayurvedic raw drugs.
(vii) To develop the quality standards, safety, efficacy profile of different parts of the plants; as well as to include new plants as Ayurvedic drugs.
(viii) Any other matter relating to the quality standards, shelf life, identification, new formulations etc.

3. The following are the targets focus of the Committee:

(i) To evolve standards of single drugs mentioned in the Ayurvedic Formularies of India.
(ii) To evolve standards for compound formulations mentioned in the Ayurvedic Formularies of India & other Ayurvedic formulations of National Priority.
(iii) To prepare draft SOP of formulations of Ayurvedic Formularies of India from the classical texts and other authentic sources.

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ABBREVIATIONS FOR PARTS OF PLANTS

Exudate	EXD.
Flower	FL.
Fruit	FR.
Fruit Rind	FR. RIND
Heart Wood	HT. WD.
Leaf	LF.
Leaf Base	LF. BASE
Root Bark	RT. BK.
Root	RT.
Rhizome	RZ.
Seed	SD.
Stilt Root	STILT RT.
Stem Bark	ST. BK.
Stem	ST.
Tuberous Root	TUB. RT.
Whole Plant	WH. PL.

Indo – Romanic Equivalents of Devanagari Alphabets

अ	**a**	ड	**ḍa**
आ	**ā**	ढ	**ḍha**
इ	**I**	ण	**ṇa**
ई	**ī**	त	**ta**
उ	**u**	थ	**tha**
ऊ	**ū**	द	**da**
ऋ	**ṛ**	ध	**dha**
ए	**a**	न	**na**
ऐ	**ai**	प	**pa**
ओ	**o**	फ	**pha**
औ	**au**	ब	**ba**
ं	**ṁ**	भ	**bha**
:	**ḥ**	म	**ma**
क	**ka**	य	**ya**
ख	**kha**	र	**ra**
ग	**ga**	ल	**la**
घ	**gha**	व	**va**
ङ	**ṅa**	श	**śa**
च	**ca**	ष	**ṣa**
छ	**cha**	स	**sa**
ज	**ja**	ह	**ha**
झ	**jha**	क्ष	**kṣa**
ञ	**ña**	त्र	**tra**
ट	**ṭa**	ज्ञ	**jña**
ठ	**ṭha**		

MONOGRAPHS PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA
PART-I, VOL.-I

1.	Ajagandha (Sd.)	*Cleome gynandra* Linn.
2.	Ajamoda (Frt.)	*Apium leptophyllum* (Pers.) F.V.M. ex Benth.
3.	Amalaki (Fr. Frt. Pulp)	*Emblica officinalis* Gaertn.
4.	Amalaki (Drd. Frt.)	*Emblica officinalis* Gaertn.
5.	Aragvadha (Frt. Pulp.)	*Cassia fistula* Linn.
6.	Arka (Rt.)	*Calotropis procera* (Ait.) R. Br.
7.	Arka (Lf.)	*Calotropis procera* (Ait.) R. Br.
8.	Asana (Ht.Wd.)	*Pterocarpus marsupium* Roxb.
9.	Ashoka (St. Bk.)	*Saraca asoca* (Rosc.) DC. Willd.
10.	Asvagandha (Rt.)	*Withania somnifera* Dunal.
11.	Asvattha (Bk.)	*Ficus religiosa* Linn.
12.	Atasi (Sd.)	*Linum usitatissimum* Linn.
13.	Atibala (Rt.)	*Abutilon indicum* (Linn.) Sw.
14.	Ativisa (Rt.)	*Aconitum heterophyllum* Wall. ex Royle
15.	Babbula (St.Bk.)	*Acacia nilotica* (Linn.) Willd. ex Del. sp. *indica* (Benth.) Brenan
16.	Bakuci (Frt.)	*Psoralea corylifolia* Linn.
17.	Bibhitaka (Frt.)	*Terminalia belerica* Roxb.
18.	Bilva (Frt. Pulp)	*Aegle marmelos* Corr.
19.	Candrasura (Sd.)	*Lepidium sativum* Linn.
20.	Citraka (Rt.)	*Plumbago zeylanica* Linn.
21.	Dhanyaka (Frt.)	*Coriandrum sativum* Linn.
22.	Dhataki (Fl.)	*Woodfordia fruticosa* (Linn.) Kurz.
23.	Eranda (Rt.)	*Ricinus communis* Linn.
24.	Gambhari (Rt. Bk.)	*Gmelina arborea* Roxb
25.	Goksura (Rt.)	*Tribulus terrestris* Linn.
26.	Goksura (Frt.)	*Tribulus terrestris* Linn.
27.	Guduci (St.)	*Tinospora cordifolia* (Willd.) Miers.
28.	Guggulu (Exudate)	*Commiphora wightii* (Arn.) Bhand.
29.	Gunja (Sd.)	*Abrus precatorius* Linn.
30.	Haridra (Rz.)	*Curcuma longa* Linn.
31.	Haritaki (Frt.)	*Terminalia chebula* Retz.
32.	Hingu (Oleo-Gum-Resin)	*Ferula foetida* Regel.
33.	Jatamansi (Rz.)	*Nardostachys jatamansi* DC.
34.	Jatiphala (Sd.)	*Myristica fragrans* Houtt.
35.	Kampilla (Frt.)	*Mallotus philippinensis* Muell.-Arg.
36.	Kancanara (St. Bk.)	*Bauhinia variegata* Blume
37.	Kankola (Frt.)	*Piper cubeba* Linn. f.
38.	Kantakari (W.P.)	*Solanum surattense* Burm. f.
39.	Kanyasara (Lf.)	*Aloe barbadensis* Mill.
40.	Karanja (Sd.)	*Pongamia pinnata* (Linn.) Merr.
41.	Karavira (Lf.)	*Nerium indicum* Mill.
42.	Karkatasrngi (Gall)	*Pistacia chinensis* Burgo
43.	Karpasa (Sd.)	G*ossypium herbaceum* Linn.
44.	Kaseru (Rz.)	*Scirpus kysoor* Roxb.
45.	Ketaki (Rt.)	*Pandanus tectorius* Soland. ex Parkinson
46.	Khadira (Ht.Wd.)	*Acacia catechu* (Linn. f.) Willd.
47.	Kiratatikta (W.P.)	*Swertia chirata* Buch.-Ham.

48.	Krsnajiraka (Frt.)	*Carum carvi* Linn.
49.	Kulattha (Sd.)	*Vigna unquiculata* (Linn.) Walp.
50.	Kustha (Rt.)	*Saussurea lappa* C.B. Clarke
51.	Kutaja (St. Bk.)	*Holarrhena antidysenterica* (Roth) A. DC.
52.	Lavanga (Fl. Bud)	*Syzygium aromaticum* (Linn.) Merr. & M.Perry
53.	Lodhra (St. Bk.)	*Symplocos racemosa* Roxb.
54.	Madana (Frt.)	*Xeromphis spinosa* (Thunb.) Keay
55.	Misreya (Frt.)	*Foeniculum vulgare* Mill.
56.	Nyagrodha (St. Bk.)	*Ficus bengalensis* Linn.
57.	Pasanabheda (Rz.)	*Bergenia ciliata* (Haw.) Sternb.
58.	Patha (Rt.)	*Cissampelos pareira* Linn.
59.	Puga (Sd.)	*Areca catechu* Linn.
60.	Punarnava (Rakta) (W.P.)	*Boerhaavia diffusa* Linn.
61.	Saptaparna (St. Bk.)	*Alstonia scholaris* (Linn.) R. Br.
62.	Sati (Rz.)	*Hedychium spicatum* Ham. ex Smith
63.	Snuhi (St.)	*Euphorbia neriifolia* Linn.
64.	Suksmaila (Frt.)	*Elettaria cardamomum* (Linn.) Maton
65.	Sunthi (Rz.)	*Zingiber officinale* Roxb.
66.	Svarnapatri (Lf.)	*Cassia angustifolia* Vahl.
67.	Svetajiraka (Frt.)	*Cuminum cyminum* Linn.
68.	Sveta Sariva (Rt.)	*Hemidesmus indicus* (Linn.) R. Br.
69.	Tagara (Rz.)	*Valeriana wallichii* DC.
70.	Tamalaki (Rt., St. & Lf.)	*Phyllanthus fraternus* Webst.
71.	Tvak (Bk.)	*Cinnamomum zeylanicum* Blume
72.	Tvakapatra (Lf.)	*Cinnamomum tamala* (Buch.-Ham.) Nees & Eberm.
73.	Udumbara (Bk.)	*Ficus racemosa* Linn.
74.	Upakuncika (Sd.)	*Nigella sativa* Linn.
75.	Varuna (St. Bk.)	*Crataeva nurvala* Buch.-Ham.
76.	Vasa (Lf.)	*Adhatoda vasica* Nees
77.	Vidanga (Frt.)	*Embelia ribes* Burm.f.
78.	Vijaya (Lf.)	*Cannabis sativa* Linn.
79.	Yasti (St. & Rt.)	*Glycyrrhiza glabra* Linn.
80.	Yavani (Frt.)	*Trachyspermum ammi* (Linn.) Sprague ex Turril

MONOGRAPHS PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL. II

1.	Akarakarabha (Rt.)	*Anacyclus pyrethrum* DC.
2.	Aksoda (Cotldn.)	*Juglans regia* Linn.
3.	Amrata (St. Bk.)	*Spondias pinnata* (Linn. f.) Kurz.
4.	Apamarga (W.P.)	*Achyranthes aspera* Linn.
5.	Aparajita (Rt.)	*Clitoria ternatea* Linn.
6.	Ardraka (Rz.)	*Zingiber officinale* Rosc.
7.	Arimeda (St.Bk.)	*Acacia leucophloea* Willd.
8.	Arjuna (St.Bk.)	*Terminalia arjuna* W.& A.
9.	Bhallataka (Frt.)	*Semecarpus anacardium* Linn.
10.	Bhrngaraja (W.P.)	*Eclipta alba* Hassk.
11.	Brahmi (W.P.)	*Bacopa monnieri* (Linn.) Wettst.
12.	Brhati (Rt.)	*Solanum indicum* Linn.
13.	Cavya (St.)	*Piper retrofractum* Vahl.
14.	Dadima (Sd.)	*Punica granatum* Linn.
15.	Daruharidra (St.)	*Berberis aristata* DC.
16.	Dronapuspi (W.P.)	*Leucas cephalotes* Spreng.
17.	Ervaru (Sd.)	*Cucumis melo* var. *utilissimus* Duthie & Fuller
18.	Gajapippali (Frt.)	*Scindapsus officinalis* Schoott.
19.	Gambhari (Frt.)	*Gmelina arborea* Roxb.
20.	Gangeru (St.Bk.)	*Grewia tenax* (Forsk.) Aschers & Schwf.
21.	Gunja (Rt.)	*Abrus precatorius* Linn.
22.	Iksu (St.)	*Saccharum officinarum* Linn.
23.	Indravaruni (Rt.)	*Citrullus colocynthis* Schrad.
24.	Indravaruni (Lf.)	*Citrullus colocynthis* Schrad.
25.	Jambu (Sd.)	*Syzygium cuminii* (Linn.) Skeels
26.	Jambu (St.Bk.)	*Syzygium cuminii* (Linn.) Skeels
27.	Jayapala (Sd.)	*Croton tiglium* Linn.
28.	Jayanti (Lf.)	*Sesbania sesban* (Linn.) Merr.
29.	Jyotismati (Sd.)	*Celastrus paniculatus* Willd.
30.	Kadamba (St.Bk.)	*Anthocephalus cadamba* Miq.
31.	Kakamaci (W.P.)	*Solanum nigrum* Linn.
32.	Kamala (Fl.)	*Nelumbo nucifera* Gaertn.
33.	Kapittha (Frt.Pulp)	*Feronia limonia* (Linn.) Swingle
34.	Karamarda (St.Bk.)	*Carissa carandas* Linn.
35.	Karanja (Rt.Bk.)	*Pongamia pinnata* (Linn.) Merr.
36.	Karanja (Rt.)	*Pongamia pinnata* (Linn.) Merr.
37.	Karanja (St.Bk.)	*Pongamia pinnata* (Linn.) Merr.
38.	Karanja (Lf.)	*Pongamia pinnata* (Linn.) Merr.
39.	Karavallaka (Fr. Frt.)	*Momordica charantia* Linn.
40.	Katuka (Rz.)	*Picrorhiza kurroa* Royle ex Benth.
41.	Kokilaksa (W.P.)	*Asteracantha longifolia* Nees
42.	Kokilaksa (Rt.)	*Asteracantha longifolia* Nees
43.	Kokilaksa (Sd.)	*Asteracantha longifolia* Nees
44.	Kozuppa (W.P.)	*Portulaca oleracea* Linn.
45.	Lajjalu (W.P.)	*Mimosa pudica* Linn.
46.	Madhuka (Fl.)	*Madhuca indica* J.F. Gmel.

47.	Matsyaksi (W.P.)	*Alternanthera sessilis* (Linn.) R. Br.
48.	Methi (Sd.)	*Trigonella foenum-graecum* Linn.
49.	Mulaka (W.P.)	*Raphanus sativus* Linn.
50.	Mulaka (Rt.)	*Raphanus sativus* Linn.
51.	Mura (Rt.)	*Selinium candollei* DC.
52.	Murva (Rt.)	*Marsdenia tenacissima* Wight. & Arn.
53.	Nagakesar (Stmn.)	*Mesua ferrea* Linn.
54.	Nili (Lf.)	*Indigofera tinctoria* Linn.
55.	Nili (Rt.)	*Indigofera tinctoria* Linn.
56.	Nimba (Lf.)	*Azadirachta indica* A. Juss.
57.	Nimba (St.Bk.)	*Azadirachta indica* A. Juss.
58.	Palasa (St.Bk.)	*Butea monosperma* (Lam.) Kuntze
59.	Paribhadra (St.Bk.)	*Erythrina indica* Lam.
60.	Pippalimula (St.)	*Piper longum* Linn.
61.	Plaksa (St.Bk.)	*Ficus lacor* Buch.-Ham.
62.	Prasarini (W.P.)	*Paederia foetida* Linn.
63.	Priyala (Sd.)	*Buchanania lanzan* Spreng.
64.	Priyangu (Infl.)	*Callicarpa macrophylla* Vahl.
65.	Sali (Rt.)	*Oryza sativa* Linn.
66.	Sankhapuspi (W.P.)	*Convolvulus pluricaulis* Choisy
67.	Saptala (W.P.)	*Euphorbia dracunculoides* Lam.
68.	Satahva (Frt.)	*Anethum sowa* Roxb. ex Flem.
69.	Sigru (Lf.)	*Moringa oleifera* Lam.
70.	Sthulaela (Sd.)	*Amomum subulatum* Roxb.
71.	Tejovati (St.Bk.)	*Zanthoxylum armatum* DC.
72.	Tulasi (W.P.)	*Ocimum sanctum* Linn.
73.	Tulasi (Lf.)	*Ocimum sanctum* Linn.
74.	Vaca (Rz.)	*Acorus calamus* Linn.
75.	Vatsanabha (Rt.)	*Aconitum chasmanthum* Stapf ex Holmes
76.	Vidari (Tub.Rt.)	*Pueraria tuberosa* DC.
77.	Yava (Frt.)	*Hordeum vulgare* Linn.
78.	Yavasaka (W.P)	*Alhagi pseudalhagi* (Bieb.) Desv.

PHARMACOPOEIAL MONOGRAPHS TO BE PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL.-III

1.	Adhaki (Rt.)	*Cajanus cajan* (Linn.) Millsp.
2.	Agnimantha (Rt.)	*Clerodendrum phlomidis* Linn. f.
3.	Ambasthaki (Rt.)	*Hibiscus sabdariffa* Linn.
4.	Amra (Sd.)	*Mangifera indica* Linn.
5.	Amra (St. Bk.)	*Mangifera indica* Linn.
6.	Amrata (St.)	*Spondias pinnata* (Linn.f.) Kurz.
7.	Apamarga (Rt.)	*Achyranthes aspera* Linn.
8.	Araluka (St. Bk.)	*Ailanthus excelsa* Roxb.
9.	Arka (St. Bk.)	*Calotropis procera* (Ait.) R. Br.
10.	Asana (St. Bk.)	*Pterocarpus marsupium* Roxb.
11.	Asthisamhrta (St.)	*Cissus quadrangularis* Linn.
12.	Atmagupta (Sd.)	*Mucuna prurita* Hook.
13.	Bharangi (Rt.)	*Clerodendrum serratum* Linn.
14.	Bijapura (Frt.)	*Citrus medica* Linn.
15.	Bilva (Rt.)	*Aegle marmelos* Corr.
16.	Bimbi (W.P.)	*Coccinia indica* W. & A.
17.	Cangeri (W.P.)	*Oxalis corniculata* Linn.
18.	Cirabilva (Frt.)	*Holoptelea integrifolia* Planch
19.	Danti (Rt.)	*Baliospermum montanum* Muell-Arg.
20.	Dhattura (Sd.)	*Datura metel* Linn.
21.	Draksa (Frt.)	*Vitis vinifera* Linn.
22.	Durva (Rt.)	*Cynodon dactylon* (Linn.) Pers.
23.	Eranda (Lf.)	*Ricinus communis* Linn.
24.	Eranda (Sd.)	*Ricinus communis* Linn.
25.	Gambhari (St.)	*Gmelina arborea* Roxb.
26.	Gojihva (Aer. Pt.)	*Onosma bracteatum* Wall.
27.	Granthiparni (Rt.)	*Leonotis nepetaefolia* R. Br.
28.	Hamsapadi (W.P.)	*Adiantum lunulatum* Burm
29.	Hapusa (Frt.)	*Juniperus communis* Linn.
30.	Indravaruni (Frt.)	*Citrullus colocynthis* Schrad.
31.	Indrayava (Sd.)	*Holarrhena antidysenterica* Wall.
32.	Isvari (Rt.)	*Aristolochia indica* Linn.
33.	Jati (Lf.)	*Jasminum officinale* Linn.
34.	Kadali (Rz.)	*Musa paradisiaca* Linn.
35.	Kakajangha (Rt.)	*Peristrophe bicalyculata* Linn.
36.	Kakanasika (Sd.)	*Martynia annua* Linn.
37.	Kakoli (Tub. Rt.)	*Lilium polyphyllum* D. Don
38.	Kamala (Rz.)	*Nelumbo nucifera* Gaertn.
39.	Karavira (Rt.)	*Nerium indicum* Mill.
40.	Karinkara (Rt.)	*Carissa carandas* Linn.
41.	Kasa (Rt.)	*Saccharum spontaneum* Linn.
42.	Katphala (Frt.)	*Myrica esculenta* Buch.-Ham. ex D. Don
43.	Katphala (St. Bk.)	*Myrica esculenta* Buch.-Ham. ex D. Don
44.	Kola (Frt. Pulp)	*Zizypus jujuba* Lam.
45.	Kola (St. Bk.)	*Zizypus jujuba* Lam.
46.	Kosataki (W.P.)	*Luffa acutangula* (Linn.) Roxb.
47.	Kumuda (Fl.)	*Nymphaea alba* Linn.
48.	Kusa (Rt. St.)	*Desmostachya bipinnata* Stapf.
49.	Langali (Rz.)	*Gloriosa superba* Linn.

50.	Lasuna (Bulb)	*Allium sativum* Linn.
51.	Mahabala (Rt.)	*Sida rhombifolia* Linn.
52.	Manjistha (St.)	*Rubia cordifolia* Linn.
53.	Marica (Frt.)	*Piper nigrum* Linn.
54.	Masaparni (W.P.)	*Teramnus labialis* Spreng.
55.	Masura (Sd.)	*Lens culinaris* Medic.
56.	Mudga (Sd.)	*Phaseolus radiatus* Linn.
57.	Mulaka (Sd.)	*Raphanus sativus* Linn.
58.	Munditika (Lf.)	*Sphaeranthus indicus* Linn.
59.	Musta (Rz.)	*Cyperus rotundus* Linn.
60.	Nagavalli (Lf.)	*Piper betle* Linn.
61.	Narikela (Endo.)	*Cocos nucifera* Linn.
62.	Nicula (Frt.)	*Barringtonia acutangula* (Linn.) Gaertn.
63.	Nili (W.P.)	*Indigofera tinctoria* Linn.
64.	Nirgundi (Lf.)	*Vitex negundo* Linn.
65.	Padmaka (Ht. Wd.)	*Prunus cerasoides* D. Don
66.	Patalai (Rt.)	*Stereospermum suaveolens* DC.
67.	Phalgu (Frt.)	*Ficus hispida* Linn.
68.	Phalgu (Rt.)	*Ficus hispida* Linn.
69.	Prapunnada (Sd.)	*Cassia tora* Linn.
70.	Raktacandana (Ht.Wd.)	*Pterocarpus santalinus* Linn.
71.	Raktapunarnava (Rt.)	*Boerhaavia diffusa* Linn.
72.	Ramasitalika (W. P.)	*Amaranthus tricolor* Linn.
73.	Rasna (Lf.)	*Pluchea lanceolata* Oliver & Hiem.
74.	Sahacara (W.P.)	*Barleria prionitis* Linn.
75.	Sahadevi (W.P.)	*Vernonia cinerea* Lees.
76.	Saileya (Lichen-'Thallus')	*Parmelia perlata* (Huds.) Ach.
77.	Saka (Ht. Wd.)	*Tectona grandis* Linn.
78.	Sakhotaka (St. Bk.)	*Streblus asper* Lour.
79.	Salaparni (Rt.)	*Desmodium gangeticum* DC.
80.	Sali (Frt.)	*Oryza sativa* Linn.
81.	Salmali (St.Bk.)	*Bombax ceiba* Linn.
82.	Sana (Sd.)	*Crotolaria juncea* Linn.
83.	Sara (Rt.)	*Saccharum bengalense* Retz.
84.	Sarala (Ht. Wd.)	*Pinus roxburghii* Sargent
85.	Sarala (Rt.)	*Pinus roxburghii* Sargent
86.	Sarsapa (Sd.)	*Brassica campestris* Linn.
87.	Satapatrika (Fl.)	*Rosa centifolia* Linn.
88.	Simsapa (Ht. Wd.)	Dalbergia *sissoo* Roxb.
89.	Simsapa (St. Bk.)	*Dalbergia sissoo* Roxb.
90.	Sirisa (St. Bk.)	*Albizzia lebbeck* Benth.
91.	Sthauneya (Lf.)	*Taxus baccata* Linn.
92.	Surana (Corm.)	*Amorphophallus campanulatus* (Roxb.) Bl.
93.	Svetacandana (Ht.Wd.)	*Santalum album* Linn.
94.	Syonaka (Rt.)	*Oroxylum indicum* Vent.
95.	Tala (Infl.)	*Borassus flabellifer* Linn.
96.	Trivrta (Rt.)	*Operculina turpethum* (Linn.) Silva Manso
97.	Tumbini (Frt.)	*Lagenaria siceraria* (Mol.) Standl.
98.	Udambara (Frt.)	*Ficus glomerata* Roxb.
99.	Usira (Rt.)	*Vetiveria zizanioides* (Linn.) Nash
100.	Utpala (Fl.)	*Nymphaea stellata* Willd.

MONOGRAPHS PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA
PART-I, VOL. – IV

1. Adhaki (Sd.)	*Cajanus cajan* Linn.
2. Agaru (Ht. Wd.)	*Aquilaria agallocha* Roxb.
3. Aklari (Endm.)	*Lodoicea maldivica* Pers.
4. Aparajita (Lf.)	*Clitoria ternatea* Linn.
5. Atmagupta (Rt.)	*Mucuna prurita* Hook.
6. Bilva (St. Bk.)	*Aegle marmelos* Corr.
7. Champaka (Fl.)	*Michelia champaca* Linn.
8. Cinca (Ft. Pl.)	*Tamarindus indica* Linn.
9. Dadima (Fr. Fruit)	*Punica granatum* Linn.
10. Dadima (Ft. Rind)	*Punica granatum* Linn.
11. Dadima (Lf.)	*Punica granatum* Linn.
12. Devadaru (Ht. Wd.)	*Cedrus deodara* (Roxb.) Loud.
13. Dhattura (W.P.)	*Datura metel* Linn.
14. Durva (W.P.)	*Cynodon dactylon* (Linn.)
15. Gambhari (St. Bk.)	*Gmelina arborea* Linn.
16. Iksu (Rt. Stock)	*Saccharum officinarum* Linn.
17. Kadali (Fl.)	*Musa paradisiaca* Linn.
18. Karcura (Rz.)	*Curcuma zedoaria* Rosc.
19. Kasturilatika (Sd.)	*Hibiscus abelmoschus* Linn.
20. Kataka (Sd.)	*Strychnos potatorum* Linn. f.
21. Kharjura (Drd. Ft.)	*Phoenix dactylifera* Linn.
22. Kharjura (Fr. Ft.)	*Phoenix dactylifera* Linn.
23. Krsnasariva (Rt.)	*Cryptolepis buchanani* Roem. & Schult.
24. Kunduru (Exud.)	*Boswellia serrata* Roxb.
25. Kunkuma (Sty. & Stg.)	*Crocus sativus* Linn.
26. Kusmanda (Ft.)	*Benincasa hispida* (Thunb.) Cogn.
27. Madayanti (Lf.)	*Lawsonia inermis* Linn.
28. Mahanimba (St. Bk.)	*Melia azedarach* Linn.
29. Mandukaparni (W.P.)	*Centella asiatica* (Linn.) Urban
30. Mayakku (Gall)	*Quercus infectoria* Oliv.
31. Mudgaparni (W.P.)	*Vigna trilobata* (Linn.) Verdc.
32. Munditika (W.P.)	*Sphaeranthus indicus* Linn.
33. Nayagrodha Jata (Ar. Rt.)	*Ficus bengalensis* Linn.
34. Nimbu (Fr. Ft.)	*Citrus limon* (Linn.) Burm. f.
35. Nirgundi (Rt.)	*Vitex negundo* Linn.
36. Palasa (Fl.)	*Butea monosperma* (Lam.) Kuntze.
37. Palasa (Gum)	*Butea monosperma* (Lam.) Kuntze.
38. Palasa (Sd.)	*Butea monosperma* (Lam.) Kuntze.
39. Parpata (W.P.)	*Fumaria parviflora* Lam.
40. Patalai (St. Bk.)	*Stereospermum chelonoides* (L.F.)DC.
41. Pattanga (Ht. Wd.)	*Caesaplinia sappan* Linn.
42. Pippali (Ft.)	*Piper longum* Linn.
43. Plaksa (Ft.)	*Ficus lacor Buch*. – Ham.
44. Priyala (St. Bk.)	*Buchanania lanzan* Spreng.
45. Priyangu (Fruit)	*Callicarpa macrophylla* Vahl.
46. Prsniparni (W.P.)	*Uraria picta* Desv.
47. Puskara (Rt.)	*Inula racemosa* Hook. f.

48. Rudraksa (Sd.)	*Elaeocarpus sphaericus* Gaertn. K. Schum
49. Saraja (Exud.)	*Vateria indica* Linn.
50. Satavari (Rt.)	*Asparagus recemosus* Willd.
51. Sigru (Rt. Bk.)	*Moringa oleifera* Lam.
52. Sigru (Sd.)	*Moringa oleifera* Lam.
53. Sigru (St. Bk)	*Moringa oleifera* Lam.
54. Srngataka (Drd.Sd)	*Trapa natans* Linn.
55. Sruvavrksa (Lf.)	*Flacourtia indica* Merr.
56. Sruvavrksa (St. Bk)	*Flacourtia indica* Merr.
57. Talamuli (Rz.)	*Curculigo orchioides* Gaertn.
58. Talisa (Drd. Lf.)	*Abies webbiana* Lindl.
59. Tila (Sd.)	*Sesamum indicum* Linn.
60. Tulasi (Sd.)	*Ocimum sanctum* Linn.
61. Tumburu (Ft.)	*Zanthoxylum armatum* DC.
62. Utingana (Sd.)	*Blepharis persica* (Burm.f.) O. Kuntze.
63. Varahi (Rz.)	*Dioscorea bulbifera* Linn.
64. Varsabhu (Rt.)	*Trianthema portulacastrum* Linn.
65. Vasa (Rt.)	*Adhatoda zeylanica* Medic.
66. Visamusti (Sd.)	*Strychnos nux-vomica* Linn.
67. Vrscikalli (W.P.)	*Tragia involucrata* Linn.
68. Yava (W.P.)	*Hordeum vulgare* Linn.

PHARMACOPOEIAL MONOGRAPHS TO BE PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL.-V

1. Amra Haridra (Rz.)	*Curcuma amada* Roxb.
2. Anisoon (Fr.)	*Pimpinelia anisum* Linn.
3. Ankola (Lf.)	*Alangium salviifolium* (Linn.f.) Wang.
4. Aragvadha (St.Bk.)	*Cassia fistula* Linn.
5. Asphota (Rt.)	*Vallaris solanacea* Kuntze
6. Bastantri (Rt.)	*Argyreia nervosa* (Burm.f.) Boj.
7. Bhurja (St.Bk.)	*Betula utilis* D.Don
8. Canda (Rt.)	*Angelica archangelica* Linn.
9. Coraka (Rt. &Rt.Stock)	*Angelica glauca* Edgw.
10. Darbha (Rt.)	*Imperata cylindrica* (Linn.) Beauv.
11. Dhanvayasa (Wh.Pl.)	*Fagonia cretica* Linn.
12. Dravanti (Sd.)	*Jatropha glandulifera* Roxb.
13. Dugdhika (Wh.Pl.)	*Euphorbia prostrata* W. Ait.
14. Elavaluka (Sd.)	*Prunus avium* Linn.f.
15. Gandira (Rt.)	*Coleus forskohlii* Briq.
16. Gavedhuka (Rt.)	*Coix lachryma-jobi* Linn.
17. Ghonta (Fr.)	*Ziziphus xylopyrus* Willd.
18. Gundrah (Rz. & Rt.)	*Typha australis* Schum. and Thonn.
19. Himsra (Rt.)	*Capparis spinosa* Linn.
20. Hingupatri (Lf.)	*Ferula jaeschkeana* Vatke
21. Itkata (Rt.)	*Sesbania bispinosa* W.F.Wight
22. Itkata (St.)	*Sesbania bispinosa* W.F.Wight
23. Jalpippalika (Wh.Pl.)	*Phyla nodiflora* Greene
24. Jivak (Pseudo-bulb)	*Malaxis acuminata* D.Don
25. Kadara (Ht. Wd.)	*Acacia suma* Buch.-Ham.
26.Kakajangha (Sd.)	*Peristrophe bicalyculata* (Retz.) Nees
27. Kakanaja (Fr.)	*Physalis alkekengi* Linn.
28. Kapitan (St.Bk.)	*Thespesia populnea* (L.) Soland. ex Correa
29. Karkash (Rt.)	*Momordica dioica* Roxb. ex Willd.
30. Karnasphota (Sd.)	*Cardiospermum halicacabum* Linn.
31. Karnasphota (Rt.)	*Cardiospermum halicacabum* Linn.
32. Kattrna (Wh.Pl.)	*Cymbopogon citratus* (DC.) Stapf
33. Kebuka (Rz.)	*Costus speciosus* (Koerning ex Retz.) Smith.
34. Khaskhas (Sd.)	*Papaver somniferum* Linn.
35. Khatmi (Rt.)	*Althaea officinalis* Linn.
36. Khatmi (Sd.)	*Althaea officinalis* Linn.
37. Khubkalan (Sd.)	*Sisymbrium irio* Linn.
38. Kodrava (Grain)	*Paspalum scrobiculatum* Linn.
39. Ksirakakoli (Bulb)	*Fritillaria roylei* Hook.
40. Kshiravidari (Rt.)	*Ipomoea digitata* Linn.
41. Kulanjan (Rz.)	*Alpinia galanga* Willd.
42. Kumbhikah (Sd.)	*Careya arborea* Roxb.
43. Latakaranja (Sd.)	*Caesalpinia bonduc* (Linn.) Roxb.
44. Lavaliphala (Fr.)	*Phyllanthus acidus* (Linn.) Skeels
45. Madhulika (Rt.)	*Eleusine corocana* (L.) Gaertn.
46. Mahameda (Rz.&Rt.)	*Polygonatum cirrhifolium* Royle
47. Mahdusnuhi (Tub.Rt.)	*Smilax china* Linn.
48. Maramanjal (Rt. & St.)	*Coscinium fenestratum* (Gaertn.) Colebr.

49. Medasakah (St.Bk.)	*Litsea chinensis* Lam.
50. Medasakah (Wd.)	*Litsea chinensis* Lam.
51. Mesasrngi (Lf.)	*Gymnema sylvestre* R.Br.
52. Mesasrngi (Rt.)	*Gymnema sylvestre* R.Br.
53. Nandi (Rt.)	*Ficus arnottiana* Miq.
54. Nilajhintika (Rt.)	*Barleria strigosa* Willd.
55. Nimba (Rt.Bk.)	*Azadirachta indica* A.Juss.
56. Nimba (Fl.)	*Azadirachta indica* A.Juss.
57. Nimba (Fr.)	*Azadirachta indica* A.Juss.
58. Palas (Sd.)	*Butea monosperma* (Lam.) Kuntze
59. Palas (Fl.)	*Butea monosperma* (Lam.) Kuntze
60. Parasikayavani (Sd.)	*Hyoscyamus niger* Linn.
61. Pattura (Wh.Pl.)	*Aerva lanata* (Linn.) Juss.
62. Pilu (Fr.)	*Salvadora persica* Linn.
63. Pilu (Lf.)	*Salvadora persica* Linn.
64. Pilu (Rt.Bk.)	*Salvadora persica* Linn.
65. Potagala (Rt.)	*Typha elephantina* Roxb.
66. Pudina (Aerial Part)	*Mentha viridis* Linn.
67. Pullani (Lf.)	*Calycopteris floribunda* Lam.
68. Pullani (Rt.)	*Calycopteris floribunda* Lam.
69. Pullani (St.)	*Calycopteris floribunda* Lam.
70. Putikaranjah (St.Bk.)	*Caesalpinia crista* Linn.
71. Renuka (Fr.)	*Vitex negundo* Linn.
72. Riddhi (Tuber)	*Habenaria intermedia* D.Don
73. Rohisa (Wh.Pl.)	*Cymbopogon martinii* (Roxb.) Wats
74. Rumimustagi (Resin)	*Pistacia lentiscus* Linn.
75. Sarala (Exudate)	*Pinus roxburghii* Sargent
76. Sarpagandha (Rt.)	*Rauwolfia serpentina* (Linn.) Benth. ex Kurz
77. Svetapunarnava (Rt.)	*Boerhaavia verticillata* Poir.
78. Tailaparna (Lf.)	*Eucalyptus globulus* Labill.
79. Tinisha (Wd.)	*Ougeinia oojeinensis* (Roxb.) Hochr.
80. Tintidika (Aerial Part)	*Rhus parviflora* Roxb.
81. Trapusa (Sd.)	*Cucumis sativus* Linn.
82. Tuni (St.Bk.)	*Cedrela toona* Roxb.
83. Vanda (Lf.)	*Dendrophthoe falcata* (Linn.f.) Ettingsh.
84. Vanda (St.)	*Dendrophthoe falcata* (Linn.f.) Ettingsh.
85. Vanda (Aerial Rt.)	*Dendrophthoe falcata* (Linn.f.) Ettingsh.
86. Vanda (Fl.)	*Dendrophthoe falcata* (Linn.f.) Ettingsh.
87. Vanda (Fr.)	*Dendrophthoe falcata* (Linn.f.) Ettingsh.
88. Vanyajiraka (Fr.)	*Centratherum anthelminticum* (L.) Kuntze
89. Vidarikand (Tuber)	*Pueraria tuberosa* DC.
90. Virala (St.Bk.)	*Diospyros exsculpta* Buch.-Ham.
91. Visala (Rt.)	*Trichosanthes bracteata* (Lam.) Voigt
92. Vyaghranakhi (Fr.)	*Capparis horrida* Linn.

MONOGRAPHS

ĀDĀRĪ (Leaf)

Ādārī consists of dried tender leaves of *Acacia pennata* (L.) Willd. Syn. *Mimosa pennata* L. (Fam. Mimosaceae), a large thorny climbing shrub distributed throughout India.

SYNONYMS – Khadiravallī, Āri

REGIONAL LANGUAGE NAMES-

Ben.	**:**	Kuchai
Guj.	**:**	Khervelya
Hin.	**:**	Biswal, Latakhadira, Aazi Khair
Kan.	**:**	Siguri
Mar.	**:**	Aarai velyakhera
Ori.	**:**	Potadontari
Tam.	**:**	Iya kozhundu
Tel.	**:**	Karusakaya

DESCRIPTION -

a) Macroscopic:

Bulk colour yellowish green or green; leaves bipinnately compound; petiole 2 cm long, with a plate shaped gland near the middle or the base; rachis grooved, obscurely prickled, with glands opposite to two uppermost pairs of pinnae; leaflets 4 to 8 mm long and 1 mm broad, linear to oblong, tip acute, base truncate, glabrous, margin ciliate, veins obscure, midrib slightly prominent and very close to the distal margin; no odour or taste.

b) Microscopic:

Rachis **-**Epidermis a single layer of rectangular cells; cortex of 5 to 8 layers of angular parenchyma, followed by a ring of sclerenchyma with 3 to 4 layers of cells, continuous except on the abaxial side, where a larger patch of sclerenchyma is found: four vascular bundles present around a small pith; xylem vessels angular; pith cells parenchymatous with starch grains having a central hilum.

Leaflet **-**Dorsiventral; in surface view, epidermal cells slightly sinuous and thin walled, cuticle present; upper epidermis a single layer of polygonal cells; palisade tissue 2 or 3 layers; spongy mesophyll consists of irregular polyhedral cells with interspaces; midrib shows a slight projection; vascular bundle almost circular in outline and encircled with a sclerenchymatous sheath; in between vascular bundle and lower epidermis, is a patch of 2 or 3 layers of parenchyma..

Powder -Greyish to yellowish green, polygonal cells of epidermis with paracytic stomata; sclerenchymatous fibres of about 20 µ width; starch grains of 18 to 21 µ across with a central hilum; pitted, scalariform and spiral vessels.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 7 per cent**,** Appendix 2.2.3
Sulphated ash	**-**	Not more than 11 per cent, Appendix 2.2.6
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 8 per cent, Appendix 2.2.6
Water- soluble extractive	-	Not less than 18 per cent, Appendix 2.2.7

T.L.C.-

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *n-hexane: ethyl acetate: methanol* (2:7:1) as mobile phase, after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105° for 5 minutes shows spots at R_f. 0.07 (light pink), 0.22 (yellow), 0.26 (light violet), 0.33 (orange), 0.43 (light pink), 0.53 (light pink), 0.62 (yellow), 0.75 (light violet), 0.87 (pale yellow), 0.88 (grey), 0.91 (orange) and 0.95 (pink).

CONSTITUENTS- Octadecadienoic, octadecanoic, palmitic and pentadecanoic acids; lupeol, α-spinasterol, β-sitosterol and tannins.

PROPERTIES AND ACTION -

Rasa	**:**	Kaṣāya, Kaṭu, Tikta
Guṇa	**:**	Laghu, Rūkṣa
Vīrya	**:**	Śīta
Vipāka :		Kaṭu
Karma :		Kāsahara, Pittaśāmaka

IMPORTANT FORMULATIONS – Eravati, Vallīkhadiraguṇaāḥ, Āriguṇāḥ

THERAPEUTIC USES – Jvara (Fever), Rāktadoṣa (Disorder of blood), Agnimāndyan (Digestive impairment)

DOSE- Cūrṇa (Powder): 3 to 6 g.

ĀMRAGANDHI-GUGGULU (Leaf)

Āmragandhi-guggulu consists of leaves of *Balsamodendron caudata* Mauch. Syn. *Commiphora caudata* Engl., *Protium caudatum* W. & A. (Fam. Burseraceae), a handsome deciduous, armed, small tree with thick trunk and papery bark occurring in dry forests in the region of the Eastern Ghats, mostly in plains.

REGIONAL LANGUAGE NAMES-

Ass.	: Devadhup
Kan.	: Kundamaavu, Kaimaavu
Mal.	: Kilimarum
Tam.	: Cenkiluvai Ilai
Tel.	: Kondamamidi

DESCRIPTION –

a) Macroscopic:

Leaves compound, borne on grooved rachis, imparipinnate, leaflets 2 to 5 pairs, glabrous, ovate or orbiculate, entire, acuminate, unequal at base, nerves finely reticulate, greenish brown; no characteristic smell, taste slightly resinous.

b) Microscopic:

Rachis **-** Cross section grooved in outline; epidermis single layered; cuticle present; a cortex of 6 or 7 layers of thick walled parenchyma cells present; the innermost layer of the cortex consists of larger cells in a continuous row, similar to an endodermis; two or 3 wavy layers of sclerenchymatous pericycle present; stele lobed in the phloem region, with a single resin canal beneath each lobe; phloem and phloem parenchyma present in a continuous wavy ring, followed by xylem ring with vessel groups alternating with xylem parenchyma; vessels large in size; pith parenchymatous; abundant druses, and scattered minute starch grains present in the cortical, phloem and pith regions.

Petiole **-** Cross section grooved in outline; epidermis single layered; cuticle present; cortical region many layered, with thick walled parenchyma; a sinuous, discontinuous sclerenchymatous band present; stele lobed; large resin canals present in the phloem; xylem in groups beneath resin canals in the lobe; pith parenchymatous; druses and starch grains present in cortex, phloem and pith.

Midrib **–** TS shows bulge on the adaxial side, concave curvature on the abaxial side; epidermis single layered with thick cuticle; sub-epidermal layers collenchymatous on both adaxial and abaxial sides; ground tissue parenchymatous; a shallow arc of vascular bundle present in the center; phloem present outside the xylem; facing the central arc a core of xylem surrounded by phloem present on adaxial side below the bulge; resin canals present; one beneath and two lateral to the vascular bundle; druses present throughout the tissues.

Lamina **–** Dorsiventral; epidermis single layered with larger cells and thicker cuticle on the adaxial side than on the abaxial side; in surface view upper epidermal cells with almost straight walls, lower with distinctly wavy walls; stomata anomocytic; stomatal number 32 to 40 / mm^2; stomatal index 26 to 28; palisade ratio 6 to 8; vein-islet number 3 to 5; veinlet termination number 28 to 32.

Powder -Greenish brown; no characteristic smell; a slight resinous taste; druses of calcium oxalate crystals of about 25 µ, starch grains upto 10 µ, vessels scalariform, pitted and reticulate, phloem fibres 200 µ to 1100 µ from the rachis.

IDENTITY, PURITYAND STRENGTH -

Foreign matter	-	Not more than	1	per cent,	Appendix 2.2.2
Total ash	-	Not more than	9	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than	3	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	6	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than	13	per cent,	Appendix 2.2.7
Fixed oil	-	Not less than	2	per cent,	Appendix 2.2.8

T.L.C. –

T.L.C. of methanolic extract on aluminium plate precoated with silica gel 'G' 60 F_{254} of 0.2 mm thickness using *toluene: ethyl acetate* (9:1) under UV 366 nm shows fluorescent zones appearing at R_f. 0.14(violet), 0.16 (pink), 0.20 (violet), 0.57, 0.60 (both pink), 0.67 (deep violet), 0.75 (pink) and 0.83 (deep violet). On dipping the plate in *vanillin-sulphuric acid reagent* and heating at 105º for 5 minutes, 12 spots appear at R_f. 0.12 (blue), 0.24 (violet), 0.29 (pink), 0.33 (blue), 0.37 (pale violet), 0.51, 0.57, 0.60 (violet), 0.75 (pale violet) and 0.83 (green).

CONSTITUENTS - Gugulsterones

PROPERTIES AND ACTION-	
Rasa	: Tikta, Kaṭu
Guṇa	: Laghu, Snigdha, Viśada, Sūkṣma, Sara, Sugandhi
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Hṛdya, Pratidūṣaka, Kapha-vātahara, Vraṇaropaṇa, Vraṇaśodhana
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES -Āmavāta (Rheumatism), Aṅgamarda (Body ache), Gaṇḍamālā (Cerivical lymphadenitis), Kuṣṭha (Leprosy / diseases of skin), Pādadari (Chaffed / cracked soles / rhagades), Prameha (Metabolic disorder), Sandhiśotha (Arthritis), Śotha (Inflammation), Vātarakta (Gout), Vātaroga (Disease due to Vata dosa), Visarpa (Erysepales), Vraṇa (Ulcer)	
DOSE –Svarasa (Juice) : 5 to 10 ml.	

ARAṆYA-SŪRAṆA (Tuber)

Araṇya-sūraṇa consists of dried tuber of *Synantherias sylvatica* Schott Gen. Aocja Syn. *Amorphophallus sylvaticus* (Roxb.) Kunth (Fam. Araceae), a perennial, tuberous herb with a small, sub-globose, smooth rhizome and a barred spathe, streaked with green and light pink. The plant is usually found along forest borders in the states of Tamil Nadu, Kerala and Karnataka.

SYNONYMS- Vajrakanda, Sitasūraṇa

REGIONAL LANGUAGE NAMES-

Ben.	:	Ola-kochu
Guj.	:	Godasurana
Hin.	:	Vanasurana
Mal.	:	Jangali-Ola
Tam.	:	Kattu-Karunaikizhanagu
Tel.	:	Mancha Kanda

DESCRIPTION –

a) Macroscopic:

Unpeeled tuber sub-globose, depressed, bulbiferous, dark greyish-brown, warty, 18 to 25 cm in thickness, whole or may be cut vertically and horizontally into transverse slices of 2 to 3 cm size; rootlets a few, thin; texture starchy; odour not distinctive; taste, acrid.

b) Microscopic:

A section through the tuber reveals an outer tegumentary tissue comprising a few layers of thin walled cork, irregular and peeled off at places; cortex massive, consisting of thin walled parenchyma abundant in starch grains; a zone of 2 or 3 layers of clear, angular, thin walled cells runs periclinally in outer region of cortex; calcium oxalate crystals also found in the form of raphide bundles; starch grains without striations, single or compound, hilum linear; simple grains spherical, ovoid or sub-reniform; compound ones usually comprising up to 6 units, polyhedral or sub- spherical; abundant in tissues surrounding the small, scattered vascular bundles; vascular bundles scattered in cortex, running straight or in oblique fashion, comprising the smaller as well as larger bundles towards the centre; xylem composed of a few vessels with spiral thickenings, and xylem parenchyma; phloem consists of sieve tubes and companion cells.

Powder – Dull creamish, fine; powder microscopy shows raphides 150 μ long; simple and compound starch grains, 2 to 6 membered and usually up to 50 μ in size, and occasionally; vessel fragments with spiral thickenings.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 1	per cent,	Appendix 2.2.2
Total ash	-	Not more than 8	per cent,	Appendix 2.2.3
Acid- insoluble ash	-	Not more than 2	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 4	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than 14	per cent,	Appendix 2.2.7

T.L.C –

T.L.C. of alcoholic extract of the drug on silica gel 'G' 60 F_{254} using mobile phase *n-hexane: ethyl acetate*: (7:3) shows spots at R_f. 0.17 (blue), 0.28 (Violet), 0.37 (dark violet) and 0.40 (dark violet) on spraying the plate with *anisaldehyde- sulphuric acid reagent* and heating it for 15 minutes at 105°.

CONSTITUENTS- No report on the chemical constituents of the tuber is available in literature.

PROPERTIES AND ACTION -

Rasa	**:**	Kaṭu, Kaṣāya
Guṇa	**:**	Rūkṣa, Tīkṣṇa
Vīrya	**:**	Uṣṇa
Vipāka	**:**	Kaṭu
Karma	**:**	Kṛmighna, Arśoghna, Rūcya, Vedanāhara

IMPORTANT FORMULATIONS- Used as single drug

THERAPEUTIC USES - Granthiśotha, (Arbuda (Tumor), Vicarcikā (Eczema), Udararoga (Diseases of abdomen), Ślīpada (Filariasis), Arśa (Piles)

DOSE – Cūrṇa (Powder)**:** 5 to 10 g after Śodhana.

ĀRĀROṬA (Rhizome)

Ārāroṭa is the dried rhizomes of *Maranta arundinacea* L. (Fam. Marantaceae), a rhizomatous herb of about 75 cm in height, cultivated in India and also often found in wild, as an escape.

SYNONYMS - Sita tavakṣīra

REGIONAL LANGUAGE NAMES-

Ben.	:	Ararut
Eng.	:	West Indian Arrowroot
Hin.	:	Araaruta
Kan.	:	Araaruta
Mar	:	Tavakira
Ori.	:	Araaruta
Pun.	:	Araaruta
Tam.	:	Aruruttukkilangu
Tel.	:	Palagunda

DESCRIPTION-

a) Macroscopic:

Rhizome- horizontal and unbranched, spindle shaped, 12 to 20 cm long and dull white to creamy in colour when fresh, prominently marked with nodal rings and scale leaves which completely encircle the nodes; internodal length is 0.5 to 1.5 cm; sliced individual pieces are cylindrical, rough, and size ranges from 1 to 2 cm long and 1 to 2.5 cm across; externally brownish and broken surface off-white; fracture, hard and fractured surface fibrous and starchy; starchy odour and taste.

b) Microscopic:

TS circular in outline, epidermis a single layer of small polygonal cells, followed by a wide cortex of large polygonal cells with interspaces; medullary vascular bundles many, of various sizes and scattered in the cortical region; each vascular bundle encircled by a semilunar bundle sheath of sclerenchymatous cells, and consists of a small phloem patch and xylem with 1 to 6 vessels; stele consists of compactly arranged smaller vascular bundles towards endodermis and larger ones in the centre, embedded in the ground tissue of parenchymatous cells; starch grains present in parenchymatous cells; irregularly ovoid, or pear shaped, ranging between 20 to 40 µ, some even upto 75 µ, occasionally, concentric striations seen, with an eccentric stellate hilum.

Powder- Creamy, starchy, under microscope shows compact polygonal parenchyma, spiral, scalariform and annular vessels; elongated spindle shaped fibres of 15 to 20 µ width; starch grains circular, oval or pear shaped with a diameter of 20 to 40 µ, occasionally even upto 75 µ, with concentric striations and a central or lateral, linear or crossed hilum.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent,	Appendix 2.2.2
Total ash	-	Not more than 5 per cent,	Appendix 2.2.3
Sulphated ash	-	Not more than 7 per cent,	Appendix 2.2.4
Acid-insoluble ash	-	Not more than 1 per cent,	Appendix 2.2.6
Alcohol-soluble extractive	-	Not less than 1 per cent,	Appendix 2.2.7
Water-soluble extractive	-	Not less than 12 per cent,	Appendix 2.2.8

T.L.C.-

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *n-hexane: chloroform: methanol* (26:13:1) as mobile phase, after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^0 for 5 minutes shows spots at R_f 0.27 (light violet), 0.53 (light violet), 0.68 (pink), 0.77 (pink), and 0.85 (pink).

CONSTITUENTS - Starch (25-30%), dextrin and sugars.

PROPERTIES AND ACTION-

Rasa	:	Madhura
Guṇa	:	Guru, Snigdha
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Pittahara, Balya, Vṛṣya

IMPORTANT FORMULATIONS-Used as single drug

THERAPEUTIC USES- Kāsa (Cough), Śvāsa (Asthama), Dāha (Burning sensation), Tṛṣṇā (Thirst), Kṣaya (Pthisis), Agnimāndya (Digestive impairment), Raktadoṣa (Disorder of blood)

DOSE- Cūrṇa (Powder): 5 to 10 g daily.

ASTHIŚṚṄKHALĀ (Aerial Part)

Asthiśṛṅkhalā consists of dried aerial parts of *Cissus quadrangularis* L. (Fam.Vitaceae), a fleshy climber with jointed stem and leaf opposed tendrils growing along hedges and distributed throughout the hotter parts of India.

SYNONYMS – Asthisamhṛta, Vajravallī

REGIONAL LANGUAGE NAMES -

Ben.	: Haadjodaa
Eng.	: Bone setter
Guj.	: Haadsaankal
Hin.	: Hadjoda
Kan.	: Mangarvallee
Mal.	: Piranta
Mar.	: Kaandvel
Ori.	: Haadabhanga gachha
Pun.	: Hadajoda
Tam.	: Pirandai
Tel.	: Nalleru, Nallerutige
Urd.	: Harjora

DESCRIPTION –

a) Macroscopic:

Stem pieces sub-quadrangular, flattened, winged and jointed, having constricted nodes and spindle shaped internodes; smooth, shiny, dull green or grayish brown when old; branches dichotomous; leaves alternate, cauline, cordate; ovate, exstipulate, soft, thick, shiny and shortly petioled; tendril brittle, long, slender, twisted, simple, arising at nodes opposite the leaves.

b) Microscopic:

Stem shows a flattened, 4 – angled, almost dumb bell shaped outline with one or two notches on each side; four angles of the stem appear blunt in cross section with a sclerenchymatous patch immediately below the epidermis in each corner; epidermis consists of a single layer of polygonal or slightly elongated cells with straight anticlinal walls and convex periclinal walls covered over by thick cuticle; in surface view, epidermal cells divided into groups of 3 to 8 due to thickened anticlinal walls; stomata uniformly distributed, anomocytic; ground tissue demarcated into an outer cortex and a central pith by a ring of vascular bundles; cortex made up of more or less compactly arranged, thin walled parenchymatous cells some of which contain crystals of calcium oxalate in the form of druses upto 25 µ dia., as well as raphides; some idioblasts stain red with Ruthenium Red indicating the presence of some mucilage in them; circular cavities present sporadically; vascular bundles conjoint, collateral, open, endarch; those under the angles of the stem larger in size and number; bundles contain a peripheral patch of sclerenchyma cells followed by, phloem elements, phellogen and xylem elements; vessels possess annular and spiral thickenings; a peripheral patch of collenchymatous cells is also associated with a group of vascular bundles; pith is composed of thin walled loosely arranged parenchymatous cells; some cells contain druses and raphides;

cavities, larger and much more abundant than those in the cortex present; transverse section of tendril has prominent semi-barrel shaped epidermal cells covered by a cuticle having fine striations, as seen in surface view of the epidermis with cuticle.

Leaf –

Midrib -Keeled on adaxial side, convexly rounded on the abaxial side; ground tissue parenchymatous, thin-walled cells, those in periphery containing chloroplasts; a small patch of sclerenchyma and below this a group of collenchyma cells in the keel; a ring of 4 to 6 vascular bundles without bundle sheaths; some cells of midrib have druses and raphides, each vascular bundle consists of a centripetal xylem composed of vessels with spiral thickenings, and xylem parenchyma and an outer phloem composed of sieve tubes, companion cells and phloem parenchyma with a few small cavities dispersed among them.

Lamina **–**A section through the leaf shows well defined upper and lower epidermis comprised of parenchymatous cells rounded in vertical section and angular in surface view; stomata present on both surfaces anomocytic; mesophyll of lamina undifferentiated; margin composed of a patch of sclerenchyma; stomatal index for upper surface not more than 4 while for lower surface not more than 5.

Powder –Epidermal cells in surface view showing anticlinal divisions and stomata; fragments consisting of hexagonal parenchymatous cells of ground tissue some showing the presence of crystals of calcium oxalate as druses and raphide; some fragments having vessels, fibers and starch grains also.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more	than	1	per cent,	Appendix 2.2.2
Total ash	**-**	Not more	than	20	per cent,	Appendix 2.2.3
Acid - insoluble ash	**-**	Not more	than	3	per cent,	Appendix 2.2.4
Alcohol - soluble extractive	**-**	Not less	than	7	per cent,	Appendix 2.2.6
Water - soluble extractive	**-**	Not less	than	2	per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract on precoated silica gel 'G' plate (0.2 mm thick) using *toluene: ethyl acetate* (7:3) under UV 366 nm shows spots at R_f 0.21 (blue); 0.45 (red); 0.53 (red); 0.66 (pink); 0.71 (red); 0.82 (red); on spraying with *anisaldehyde- sulphuric acid reagent* and on heating the plate for ten minutes at 105^o spots appear at R_f. 0.35 (grey), 0.57 (brownish green), 0.73 (light yellow), 0.78 (brownish green) and 0.87 (brown).

CONSTITUENTS –Triterpenoids: 7-oxo-onocer-8-ene-3β,21α-diol; friedelan-3-one; taraxerol; isopentacosanoic acid; β-sitosterol.

PROPERTIES AND ACTION –	
Rasa	: Kaṭu, Kaṣāya, Madhura
Guṇa	: Laghu, Sara, Snigdha, Picchila
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Balya, Kaphahara, Kṛmighna, Pācana, Sandhānīya, Stambhana, Vātahara, Vṛṣya

IMPORTANT FORMULATIONS - Lākṣādya guggulu, Srnkhala Gunah, Vajravalli, Asthisrnkhala Guna, Asthisanharaka Guna, Kāṇḍavallīguṇaāḥ, Asthisaṁhāra (Kāṇḍa), Asthisanghatika Yoga, Asthisaṁhāraḥvaṭikāvidhiḥ, Astisanhara Arka Gunah, Asthisaṁhāratailam
THERAPEUTIC USES - Arśa (Piles), Asthibhagna (Bone fracture), Kṛmi (Worm infestation), Netraroga (Diseases of the eye), Śvāsa (Asthma), Urustambha (Stiffness in thigh muscles), Vraṇa (Ulcer)
DOSE - Svarasa (Juice): 10 to 20 ml. Ādrakalka (Paste): 10 to 20 g.

BHŪTAKEŚĪ (Fruit)

Bhūtakeśī consists of dried fruits of *Selinum vaginatum* C.B. Clarke (Fam. Apiaceae), a glabrous herb attaining a height of 1 to 1.5 m distributed in Himalayas from Kashmir to Kumaon between altitudes of 1800 to 3900 m.

SYNONYMS –Ākāsamāṁsi, Murā, Bhūrigandhā, Gandhamadanī

REGIONAL LANGUAGE NAMES –

Ben.	:	Bhutakesi
Hin.	:	Bhutakesi, Muramaansi
Kan.	:	Mura
Mal.	:	Moramamsi
Mar.	:	Mura
Ori.	:	Bhutakesi
Pun.	:	Pushwari
Tel.	:	Bhutakesi

DESCRIPTION -

a) Macroscopic:

Drug consists of yellowish-brown separated mericarps; each mericarp broadly oblong, dorsally compressed, 5 to 9 mm long, 3 to 4 mm wide and 1 to 2 mm thick; ridges five, yellowish-brown, three dorsal and two lateral, the lateral being large, membranous and winged; taste, bitter and spicy; odour, sweet and musk-like.

b) Microscopic:

TS of the mericarp shows epicarp consisting of a single layered epidermis of rectangular, tubular cells having thick outer walls, striated cuticle and a few stomata; parenchymatous mesocarp, 3 to 4 layered, thickened, lignified and occasionally reticulate in the region of vascular bundles; a narrow endocarp of elongated, rectangular cells; testa composed of single layer of yellowish cells; endosperm consisting of thick-walled cubical parenchyma; vascular bundles one in each primary ridge; vittae, four on dorsal, two to four on commissural surface, each lined internally by endothelial cells and filled with yellowish oil; cells of endosperm filled with numerous small aleurone grains, fixed oil and micro-rosette crystals of calcium oxalate.

Powder -Light brown, shows epidermal cells of epicarp with striated cuticle in surface view; fragments of yellowish-brown endothelium of vittae; parenchymatous cells with pitted thickening; fragments of reticulate vessels attached with pitted parenchyma and lignified sclerenchyma with reticulate thickening; patches of endospermic parenchymatous cells containing fixed oil, numerous small aleurone grains and micro-rosette crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 8 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 7 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 17 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract of the drug on precoated silica gel 'G' 60 F_{254} TLC plate (E. Merck) of 0.2 mm thickness using *toluene : ethyl acetate* (85:15) under UV 254 nm shows spots at R_f. 0.18 (blue), 0.29 (blue-green), 0.33 (light blue), 0.50 (bright blue) and 0.61 (green).

CONSTITUENTS - Essential oil and coumarins.

PROPERTIES AND ACTION -	
Rasa	: Tikta, Kaṭu, Kaṣāya
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Trīdoṣaghna, Vedanāhara, Rakṣoghna, Keśya, Kāntiprada
IMPORTANT FORMULATIONS -Candanādi Taila	
THERAPEUTIC USES - Apasmāra (Epilepsy), Bhrama (Vertigo), Jvara (Fever), Kṣaya (Pthisis), Śvāsa (Asthma), Mūrcchā (Syncope), Raktagata vāta (Hypertension), Raktapitta (Bleeding disorder), Tṛṣā (Thirst), Vātavyādhi (Disease due to Vata dosa)	
DOSE -Cūrṇa (Powder) :1 to 3 g.	

BHŪTAKEŚĪ (Rhizome)

Bhūtakeśī consists of dried rhizomes of *Selinum vaginatum* C.B. Clarke (Fam. Apiaceae), a glabrous herb attaining a height of 1 to 1.5 m distributed in Himalayas from Kashmir to Kumaon between altitudes of 1800 and 3900 m.

SYNONYMS – Rocanatagara, Mānsī Viśeṣa

REGIONAL LANGUAGE NAMES –

Ben.	:	Bhutakesi
Hin.	:	Bhutakesi, Muramaansi
Kan.	:	Mura
Mal.	:	Moramamsi
Mar.	:	Mura
Ori.	:	Bhutakesi
Pun.	:	Pushwari
Tel.	:	Bhutakesi

DESCRIPTION -

a) Macroscopic:

Dried rhizome pieces cylindrical, curved, upto 12 cm long and 0.5 cm thick; surface earthy brown to brown in colour, rough, longitudinally wrinkled, bearing horizontally arranged, protruded lenticels and circular scars of roots; fracture short, horny revealing distinct creamish white, central cylinder of wood and brownish bark towards periphery; odour not distinct; taste, astringent.

b) Microscopic:

TS of rhizome show multilayered cork of thin walled rectangular cells; cork cambium not distinct; cortex consists of 5 to 10 to several rows of circular to oval parenchyma cells with groups of sclereids; secondary phloem wide, largely composed of parenchyma, a few fibres, obliterated sieve elements and interspersed with oval secretory canals; cambium is distinct, consisting of 6 to 8 layers of thin walled, small rectangular cells; secondary xylem consists of vessels, tracheids, fibres and xylem parenchyma; xylem vessels occur singly or in groups of 2 to 5; medullary rays multiseriate, traversing both xylem and phloem; pith consists of large circular to oval pitted cells filled with round, simple or compound starch grains with 2 to 5 components, measuring 5 to 15 µ in diameter.

Powder -Light brown, shows fragments of cork in surface view; groups of sclereids; patches of pitted parenchyma; spiral and pitted vessels and round, simple or compound starch grains measuring 5 to 15 µ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix	2.2.2
Total ash	**-**	Not more than	8	per cent,	Appendix	2.2.3
Acid - insoluble ash	**-**	Not more than	4	per cent,	Appendix	2.2.4
Alcohol - soluble extractive	**-**	Not less than	23	per cent,	Appendix	2.2.6
Water - soluble extractive	**-**	Not less than	7	per cent,	Appendix	2.2.7

T.L.C. -

T.L.C. of ethanolic extract (cold maceration at room temperature) of the drug on precoated silica gel 'G' 60 F_{254} TLC plate of 0.2 mm thickness using solvent system *toluene: ethyl acetate* (9.2: 0.8) shows spots R_f 0.15 (dark brown), 0.26 (magenta), 0.29 (dark orange), 0.39 (violet), 0.49 (light pink), 0.54 (brownish-yellow), 0.59 (light pink), 0.85 (magenta), 0.95 (magenta), and on spraying with *anisaldehyde-sulphuric acid reagent* followed by heating at 105º for 10 minutes.

CONSTITUENTS -Coumarins: vaginatin, selinidin, vaginol, vaginidin and archangelone.

PROPERTIES AND ACTION -	
Rasa	: Kaṣāya, Tikta
Guṇa	: Sugandhi, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Tridoṣahara, Vedanāhara, Rakṣoghna, Keśya, Vraṇaśodhana
IMPORTANT FORMULATIONS –Used as single drug	
THERAPEUTIC USES - Apasmāra (Epilepsy), Jvara (Fever), Kāsa (Cough), Kṛmi (Helminthiasis), Pratisyaya (Coryza), Ucca Raktacapa (Hypertension), Unmāda (Mania / psychosis), Vātavyādhi (Disease due to Vata dosa)	
DOSE - Cūrṇa (Powder): 3 to 6 g.	

BĪJAPATRĀ (Whole Plant)

Bījapatrā consists of the dried whole plant of *Adiantum capillus-veneris* L. {Fam. Adiantaceae (Polypodiaceae) a terrestrial fern occurring throughout the hills in India in moist shady places especially on damp old walls and crevices of rocks.

SYNONYMS - Kṛṣṇadaṇḍikā, Haṁsapadīsadṛśā

REGIONAL LANGUAGE NAMES -

Eng.	: Maiden-hair fern
Guj.	: Kaalo hansaraaj, Hanspadi
Hin.	: Kaalaa Hansraja
Kan.	: Hansraaja, Mubaraka
Mal.	: Plavu
Mar.	: Hansraaja
Ori.	: Hansraaja
Tel.	: Naalla Hamsapadu
Urd.	: Parsiaoshan

DESCRIPTION-

a) Macroscopic:

Rhizome **–**Brown, soft with variable lengths upto 7 mm in thickness, paleae covering the rhizome, root present.

Root –Well branched, black coloured, thin, wiry and arising in clusters from the underside of the rhizome.

Frond **–**Circinately coiled in the bud condition, rachis dark and shining, bi or tripinnate often covered with paleae that may extend onto rachis and also sometimes on pinnules or leaflets, pinnae stalked, rachis may terminate in a pinna or may be elongated bearing a vegetative bud at the tip, rachis divides pinnately and the ultimate branches bear pinnules in an alternate manner; the terminal pinnule usually differs in shape and size; the venation is open and dichotomous, veins spread in the a fan like manner in the lamina; sub marginal sori borne at the distal ends of the pinnae or pinnules and consists of sporangia borne superficially over a short portion towards the distal regions of the veins, the ultimate ends of the veins do not bear sporangia.

b) Microscopic:

Root **–**Epidermis single layered; cuticle present; cortex of two zones, outer parenchymatous usually 3 layered and inner sclerenchymatous; endodermis distinct with casparian thickening; pericycle distinct; stele diarch and exarch; phloem forms two conspicuous groups alternating with the xylem.

Rhizome **–**Epidermis single layered, thin walled; cuticle present; cortex parenchymatous filled with starch grains; stele dictyosetle, 5 to 7 meristeles; each meristele is a protostelic type surrounded by a distinct endodermis and pericycle; xylem exarch and diarch surrounded by phloem.

Frond –

Rachis **–**Epidermis single layered with thick cuticle, followed by 1 or 2 layered sclerenchymatous hypodermis; cortex parenchymatous and contains starch grains; stele consists of single layered endodermis followed by pericycle; xylem triarch, exarch, surrounded by phloem.

Petiole **–**Epidermis single layered with thick cuticle, followed by sclerenchymatous cortex; vascular bundle consists of single layered endodermis and pericycle; xylem surrounded by phloem.

Pinnule **–**Mid-vein –laterally flat outline; mesophyll one or 2 layered; vascular bundle surrounded by thick sclerenchymatous bundle sheath, followed by a single layered endodermis and pericycle; xylem surrounded by phloem.

Lamina **–**Undifferentiated, with one or 2 layered irregular shaped cells in the mesophyll; stomata present in lower epidermis; epidermal cells are elongated, parallel to the long axis of the leaf, in surface view more wavy in abaxial side and less wavy in adaxial side; stomatal number 30 to 35/mm^2; stomatal index for lower epidermis 32 to 35; fertile leaves present showing sporangia.

Powder –Dark reddish brown, spiral vessels, fibres, starch grains 10 to 20 µ, epidermis with stomata present, sporangium upto 400 µ in size with stalk and head, stalk 2 or 3 cells wide and about 4 cells long, head biconvex in shape and single layered wall with annulus (thick wall) and stomium (thin wall), spores homosporous tetrahedral, triradiate ridge with concave side and upto 90 µ in size.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	2	per cent, Appendix	2.2.2
Total ash	-	Not more than	15	per cent, Appendix	2.2.3
Acid - insoluble ash	-	Not more than	10	per cent, Appendix	2.2.4
Water- soluble extractive	-	Not less than	4	per cent, Appendix	2.2.6
Alcohol- soluble extractive	-	Not less than	10	per cent, Appendix	2.2.7

T.L.C.-

T.L.C. of chloroform extract on aluminium plates precoated with silica gel 'G' 60 F_{254} of 0.2 mm thickness using *toluene : ethyl acetate* (6:1) under UV 254 nm shows spots at R_f. 0.18, 0.22, 0.40, 0.64, 0.71, 0.76, 0.80 and 0.87 (all green). Under UV 366 nm fluorescent zones at R_f. 0.18 (pink), 0.20, 0.32 (both purple), 0.36, 0.55, 0.59 (all pink), 0.66 (blue), 0.70, 0.80 (both pink). On spraying the plates with *vanillin-sulphuric acid reagent* and heating at 105° for 5 minutes, spots at R_f. 0.29 (blue), 0.40, 0.46 (both purple), 0.55 (yellow), 0.66 (purple), 0.76 (green), 0.88, 0.93 (both grey) appear.

CONSTITUENTS - Adiantone; adiantoxide; astragalin; nicotiflorin; isoquercitrin; rutin; kaempferol-3-O-rutinoside; 1-caffeylglucose and sulphate esters of 1-coumarylglucose and 1-coumarylgalactose; kaempferol-3-glucuronide; quercetin; β-sitosterol; stigmasterol; campesterol

PROPERTIES AND ACTION -

Rasa	: Kaṣāya, Kaṭu
Guṇa	: Guru
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Kaṇṭhya, Kaphahara, Kaphapittaśāmaka, Mūtrajanana, Rasāyana, Stambhana, Viṣaghna, Vraṇaropaṇa

IMPORTANT FORMULATIONS – Vasa Yoga

THERAPEUTIC USES – Agnirohini (Diphtheia (Acute), Angamarda (Body ache), Apaśmāra (Epilepsy), Atisāra (Diarrhoea), Bhrama (Vertigo), Dāha (Burning sensation), Gulma (Abdominal lump), Jvara (Fever), Kāsa (Cough), Lūtāviṣa (Spider bite), Mūtrakṛcchra (Dysuria), Raktapitta (Bleeding disorders), Raktavikāra (Disorders of blood), Śoṣa (Emaciation), Śotha (Oedema), Śvāsa (Asthma), Svrabheda (Hoarseness of voice), Visarpa (Erysepales), Vraṇa (Ulcer)

DOSE - Cūrṇa (Powder): 1 to 3 g.
Svarasa (Juice) : 10 to 20 g.

BIMBĪ (Leaf)

Bimbī consists of the dried leaves of *Coccinia grandis* (L.) Voigt Syn. *C. cordifolia* Cogn, *C.indica* W & A, *Cephalandra indica* Naud. (Fam. Cucurbitaceae), a monoecious perennial climber, distributed all over India and often cultivated.

SYNONYMS – Raktaphalā, Tuṇḍī, Bimbikā, Oṣṭhopamaphalā

REGIONAL LANGUAGE NAMES -

Ass.	: Kanabhaturi
Ben.	: Tela Kuccha, Bimbu
Eng.	: Ivy gourd
Guj.	: Gholam, Ghilodi, Tindoran, Kadavi Ghilodi
Hin.	: Kunduru, Kunru
Kan.	: Tonde balli
Mal.	: Koval, Kova, Nallakova
Mar.	: Tondlee
Ori.	: Kainchi kakudi, Bano Kundri
Pun.	: Kunduru, Kunduri
Tam.	: Kovai
Tel.	: Donda tige
Urd.	: Kunduru

DESCRIPTION -

a) Macroscopic:

Bulk colour dark green; leaves brittle; simple, alternate, petiolate, exstipulate, 5 to 10 cm. long and 4 to 8 cm in width; lamina variable in size, usually 5 angled with shallow sinuses; bright green above with blackish dots on the surface and paler beneath; palmately reticulate with five main veins, base cordate, apex acute, margin more or less sinuate toothed; surface of the lamina rough.

b) Microscopic:

***Midrib* -**TS of midrib is flat toward adaxial surface and ridged towards abaxial side; epidermal cells of adaxial and abaxial surface brick shaped; hypodermis adjacent to both epidermis collenchymatous; ground tissue of parenchyma containing prismatic calcium oxalate crystals; two vascular bundles present, one towards adaxial and the other towards abaxial surface; adaxial vascular bundle smaller than that of abaxial surface; xylem composed of vessels with annular and spiral thickenings, xylem parenchyma, and fibres; phloem contains sieve tubes with simple sieve plates, companion cells, parenchyma and fibres.

***Lamina* -**TS through laminar region shows that the leaf is dorsiventral; cuticle present; epidermal cells of adaxial surface slightly elongated, larger and oval where black dots representing glands present; the epidermal cells of abaxial surface are brick shaped; cuticle present; palisade layer a single row; and absent over midrib region; spongy parenchyma cells chlorenchymatous and wavy walled; xylem contains vessels with annular and spiral thickenings;

epidermal cells of both adaxial and abaxial epidermis in surface view are occasionally elongated, walls thin, deeply sinuate; multicellular sessile glandular trichomes with head measuring 100 to 120 µ in diameter are present on adaxial epidermis; covering trichomes measuring 18 to 20 wide and 280 to 300 µ long, gradually tapering are sparsely distributed and are localised at the costal region of the adaxial epidermis; stomata anomocytic ; stomatal index of abaxial epidermis 20 to 25, adaxial surface 16 to 18.

Powder -Light green, shows epidermal cells, anomocytic stomata, concentric starch grains 3 to 5 µ in diameter, xylem vessels with annular and spiral thickenings; calcium oxalate crystals, epidermal fragments with glands and trichomes.

IDENTITY, PURITY AND STRENGH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	6	per cent,	Appendix 2.2.3
Acid- insoluble ash	-	Not more than	2	per cent,	Appendix 2.2.4
Alcohol -soluble extractive	-	Not less than	15	per cent,	Appendix 2.2.6
Water -soluble extractive	-	Not less than	38	per cent,	Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract on silica gel 'G' plate using *n-hexane: ethyl acetate* (9:1) under UV 366 nm shows fluorescent spots (all blue) R_f. values 0.12, 0.39, 0.47, 0.55, 0.78 and 0.92; on exposure to *iodine vapours* two spots (both yellow) appear at R_f. 0.05, 0.12 and 0.39. On spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° seven spots appear at R_f. values, 0.12, 0.29, 0.39, 0.47, 0.55, 0.61 and 0.78.

CONSTITUENTS -Cephalandrine A, cephalandrine B, cephalandrine, β-sitosterol and triacontane.

PROPERTIES AND ACTION –	
Rasa	: Madhura, Kaṣāya, Tikta
Guṇa	: Laghu
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Grāhī, Kapha pittahara, Vātakara
IMPORTANT FORMULATIONS – Bimbīghṛatam, Bimbi Guna, Bimbi Phala Guna, Bimbīguṇāh, Bimbi Guna, Bimbi Gunam , Bimbi Saka, Bimbi Puspam, Bimbi Phalam, Tundi Ghrt, Kunadaru guna, Tiktatundi Guna, Bimbāghṛtam, Bimbī (Pañcāṅga), Bimbīphalam	
THERAPEUTIC USES - Kāmalā (Jaundice), Madhumeha (Diabetes mellitus), Pūya meha (Dysuria)	
DOSE - Svarasa(Juice) : 10 to 20 ml Cūrṇa (Powder) : 3 to 6 g	

BIMBĪ (Stem)

Bimbī is the dried stem of *Coccinia grandis* (L.) Voigt Syn. *C. cordifolia* Cogn., *C. indica*, W & A., *Cephalandra indica* Naud (Fam. Cucurbitaceae), a monoecious perennial climber distributed all over India and often cultivated.

SYNONYMS – Raktaphalā, Tuṇḍī, Bimbikā, Oṣṭhopamaphalā

REGIONAL LANGUAGE NAMES –

Ass.	: Kanabhaturi
Ben.	: Tela Kuccha, Bimbu
Eng.	: Ivy gourd
Guj.	: Gholam, Ghilodi, Tindoran, Kadavi Ghilodi
Hin.	: Kunduru, Kunru
Kan.	: Tonde balli
Mal.	: Koval, Kova, Nallakova
Mar.	: Tondlee
Ori.	: Kainchi kakudi, Bano Kundri
Pun.	: Kunduru, Kunduri
Tam.	: Kovai
Tel.	: Donda tige
Urd.	: Kunduru

DESCRIPTION -

a) Macroscopic:

Stems pieces measuring 2 to 10 cm in length and 0.5 to 4 cm in thickness, externally ridged, grey or greenish grey; cut surface smooth with a thin bark and abundant light coloured central wide wood; odour and taste indistinct.

b) Microscopic:

In TS the mature stem consists of cork, composed of stratified rectangular, tangentially elongated cells; cortex composed of 10 to 15 layers of thin walled, isodiametric parenchymatous cells with intercellular spaces, filled with numerous concentric starch grains, of about 5 µ in diameter; pericycle in the form of patches of fibres, with thick walls, narrow lumen, measuring 10 to 15 µ in diameter; vascular bundles conjoint, wedge shaped, bicollateral, phloem contains sieve tubes, companion cells, extensive parenchyma of isodiametric cells, and fibres of 550 to 625 µ long and 12 to 18 µ width , xylem consists of vessels with reticulate and scalariform thickenings, protoxylem elements possess annular and spiral thickenings; very short fibres upto 30 µ in width, walls very thick with simple pits; medullary rays multiseriate, composed of 18 to 22 radially elongated with some filled with starch grains; pith scanty, parenchymatous, cells isodiametric, thin walled.

Powder -Pale cream, microscopically it shows isodiametric parenchymatous cells, xylem and phloem fibres, sieve tubes, sieve plates and vessels; paranchymatous cells filled with numerous concentric starch grains upto about 5 µ; xylem vessels with, scalariform and reticulate thickenings.

IDENTITY PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	10	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than	1	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	33	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than	40	per cent,	Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract on silica gel 'G' plate using *n-hexane: ethyl acetate* (9:1) under UV 366 nm shows fluorescent spots (all blue) at R_f. 0.10, 0.15, 0.35, 0.47, 0.50, 0.63 and 0.72, on exposure to *iodine vapours* spots (all yellow) at R_f. 0.15, 0.47, 0.63 and 0.94, on spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° spots appear at R_f. 0.10, 0.15, 0.35, 0.47, 0.50, 0.63, 0.72 and 0.94.

CONSTITUENTS -Alkaloids such as cephalandrine-A, cephalandrine- B sand β - sitosterol, triacontane
.

PROPERTIES AND ACTION -	
Rasa	: Kaṣāya, Tikta, Madhura
Guṇa	: Laghu
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Grāhī, Kapha pittahara, Vātakara
IMPORTANT FORMULATIONS - Bimbīghṛatam, Bimbi Guna, Bimbi Phala Guna, Bimbīguṇāh, Bimbi Guna, Bimbi Gunam , Bimbi Saka, Bimbi Puspam, Bimbi Phalam, Tundi Ghrt, Kunadaru guna, Tiktatundi Guna, Bimbāghṛtam, Bimbī (Pañcāṅga), Bimbīphalam	
THERAPEUTIC USES - Aruci (Tastelessness), Prameha (Metabolic disorder), Pravāhikā (Dysentery), Raktapitta (Bleeding disorder)	
DOSE - Cūrṇa (Powder): 3 to 6 g.	

BṚHAT DUGDHIKĀ (Whole Plant)

Bṛhat Dugdhikā consists of dried whole plant of *Euphorbia hirta* L. Syn. *E. pilulifera* Auct. non L. (Fam. Euphorbiaceae), a small erect or ascending annual herb with milky latex, found throughout the hotter parts of India as a common weed.

SYNONYMS - Dugdhikā

REGIONAL LANGUAGE NAMES-

Ben.	:	Barakherui
Eng.	:	Asthma weed
Guj.	:	Dudhelo, Dudeli, Dudhi
Hin.	:	Dudhi, Badi dudhdi
Mal.	:	Nelapalai
Mar.	:	Mothi dudhi, Naayato, Dudhi, Dudali, Mothi naayati
Ori.	:	Dudili, Dudoli
Pun..	:	Dudhi
Tam.	:	Ammanpatchaiarisi
Tel.	:	Reddivarinanubalu, Nanubalu

DESCRIPTION –

a) Macroscopic:

Root –Six to 9 cm long, 2 to 3 mm in dia., almost cylindrical with tapering ends, small rootlets, surface smooth, except for small protuberances at certain places.

Stem –Erect, usually branched, terete, branches often compressed, covered with crisp hairs, stem pieces 3 to 5 mm tick in dia., very thin bark, fracture short.

Leaf –Petiolate, petioles about 3 mm long; occasionally reddish, simple, opposite, superposed, subsessile, 1 to 4 by 0.5 cm. oblong, lanceolate or obovate lanceolate, acute or sub acute, dentate, minutely stipulate, dark green above pale beneath, venation reticulate.

Flower –Infloresence shortly pedunculate, axillary cymes; bracteate; perianth absent, involucres numerous, less than 1 to 1.5 mm long on single stalked stamen, anthers two celled; pistil tricarpellary, ovary superior, axile placentation.

b) Microscopic:

Root –TS shows outermost region of cork consisting of 4 or 5 layers of thin walled, brown suberised rectangular parenchymatous cells; cork cambium seen; cortex consists of 6 to 8 layers of tangentially elongated parenchymatous cells without intercellular spaces; some of these cells contain simple starch grains and prismatic calcium oxalate crystals; the vascular cylinder has thin walled polygonal phloem cells, xylem consists of vessels and thick walled parenchyma, traversed by uniseriate medullary rays; pith absent.

***Stem* –**TS shows nearly circular outline, epidermal cells slightly cells slightly elongated laterally with thick cuticle; multicellular, uniseriate covering trichomes about 30 to 200 in length; cortex consists of 6 to 8 layers of rounded or oval shaped parenchymatous cells, a few cells containing simple, oval shaped starch grains and prismatic calcium oxalate crystals; next to the cortex is a broad vascular cylinder separated by an endodermis and a single layer of pericyle; phloem narrow and xylem has reticulate vessels; pith consists of circular cells with intercellular spaces, prismatic calcium oxalate crystals measuring about 8 to 25 µ are seen in a few cells.

***Leaf* –**

***Petiole* –**TS shows somewhat circular outline; epidermis single layered, externally covered with thick cuticle and have covering trichomes similar to that of stem; stele composed of vascular bundle located in center, xylem composed of vessels with protoxylem facing towards upper surface and phloem on the abaxial side, enclosed within a bundle sheath; ground tissue composed of thin walled parenchymatous cells, a few having prismatic calcium oxalate crystal and starch grains.

***Midrib* –**Strongly projects on the lower side; epidermis single layered with thick cuticle on both surfaces; collenchyma single layered present only on lower surface just adjacent to lower epidermis; stele shows similar structure as described in petiole except bundle sheath is very prominent and shows starch grains in a few cells; prismatic calcium oxalate crystal and starch grains in a few cells of ground tissue.

***Lamina* –**Shows dorsiventral structure; epidermis single layered on either surface, upper epidermis consists of tabular cells, walls slightly wavy in surface view; whereas walls of lower epidermal cells straight; trichomes similar to those of stem; palisade two layered; spongy parenchyma 2 to 4 layered, loosely arranged; vascular bundles embedded in spongy parenchyma; stomata anomocytic present on both surfaces; palisade ratio 5 or 6, stomatal index 27 to 36 on lower surface and 25 to 30 / mm^2 on upper surface, vein islet number 1 to 2, veinlet termination number 6 to 9.

Powder –Yellowish brown, shows abundant fragments of parenchymatous cells, a few filled with starch grains; vessels with reticulate and spiral thickenings; phloem fibres; crystals of calcium oxalate in the form of prism; abundant covering, multicellular trichomes, and a few parenchymatous cells with brownish contents.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more than	2	per cent,	Appendix	2.2.2
Total ash	**-**	Not more than	12	per cent,	Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	7	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not less than	3	per cent,	Appendix	2.2.6
Water-soluble extractive	**-**	Not less than	10	per cent,	Appendix	2.2.7

T.L.C. –

T.L.C. of the alcoholic extract on silica gel 'G' plate using *toluene: ethyl acetate* (95:5) under UV 366 nm shows fluorescent zones at R_f. 0.15 (grey), 0.32 (pink) and 0.36 (green). On spraying with *vanillin-sulphuric acid reagent* and heating the plate for five minutes at 105^o four spots appear at R_f. 0.22 (pink), 0.36 (violet), 0.70 (pale violet) and 0.91 (purple).

CONSTITUENTS – Flavonoids, ellagotannins and triterpenoids.

PROPERTIES AND ACTION –	
Rasa	: Kaṭu, Tikta, Madhura
Guṇa	: Rūkṣa, Guru, Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Garbhakāraka, Kaphahara, Mūtrala, Śleṣmanissāraka, Stanya, Vṛṣya, Viṣṭambhī
IMPORTANT FORMULATION – Dugdhikā	
THERAPEUTIC USES - Dadru (Taeniasis), Kṛmi (Worm infestation), Kāsa (Cough), Kuṣṭha (Leprosy / diseases of skin), Mūtrakṛcchra (Dysuria), Pūyameha, Śūla (Pain / colic), Tamakaśvāsa (Bronchial asthma)	
DOSE - Cūrṇa (Powder): 1 to 3 g. Svarasa (Juice): 10 to 20 drops.	

BṚHATĪ (Whole Plant)

Bṛhatī consists of dried whole plant of *Solanum anguivi* Lam. Syn. *S. indicum* L.(Fam. Solanaceae), a prickly, much branched perennial undershrub, up to 1.8 m high, mostly found throughout warmer parts of the country upto an elevation of 1500 m.

SYNONYMS – Bṛhatkaṇṭakārī, Mahadvyāghrī, Siṁhikā, Bhanṭākī, Vanavṛntāka

REGIONAL LANGUAGE NAMES-

Ass.	: Tidbhagnri, Tidbaghuri
Ben.	: Vyaakud, Byakura
Eng.	: Indian Nightshade
Guj.	: Ubhi ringni, Ubhimo ringni
Hin.	: Badi kateri, Kataai, Vanbhantaa
Kan.	: Kirigulia, Heggullu
Mal.	: Cheru vazhuthina, Putiri chunda
Mar.	: Dorli, Ringani
Ori.	: Lavyaankudi, Dengaabheji, Bryhoti
Pun.	: Kandwaari vaddi
Tam.	: Pappar mulli, Cheru vazhuthalai, Mullamkatti
Tel.	: Tella mulaka
Urd.	: Badi kateli

DESCRIPTION -

a) Macroscopic:

***Root* -** Root well developed, long, ribbed, woody, cylindrical, pale yellowish-brown, 1 to 2.5 cm in dia; a number of secondary roots and their branches present, surface rough due to presence of longitudinal striations and root scars; fracture, short and splintery; no distinct odour and taste.

***Stem* -** Dried stem pieces cylindrical, prickly, about 2 to 5 cm in length and 0.5 to 2 cm in thickness; external surface greyish-green, rough, longitudinally fissured and bearing longitudinally arranged vertical lenticels and recurved flattened spines; transversely cut smooth surface shows narrow brownish bark towards periphery and creamish -white wood around central pith; fracture hard, fibrous, breaks with snap; odour not distinct, taste bitter.

Leaf - Leaves simple, petiolated, subentire or pinnatifid, occuring in broken, curled pieces of different sizes; upper surface grayish-green and lower surface whitish in colour; fracture brittle; taste, bitter.

***Fruit* –** Dried berries globose, yellow to reddish-brown in colour measuring about 0.5 to 1 cm in diameter bearing small spiny remains of stigma on one side and calyx with attached pedicels on other side; taste astringent; seeds many in dried pulp.

b) Microscopic:

***Root* -** TS of root shows thin cork composed of 5 to 15 layers of thin-walled, tangentially elongated, rectangular cells filled with yellowish-brown content; cork cambium single layered; secondary cortex composed of 5 to 9 layers of thin-walled, oval and tangentially elongated cells; stone cells present in singles or in groups of 2 to 5 or more in this region; secondary phloem composed of sieve elements, parenchyma and stone cells, traversed by phloem rays; phloem parenchyma abundant, thin-walled; stone cells present in outer phloem region in singles or groups of 2 to 5, varying greatly in shape and size; phloem rays 1 to 3 cells wide, isodiamteric to slightly radially elongated in inner phloem region and radially elongated in outer phloem region, occasionally stone cells also found in medullary rays; wood occupies bulk of root and composed of vessels, tracheids, fibres and xylem parenchyma, traversed by xylem rays, all elements being lignified; vessels occurs singly or in groups of 2 to 5 with simple pits; xylem fibres moderately thick-walled with simple pits and pointed ends found in abundance; xylem parenchyma have simple pits or reticulate thickening; xylem rays uni to biseriate, thick-walled, cells radially elongated and pitted, microsphenoidal crystals of calcium oxalate as sandy masses and simple starch grains present in some cells of secondary cortex, phloem and medullary rays; simple and rounded to oval starch grains, measuring 5.5 to 11.6 μ m in diameter.

***Stem* -** TS of stem shows cork composed of 4 or 5 layers of rectangular cells interrupted by lenticels and at places bearing multicellular branched trichomes; cortex consists of an outer zone of 5 to 8 layers of small, rounded parenchyma cells filled with brownish contents, and inner cortex consisting of 4 or 5 rows of oval to round, comparatively larger parenchyma cells; groups of pericyclic fibres present outside the phloem; phloem composed of sieve elements, phloem fibres and phloem parenchyma filled with black-coloured contents; xylem composed of vessels, tracheids, fibres and parenchyma; xylem vessels occur singly or in groups of 2 to 5 with pitted walls; xylem rays uniseriate, consisting of radially elongated parenchyma cells; pith composed of circular to oval parenchyma cells filled with starch grains.

Leaf-

Petiole - TS of petiole shows a single layered epidermis of parenchyma cells interrupted at places by multicellular, branched trichomes and glandular trichomes; 3 or 4 layered hypodermis of chlorenchyma cells; ground tissue of round parenchyma cells encircling a large, conjoint, collateral, arch-shaped, vascular bundle in the centre and two small vascular bundles in the wings region below hypodermis.

***Lamina* –** TS of leaf shows a dorsiventral structure with a single layered epidermis on both surfaces interrupted at places by multicellular, branched trichomes; bilayered palisade of columnar cells below upper epidermis and 3 or 4 layered spongy mesophyll of round to oval parenchyma cells.

Midrib -Contains a single vascular bundle consisting of radially arranged xylem and phloem; patches of collenchyma on both dorsal and ventral side of vascular bundle below epidermis.

Powder -Shows cork in surface view; leaf epidermis in surface view; abundant branched multicellular trichomes; yellowish fragments of epicarp and greenish fragments of testa in surface view; thin walled fibres; pitted and spiral vessels; microsphenoidal crystals of calcium oxalate and circular, simple or 2 to 4 compound starch grains.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent	, Appendix	2.2.2
Total ash	**-**	Not more than	12	per cent	, Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	5	per cent	, Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not less than	4	per cent	, Appendix	2.2.6
Water-soluble extractive	**-**	Not less than	6	per cent	, Appendix	2.2.7

T.L.C. –

T.L.C. of ethanolic extract (cold maceration at room temperature) of the drug on precoated silica gel 'G' 60 F_{254} TLC plate of 0.2 mm thickness using solvent system *toluene: ethyl acetate* (7:3) shows spots at R_f. 0.16 (light grey), 0.28 (grey), 0.43 (light pink), 0.55 (green), 0.62 (pink), 0.66 (dark pink), 0.77 (light pink) and 0.85 (pink) on spraying with *anisaldehyde-sulphuric acid reagent* followed by heating at 105º for 10 minutes.

CONSTITUENTS - Steroidal saponins: Protodiscin saponin C, indioside A, B, C, D and E; solafuranone.

PROPERTIES AND ACTION –

Rasa	:Tikta, Kaṭu
Guṇa	:Laghu, Rūkṣa, Tīkṣṇa
Vīrya	:Uṣṇa
Vipāka	:Kaṭu
Karma	:Dīpana, Grāhī, Hṛdya, Kaphahara, Keśya, Pācana, Vātahara, Vedanāsthāpana

IMPORTANT FORMULATION – Dashmularishta, Dashmulakwath

THERAPEUTIC USES - Āmadoṣa (Products of impaired digeston and metabolism), Agnimāndya (Digestive impairment), Aruci (Tastelessness), Chardi (Emesis), Hṛdroga (Heart dieseases), Hikkā (Hiccup), Jvara (Fever), Kṛmi (Worm infestation / Helminthiasis), Kāsa (Cough), Kuṣṭha (Leprosy/ diseases of skin), Netraroga (Diseases of the eye), Pratiṣyāya (Rhinitis), Svarabheda (Hoarseness), Śvāsa (Asthma) , Śūla (Pain)

DOSE – Cūrṇa (Powder) : 3 to 6 g.
Kvātha (Decoction) : 40 to 80 ml.

CAṆAKA (Whole Plant)

Caṇaka consists of the whole plant of *Cicer arietinum* L. (Fam. Fabaceae), a much branched herb cultivated in most parts of India for its seeds used as pulses.

SYNONYMS – Harimanthaḥ, Sakalapriya, Vājimantha

REGIONAL LANGUAGE NAMES-

Ass.	:	Imas
Ben.	:	Chholaa
Eng.	:	Bengal gram, Chick pea, Gram
Guj.	:	Chanaa, Chanya
Hin.	:	Buut, Chanaa, Chunnaa, Chane, Chholaa
Kan.	:	Kadale
Mal.	:	Katal
Mar.	:	Harbaraa, Chane
Punj.	:	Chholaa
Tam.	:	Katalai, Kadalai, Kondakkadalai
Tel.	:	Sangalu

DESCRIPTION -

a) Macroscopic:

***Root* -** Root upto 25 cm long, 2 to 12 mm thick with secondary and tertiary roots, surface light brown, rough with longitudinal wrinkles; fracture, tough showing creamish interior; odour, mild and taste characteristic. .

***Stem* -** Stem elongated, with nodes and internodes, variable in length, upto 6 mm in diameter, surface pale brown with a few purple patches and longitudinal wrinkles; fracture, short showing creamish interior; odour, mild and characteristic taste.

***Leaf* -** Leaf compound, imparipinnate, leaflets 8 to 13 pairs, each upto 1 cm in length and 5 mm in width; light brown; oval to oblong, margin serrate, base round, apex acute, both surfaces pubescent; odour characteristic; taste, sour.

***Fruit* -** Fruit turgid, pod with persistent calyx and short stalk; 1.5 to 2.0 cm in length and 5 mm to 1 cm in breadth; apex acute, base tapering, surface light brown, pubescent; seeds 1 to 3, brown, triangular, with pointed apex, micropyle present below the apex; cotyledons 2, yellowish to dark yellow; odour, mild but specific; taste, slightly astringent.

b) Microscopic:

***Root* -** Root shows single layered epidermis followed by cortex consisting of 5 to 8 layers of thin walled parenchyma cells; pericycle represented by patches of long, thick walled and lignified fibres; phloem composed of sieve tubes, companion cells and phloem parenchyma being traversed by uni to triseriate, thin walled medullary rays; xylem shows vessels, tracheids, fibres, parenchyma and medullary rays with thick and pitted walls ; vessels and tracheids show bordered pits, parenchyma cells simple pitted and fibres have simple oblique pits; pith composed of thin walled parenchyma cells.

***Stem* -** Circular in outline with 5 to 6 small ridges; epidermis single layered covered externally with cuticle, some of them elongate to form long unicellular as well as glandular trichomes with 2 or 3 celled stalk and 4 to 6 celled head, both measuring from 350 to 680 µ in length; cortex composed of collenchyma and parenchyma; collenchyma

cells present below the ridges only; pericycle represented by patches of fibres; phloem consists of sieve tubes, companion cells and phloem parenchyma being traversed by uni to biseriate medullary rays; xylem shows border pitted vessels and tracheids, simple pitted parenchyma cells and long fibres, all the elements being thick walled and lignified; pith composed of thin walled circular to oval parenchyma cells.

Leaf -

Rachis -crescent shaped in outline; epidermis single layered with both covering and glandular trichomes similar to those of stem; cortex consists of thin walled circular to oval parenchyma cells; central region occupied by large vascular bundle in the middle flanked by 2 small vascular bundles on each side; small patches of pericycle present on both upper and lower sides of vascular bundles.

Midrib -shows single layered epidermis covered with cuticle, centre of midrib occupied by vascular bundle with small patches of sclerenchymatous cells on both dorsal and ventral side; remaining portion occupied by thin walled parenchyma cells.

Lamina -shows dorsiventral structure; epidermis single layered covered externally with cuticle, covering and glandular trichomes similar to those of stem present on both surfaces; in surface view upper epidermal cells larger with some what straight walls, lower epidermal cells smaller with sinuous walls, anomocytic and a few anisocytic stomata present on both surfaces; mesophyll shows two layers of palisade cells below the upper epidermis followed by cells of spongy parenchyma, a number of small vascular bundles present in mesophyll; stomatal index 11 to 13 (upper surface), 22 to 25 (lower surface); palisade ratio 3 to 5.

Fruit -Fruit shows single layered epicarp covered with cuticle, covering and glandular trichomes similar to stem; mesocarp consists of thin walled parenchyma cells, a number of vascular bundles similar to leaf present in a row; lower mesocarpic region shows a band of 3 to 4 layers of lignified sclereids with narrow lumen, followed by a row of thick walled and lignified fibres, inner most region show 2 to 3 layers of parenchyma cell; seed coat shows 2 rows of palisade like macrosclereids, linea lucida present in outer layer; followed by a zone of thin walled parenchymatous cells, outer 2 to 3 layers thin walled and tangentially elongated cells, remaining cells circular to oval, lower parenchyma cells tangentially elongated and collapsed, small vascular bundles and vascular strands present; cotyledon shows thin walled parenchyma cells, most of them loaded with aleurone and starch grains; starch grains simple, mostly oval with cleft shaped central hilum, measuring upto 20 μ in length.

Powder –Shows fragments of epidermal cells with anomocytic and anisocytic stomata with covering and glandular trichomes, palisade like macrosclereids, parenchyma cells with starch and aleurone grains, bordered pitted tracheids and vessels, simple pitted parenchyma cells, thick walled fibres, groups of radially elongated sclereids, isolated covering and glandular trichomes and palisade cells.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 2	per cent,	Appendix 2.2.2
Total ash	-	Not more than 12	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than 3	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 9	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than 14	per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of alcoholic extract on silica gel 'G' precoated plate using *toluene: ethyl acetate: ethyl alcohol* (7:1:2) as mobile phase , spots under UV 254 nm shows at R_f. 0.81(pink), 0.51, 0.37 (both light blue), 0.63, 0.22, 0.10 (all blue).

CONSTITUENTS - Flavonoids, such as, quercetin, isoquercetin, kaempferol-3-glucoside, astragalin, populnin, biochenin-A-7-glucoside, isorhamnetin, protensein, garbanzol and cyanogenic glycosides.

PROPERTIES AND ACTION –

Rasa : Kaṣāya, Lavaṇa, Amla
Guṇa : Rūkṣa, Laghu
Vīrya : Śīta
Vipāka : Kaṭu
Karma : Vātakara, Pittahara, Kaphahara, Viṣṭambhī, Balya, Rūcikara, Ādhmānakāraka

IMPORTANT FORMULATIONS - Gandhaka Vaṭī, Kravyāda Rasa, Canakamla, Canaka Saka, Canaka Gunah, Śuṣkabharjitacaṇakaguṇaḥ, Yusa Guna, Krisna Canaka Guna

THERAPEUTIC USES - Annadravaśūla (Gastric ulccer), Chardi (Emesis), Dāha (Burning sensation), Ivara, Kāsa (Cough), Pīnasa (Chronic rhinitis / sinusitis), Prameha (Metabolic disorder), Śoṣa (Cachexia), Śvāsa (Asthma), Tṛṣṇā (Thirst), Udara (Diseases of abdomen)

DOSE - Cūrṇa: 5 to 20 g.

DĀRUHARIDRĀ (Fruit)

Drug consists of dried fruits of *Berberis aristata* DC. (Fam. Berberidaceae), an erect, glabrous, spinescent shrub found in the Himalayas between 2000 to 3000 m and also growing in Nilgiri hills.

SYNONYMS – Dārvi, Dārunisā

REGIONAL LANGUAGE NAMES

Ben.	: Darhaldi, Daaruharidraa
Eng.	: Indian barberry
Guj.	: Daaruhaldar
Hin.	: Daaruhaldi, Darhald, Zarishka (Fruit), Chitraa
Mal.	: Maradarisina, Maramaanjal
Mar.	: Daaruhalada
Ori.	: Daaruhaldi
Pun.	: Chitra, Kasmal, Simlu, Sumlu, Daarhaldi
Tel.	: Manupasupu
Urd.	: Zarishk

DESCRIPTION –

a) Macroscopic:

Young fruit bright red in colour but changes to blue black when mature, 10 to 12 mm long, 5 to 8 mm thick; ovoid; outer surface shows wrinkles when dried; seeds, 3 in each fruit, about 6 mm long, 2 to 3 mm thick, ovoid, and somewhat flattended; characteristic odour present taste slightly bitter.

b) Microscopic:

Pericarp **-**TS of fruit shows pericarp consists of a single layer radially elongated, lignified cells of epicarp covered with thick cuticle, mesocarp wide, composed of 20 to 25 layered parenchymatous cells; some prismatic and clusters of calcium oxalate crystals present in this region; endocarp parenchymatous, single layered.

Seed **-**Testa shows two coats; outer coat comprising of 7 or 8 layers of lignified cells; epidermis of the outer coat consists of elongated cells, followed by 6 to 7 layers of parenchymatous cells; inner coat comprising of 4 to 6 layers of compactly arranged thin walled cells containing starch grains; individual starch grains simple to compound with 2 or 3 components, oval to spherical, variable in size, about 2 to 7 μ in diameter with a centric hilum; embryo parenchymatous.

Powder -Black-brown, taste slightly bitter; starch grains simple to compound with 2 or 3 components, oval to spherical variable in size; about 2 to 7 μ in diameter with a centric hilum, prismatic and clusters of calcium oxalate crystals; fibres; vessels reticulately thickened, thin walled tracheids with some pits; surface view of testa; elongated cells of epidermis.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	7	per cent,	Appendix 2.2.3
Acid -insoluble ash	-	Not more than	1	per cent,	Appendix 2.2.4
Alcohol -soluble extractive	-	Not less than	13	per cent,	Appendix 2.2.6
Water–soluble extractive	-	Not less than	14	per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract of the drug on silica gel 'G' plate using *toluene : ethyl acetate* (90:10) shows spots at R_f. 0.11, 0.23, 0.34, 0.46, 0.80 & 0.93 (all violet) on spraying with *anisaldehyde sulphuric acid reagent* and heating the plate for ten minutes at 105°. On spraying the plate with 5% *methanolic sulphuric acid reagent* and heating for ten minutes at 105°, it shows spots at R_f. 0.11, 0.28, 0.39, 0.66, 0.72 & 0.95 (all violet). On exposure to *iodine vapors*, spots appear at R_f. 0.23, 0.30, 0.82 and 0.93 (all yellow).

T.L.C. of the alcoholic extract of the drug on silica gel 'G' plate using *toluene : ethyl acetate : formic acid* (50:15:5) shows spots i.e. one light yellow and one red in UV, in iodine spots at R_f. 0.20, 0.49, 0.65, 0.75, 0.81, 0.87, 0.93 and 0.99 all brown. On spraying with 10 % *sulphuric acid* and heating the plate for 10 minutes at 105° spots appear at R_f. 0.12, 0.19, 0.26, 0.29, 0.35, 0.74, 0.83, 0.90 and 0.97.

The alcoholic extract of the drug in solvent system *chloroform: methanol: ammonia* (60:30:1) shows one greenish spot at R_f. 0.94 in visible light. In UV yellow spots appear at R_f. 0.15, 0.62, 0.80 and 0.96. On spraying with modified *Dragendorff's reagent*, orange spots appear at R_f. 0.87, 0.92 and 0.97.

CONSTITUENTS – Alkaloids: Berberine, oxyberberine, berbamine, palmatine, jatrorhizine, tetrahydropalmitine etc.

PROPERTIES AND ACTION –

Rasa	**:** Madhurāmla	
Guṇa	: Laghu, Rūkṣa	
Vīrya	: Śita	
Vipāka	: Kaṭu	
Karma	: Rucya, Pittaśamana, Viṣṭambhī	
IMPORTANT FORMULATIONS- Dārvīsekaḥ, Dārvīsvarasaḥ, Dāruharidrā, Yavakṣārādivaṭī, Darvi Guna, Rasanjana GunaRasanjana Prayoga		
THERAPEUTIC USES - Āmātisāra (Diarrhoea due to indigestion), Aruci (Tastelessness), Hṛllāsa (Nausea), Jvara (Fever); Pittaja-atisāra (Diarrhoea due to Pitta dosa), Raktavikarā (Disorders of blood), Tṛṣṇā (Thirst), Vamana, Viṣavikāra (Disorders due to poison), Yakṛtodara (Enlargement of liver (Hepatomegaly)		
DOSE- Cūrṇa (Powder) : 3 to 5 g.		

DHAVA (Fruit)

Dhava consists of dried fruits of *Anogeissus latifolia* Wall. (Fam. Combretaceae), a large to moderate sized tree common throughout India, in deciduous forests ascending upto 1350 m in the Himalayas and in the South Indian Hills.

SYNONYMS – Gaura, Dhurandhara

REGIONAL LANGUAGE NAMES-

Ben.	:	Dhaauyaa gaachh
Eng.	:	Axle – wood
Guj.	:	Dhaavado
Hin.	:	Baakali, Dhauraa, Dhav, Dhaavaa
Kan.	:	Dinduge
Mal.	:	Vellanava, Malukkanniram
Mar.	:	Dhaavdaa, Dhaval
Ori.	:	Dhaau
Tam.	:	Vellanagai, Vellanamai
Tel.	:	Chirimaanu

DESCRIPTION -

a) Macroscopic:

Fruit 5 to 6 mm long, 9 to 11 mm in diameter including 2 wings, coriaceous, compressed and packed horizontally into dense heads; containing 1-seed, 4 or 5 mm long, 7 or 8 mm in diameter; characteristic odour, tasteless.

b) Microscopic:

Pericarp -Pericarp about 500 µ in depth shows two distinct regions: outer region is the epicarp having thick sclereid with an outer thick cuticle, followed by 6 to 9 layers of thick walled, elongated cells of mesocarp; endocarp not distinct; prismatic and rosettes of calcium oxalate scattered in the region of mesocarp.

Seed -Seed coat about 140 to 220 µ thick, comprise of 6 to 11 layers of thin walled, elongated and highly compressed parenchymatous cells; cells of the seed coat also contain prismatic and rosette of calcium oxalate; 2 or 3 layers of thin walled cells of endocarp present beneath the seed coat followed by the embryo; cotyledons are composed of thin walled parenchymatous cells with brown pigment.

Powder -Dark brown, odour specific, tasteless, characterized by the presence of prisms and rosettes of calcium oxalate, sclereids, thick walled parenchymatous cells, thick walled fibres and vessels with bordered pits are present.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	Not more than 2 per cent, Appendix 2.2.2
Total ash	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	Not more than 0.1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	Not less than 0.4 per cent, Appendix 2.2.6

Water–soluble extractive Not less than 8 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract of the drug on silica gel 'G' plate using *toluene : acetone : formic acid* (55: 40: 5) under UV light 365 nm shows fluorescent zones at R_f. 0.72 and 0.78 (both greenish), on exposure to *iodine vapour* spots appear at R_f. 0.16, 0.21, 0.48, 0.56, 0.80, and 0.93 (all yellow).

In *toluene: ethyl acetate: formic acid* (40:25:04) yellow colured spots appear in visible light. On spraying with *anisaldehyde sulphuric acid reagent* and heating for 10 minutes at at 105°, spots at R_f. value 0.19 (faint reddish), 0.23 (faint reddish), 0.30 (bluish black), 0.64 (reddish), 0.75 (reddish) 0.80 (blackish) and 0.92 (violet).

In *toluene: ethyl acetate* (93:7) under UV 365 nm intense blue spot at R_f. 0.36 appears. On spraying *vanillin sulphuric acid reagent* and heating for 10 minutes at 105°, spots at R_f. value 0.28 (violet), 0.33 (violet), 0.43 (violet), 0.54 (violet), 0.60 (violet), 0.70 (violet), 0.78 (violet), and 0.83 (violet) appear.

CONSTITUENTS - Tannins, gallic acid, saponins, quercetin and myricetin.

PROPERTIES AND ACTION -

Rasa **:** Madhura, Kaṣāya
Guṇa **:** Rūkṣa, Guru
Vīrya **:** Sīta
Vipāka **:** Kaṭu
Karma **:** Pittahara, Kaphahara, Rūcya, Dīpana, Vātakara

IMPORTANT FORMULATIONS – Dhavamūlaguṇaāḥ, Dhava Guna, Dhavaphalaguṇaḥ, Dhavaguṇaḥ, Dhava Phala Guna, Dhavaguṇaāḥ

THERAPEUTIC USES - Aśmarī (Calculus), Arśa (Piles), Mūtrakṛcchra (Dysuria), Medoroga (Obesity), Pāṇḍu (Anaemia), Prameha (Metabolic disorder), Raktavīkāra (Disorders of blood), Upadaṁśa (Syphilis / soft chancre)

DOSE- Cūrṇa (Powder): 5 to 10 g.

DHAVA (Stem Bark)

Dhava consists of dried stem bark of *Anogeissus latifolia* Wall. (Fam. Combretaceae), a large to moderate sized tree common throughout India, in deciduous forests ascending upto 1350 m in the Himalayas and South Indian Hills.

SYNONYMS – Gaura, Dhurandhara

REGIONAL LANGUAGE NAMES-

Ben.	:	Dhaauyaa gaachh
Eng.	:	Axle - wood
Guj.	:	Dhaavado
Hin.	:	Baakali, Dhauraa, Dhav, Dhaavaa
Kan.	:	Dinduge
Mal.	:	Vellanava, Malukkanniram
Mar.	:	Dhaavdaa, Dhaval
Ori.	:	Dhaau
Tam.	:	Vellanagai, Vellanamai
Tel.	:	Chirimaanu

DESCRIPTION –

a) Macroscopic:

Pieces of bark mostly about 4 to 6 cm long, 1.5 to 1.75 cm wide and 1 or 2 mm thick, hard, recurved, externally pale, fairly smooth having small ridges; inner surface pale brown, smooth but longitudinally striated; fracture clean; faint odour; taste, slightly bitter and astringent.

b) Microscopic:

Mature bark consists of an outer 7 to 9 radially arranged layers of cork cells, followed by 20 to 24 layers of parenchymatous thin walled cells of phelloderm, both regions containing prismatic and rosette crystals of calcium oxalate; secondary phloem very wide and characterized by the occurrence of numerous patches of sclereids, fibres, sieve tubes, companion cells and phloem parenchyma; crystals of calcium oxalate and granules of starch grains also present in cells; starch grains circular in appearance with a centric hilum and measure 6 to 13 µ.

Powder -Light brown, taste bitter, shows circular starch grains measuring 6 to 13 µ, numerous prismatic and rosettes of calcium oxalate, phloem fibres both simple and septate, thin walled, 155 to 200 µ long, 10 to 20 µ in width; thick walled fibres about 275 to 340 µ long, 9 to 20 µ in width with 6 to 11 µ wide lumen; sclereids of various shapes, measuring about 80 to 235 µ long and 25 to 75 µ wide, thin walled parenchymatous cells also present.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more than 2 per cent, Appendix 2.2.2
Total ash	**-**	Not more than11 per cent, Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than 11 per cent, Appendix 2.2.6
Water–soluble extractive	**-**	Not less than 20 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract of the drug on silica gel 'G' plate of 0.2 mm thickness using *toluene: ethyl acetate* (93:7) under UV light 365 nm shows only one fluorescent zone at R_f. 0.10 (greenish). On spraying with *anisaldehyde sulphuric acid reagent* and heating the plate for 15 minutes at 105°, spots appear at R_f. 0.10 (black), 0.20 (pink), 0.30 (green), 0..34 (blue), 0.40 (green) 0.44 (pink), 0.50 (blue), 0.56 (blue), 0.65 (black), 0.73 (pink), 0.86 (green), 0.93 (blue).

T.L.C. of the alcoholic extract in solvent system *toluene : ethyl acetate* (90:10) and on spraying with *vanillin sulphuric acid reagent* show spots appearing at R_f. 0.40 (violet), 0.58 (violet), 0.72 (brownish), 0.87 (violet) and 0.98 (violet).

CONSTITUENTS - Phenolic compounds such as ellagic acid, flavellagic acid, quercetin, myricetin and procyandin along with gallotannins, shikimic acid, quinic acid, amino acids, alanine and phenylanine.

PROPERTIES AND ACTION –

Rasa	**:**	Madhura, Kaṣāya
Guna	**:**	Rūkṣa, Guru
Vīrya	**:**	Śīta
Vipāka	**:**	Kaṭu
Karma	**:**	Pittahara, Kaphahara, Rasāyana, Dīpana, Medoghna

IMPORTANT FORMULATIONS -Ayaskṛti, Nyagrodhādi Cūrṇa, Dhavamūlaguṇaāḥ, Dhava Guna, Dhavaphalaguṇaḥ, Dhavaguṇaḥ, Dhava Phala Guna, Dhavaguṇaāḥ

THERAPEUTIC USES - Aśmarī (Calculus), Arśa (Piles), Karṇasrāva (Otorrhoea), Kuṣṭha (Leprosy / diseases of skin), Mūtrakṛcchra (Dysuria), Medoroga (Obesity), Pāṇḍu (Anaemia), Prameha (Metabolic disorder), Raktavīkāra (Disorders of blood), Upadaṁśa (Syphilis / soft chancre), Visarpa (Erysepales)

DOSE -Kvātha (Decoction): 30 to 50 ml.

DVĪPĀNTARA DAMANAKA (Whole Plant)

Dvīpāntara Damanaka consists of the dried whole plant in flowering stage of *Artemisia absinthium* L. (Fam. Asteraceae), a herbaceous plant found in Kashmir and Nepal.

SYNONYMS – Koṇākāṇdā, Sugandhidru, Śiraḥśūlakarī

REGIONAL LANGUAGE NAMES-

Ben.	: Mastaru
Eng.	: Worm wood, Absinth
Guj.	: Mastaru
Hin.	: Vilayati afsantin
Kan.	: Titaveen, Vruvalu
Mal.	: Nilampala, Tirunitripachcha
Mar.	: Serpana
Pun.	: Mastiyaaraa
Tel.	: Moshipatri, Machipatri
Urd.	: Afsanteen

DESCRIPTION –

a) Macroscopic:

Stem **–**Usually unbranched, internodes 4 to 5 cm in length, 0.5 to 5 mm in thickness; surface pale brown, longitudinally furrowed, with attached petiole or its scar at the nodal region; pubescent; fracture short and splintery in the bark, fractured surface yellowish; odour not characteristic; taste, bitter.

Leaf **–**Crumpled and broken; measuring about 2 cm in length and 2 mm in breadth, easily getting detached from the stem; petiolate, ovate to obovate, pinnatifidly cut into 2 or 3 spreading linear or lanceolate, obtuse segments, hairy on both sides, greyish green in colour and bitter in taste.

Flower head **–**Pedunculate, borne on a hairy receptacle of 1.5 to 5 mm in dia.; ligulate flower, many, yellow, heterogamous; stigma bilobed; stamens 5, anthers syngenicious; ray florets, a few, dilated below; involucre of bracts, oblong, hairy, narrowly scarious; achenes, flat, elliptic oblong and black in colour.

b) Microscopic:

Stem **–**Stem circular in outline, faintly elevated and furrowed at places, epidermis, covered with abundant trichomes of varying sizes and shapes; simple unicellular covering trichomes are 45 to 80 µ in length, multicellular of 2 to 4 celled, 140 to 150 µ in length; hooked or sickle shaped, 175 to 230 µ in length and 'T' shaped with uni or bicellular stalk, with spreading 245 to 250 µ long arms; glandular trichomes stalked, very short, measuring 2 to 20 µ in length with multicellular head; cortex collenchymatous; endodermis distinct, consisting of barrel shaped tangentially elongated, biconvex cells; pericycle, characterized by oval shaped well developed patches of lignified sclerenchyma usually lying above each of the vascular bundle; phloem very narrow, at places obliterated; xylem consisting of vessels, tracheids and thin walled fibres, vessels radially arranged, border pitted, annular or scalariform, and measure 230 to 240 µ in length and 20 to 35 µ in breadth; medullary rays lignified, radially

elongated, uni to triseriate, especially in older stem; pith wide, cells parenchymatous, pitted ant thick walled, secretory canals isolated and located towards the peripheral region of the pith.

Leaf **–**Surface preparation of the leaf shows thick walled, slightly wavy, epidermal cells with faint striated cuticle and stomata of anomocytic type; trichomes plenty, identical with that of stem, 'T' shaped trichomes are maximum in number characterized with their long spreading arms measuring 295 to 350 μ in length, occasionally glandular trichomes appressed, with oval or bilobed heads.

Powder –Pale yellowish-brown, extremely bitter in taste; with characteristic bitterish odour; 'T' shaped trichomes of leaf and stem, are plenty; other characters are, uniseriate multicellular trichomes of leaf and bracts; wooly trichomes of ray florets; anomocytic type stomata of leaf; lignified somewhat rectangular shaped anther cells; triangular pollen grains, thick walled pitted cells of pith and groups of lignified fibres, and fragments of pitted and spirally thickened vessels of the stem.

IDENTITY, PURITY AND STRENGTN –

Foreign matter	**-**	Not more than	2	per cent, Appendix	2.2.2
Total ash	**-**	Not more than	14	per cent, Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	7	per cent, Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not more than	5	per cent, Appendix	2.2.6
Water-soluble extractive	**-**	Not more than	11	per cent, Appendix	2.2.7
Volatile oil	**-**	Not more than	0.1	per cent, Appendix	2.2.10

Chemical Test –Take a small portion of alcohol extract with chloroform and add acetic anhydride followed by conc. sulphuric acid drop wise. Violet colour is produced.

T.L.C. –

T.L.C. of the volatile oil on silica gel 'G' plate (0.2 mm thick) using *toluene:ethyl acetate* (93:7) under UV 366 nm shows fluorescent spots at R_f. 0.47, 0.64, 0.70 and 0.82. On exposure to *iodine vapour*, spots appear at R_f. 0.28, 0.31, 0.35, 0.41, 0.55, 0.75 and 0.86.

CONSTITUENTS –Volatile oil (which contain α-pinene, β-pinene, β-phellandrene, thujone, azulene, sabinyl acetate, etc.) bitter principle absinthin, iso-absinthin.

PROPERTIES AND ACTION -	
Rasa	: Tikta
Guṇa	: Laghu, Rūkṣa, Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Ārtavajanana, Dīpana, Kaphahara, Kṛmighna, Mūtrala, Śothahara, Sugandhi, Vātahara, Vedanāsthāpana
IMPORTANT FORMULATIONS - Used as single drug	
THERAPEUTIC USES- Agnimāndya (Digestive impairment), Apasmāra (Epilepsy), Jīrṇajvara (Chronic fever), Jalodara (Ascites), Kṛmi (Worm infestation), Kaṣṭārtava (Dysmenorrhoea),	

Karṇaśūla (Otalgia), Mūtrakṛcchra (Dysuria), Pakṣāghāta (Paralysis / Hemiplegia), Plīhāroga (Splenic disease), Sandhiśotha (Arthritis), Śotha (Inflammation), Udararoga (Diseases of abdomen), Vātaroga (Disease due to Vata dosa), Yakṛt roga (Liver disorder)
DOSE -Cūrṇa (Powder): 1 to 2 g.

DVĪPĀNTARA ŚATĀVARĪ (Root)

Dvīpāntara Śatāvarī consists of dried roots of *Asparagus officinalis* L. (Fam. Liliaceae), a shrub found in Europe and America, introduced in India and successfully cultivated at higher elevations in Kashmir and also in parts of plains.

SYNONYMS - Sūciguccha

REGIONAL LANGUAGE NAMES-

Ben.	: Hikua, Hillua
Eng.	: Asparagus, Sperage
Hin.	: Halyun
Mar.	: Halyun
Urd.	: Haliyoon

DESCRIPTION –

a) Macroscopic:

The root occurs in small pieces, 2 to 6 cm long and 0.2 to 0.5 cm thick; surface rough due to longitudinal wrinkles, root hairs and scars; creamish white externally and pale white internally; fracture hard and fibrous; odour, rancid, taste, disagreeable.

b) Microscopic:

TS consists of an outer cuticle and a single layer of epiblema, cells polygonal; unicellular hairs present; below epidermis 3 or 4 rows of cork cells; cortical tissue consists of parenchymatous cells, more or less circular in outline with small intercellular spaces, and several cells show the presence of raphides; endodermal cells possess casparian strips on their radial walls; xylem bundles arranged in radial rows alternately with phloem and consists of vessels and tracheids; pith cells parenchymatous with a large number of intercellular spaces.

Powder –Cream coloured, shows under microscope, cortical parenchyma with raphides; vessels with simple cross wall performation plates, numerous small and large pits on the walls; tracheids lignified elongated and pointed with annular thickenings; fibres elongated and pointed at both the ends.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more than	1	per cent,	Appendix 2.2.2
Total ash	**-**	Not more than	10	per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than	2.5	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than	9	per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than	24	per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of methanolic extract of the drug on a precoated silica gel 'G' plate, using *chloroform: methanol: water* (65:35:10), on spraying with Libermann – Burchard reagent and heating the plate for about five minute at 105^{o} show, spots at R_f. 0.65 & 0.50 (both light brown) and 0.24 (light yellow).

CONSTITUENTS –Saponin glycosides, β-sitosterol, saccharopine, 2-aminoadipic acid, asparagusic acid, dihydroasparagusic acid, *S*-acetyl dihydroasparagusic acid, spirostanol glucoside, sarsasapogenin glycoside, asparasaponin I and asparasaponin II and nine steroid glucosides named as asparagosides A, B, C, D, E, F, G, H and I.

PROPERTIES AND ACTION –	
Rasa	: Madhura
Guṇa	: Snigdha, Guru
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Hṛdya, Mūtrala, Pittahara, Vṛṣya, Vājīkaraṇa
IMPORTANT FORMULATIONS - Used as single drug	
THERAPEUTIC USES - Aśmarī (Calculus), Kāmalā (Jaundice), Mūtrakṛcchra (Dysuria), Śotha (Inflammation), Vātararakta (Gout)	
DOSE - Cūrṇa (Powder) : 3 to 6 g.	

ELAVĀLUKAM (Root)

Elavālukam consists of roots of *Prunus avium* L. (Fam. Rosaceae), a small tree with fascicled white flowers which appear along with the new leaves. The wild form of this species is often used as a stock for grafting cultivated varieties of cherry. The plant is found in Kashmir, Kumaon and Himachal Pradesh.

SYNONYMS - Āluka, Vāluka, Eluka

REGIONAL LANGUAGE NAMES-

Ben.	: Elavaaluka
Eng.	: Sweet Cherry
Hin.	: Alubukhara, Aluvaalu, Gilaas, Aalubaalu
Kan.	: Chary hannu
Ori.	: Mitha cherry
Pun.	: Alubukhara
Tel.	: Cherychettu, Alubakraapandu
Urd.	: Alubalu, Alubukhara

DESCRIPTION -

a) Macroscopic:

Root knotty and irregular, tortuous, with a dark grey bark up to 3.5 mm thick and transversely elongated brown lenticels; wood hard, yellow inside, yellowish-orange on the outer smooth surface; fracture, irregular, splintery; odour and taste not distinctive.

b) Microscopic:

Transverse section through the root shows a rather diffuse wood structure showing small isolated vessels, 60 to 70 µ in diameter, and abundant fibres; vessels mostly show simple to bordered pits and have simple perforations; fibres present in large groups and sometimes having fine septa; parenchyma rare and if present, diffused or scattered; rays 1 to 4 seriate, several cell high, parenchymatous, made of rectangular cells possessing starch grains.

Powder – Light brown, coarse and fibrous; taste and odour not distinct; powder microscopy shows vessels with simple and bordered pits, fibres in isolation or in groups, fragments of tissue showing ray parenchyma cells and fibres.

IDENTITY, PURITY AND STRENGTH –

Foreign matter - Not more than 2 per cent, Appendix 2.2.2
Total ash - Not more than 8 percent, Appendix 2.2.3
Acid-insoluble ash - Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive - Not less than 7 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 5 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract on pre-coated silica gel 'G' F_{254} plate using mobile phase *chloroform: methanol* (8:2), on spraying the plate with NP/PEG reagent, shows spots at R_f. 0.09 (pink), 0.23 (fluorescent spot), 0.39 (reddish brown), 0.46 (fluorescent spot), 0.64 (violet) and 0.87 (orange) at 366 nm.

CONSTITUENTS – D-mandelonitril-β- glucoside (prunasin).

PROPERTIES AND ACTION-

Rasa : Kaṣāya, Tikta
Guṇa : Laghu
Vīrya : Śīta
Vipāka : Kaṭu
Karma : Kaphahara, Pittahara, Śukraśodhana, Vedanāsthāpana, Vamana

IMPORTANT FORMULATIONS- Evavaluka Guna, Elavālukaḥ, Balukam Guna, Balukam Phalam Guna, Elavālukaguṇaāh, Valukam(Trapusa Visesa) Guna

THERAPEUTIC USES- Arśa (Piles), Aruci (Tastelessness), Kṛmi roga (Worm infestation), Kaṇḍu (Itching), Kuṣṭha (Leprosy / diseases of skin), Vraṇa (Ulcer), Mūtra roga (Urinary diseases), Rakta-pitta (Bleeding disorder)

DOSE- Cūrṇa (Powder): 1 to 3 g.

ELAVĀLUKAM (Stem Bark)

Elavālukam consists of stem bark of *Prunus avium* L. (Fam. Rosaceae), a small tree with fascicled white flowers which appear along with the new leaves. The wild form of this species is often used as a stock for grafting cultivated varieties of cherry. The plant is found Kashmir, Kumaon and Himachal Pradesh.

SYNONYMS - Āluka, Vāluka, Eluka

REGIONAL LANGUAGE NAMES-

Ben.	: Elavaaluka
Eng.	: Sweet Cherry
Hin.	: Aluvaalu, Gilaas, Aalubaalu, Alubukhara
Kan.	: Chary hannu
Ori.	: Mitha cherry
Pun.	: Alubukhara
Tel.	: Cherychettu, Alubakraapandu
Urd.	: Alubalu, Alubukhara

DESCRIPTION-

a) Macroscopic:

Bark up to 3.5 mm in thickness, rough, dark grey outside, smooth and orange inside; usually exfoliating in 2 layers- outer thin greyish layer which recurves transversely on removal and forms a quill or a double quill, and the inner greenish yellow, thicker layer which remains straight or curved; lenticels scattered, elongated, spindle or oval shaped, transversely oriented, having a central slit and raised upper and lower margins, brown; stem bark may sometimes be associated with foliose lichens of greenish light grey colour; fracture, short, fibrous; odour, sharp; taste, bitter.

b) Microscopic:

The bark in transverse section often shows small layers of cork cells peeling off in a recurved manner from many layered corky tissue which is subtended by a few layers of clear, rectangular, thin walled cells of cork cambium; 2 to 3 layers of secondary cortex inner to cork cambium have highly flattened, tangentially elongated cells; secondary cortex parenchymatous, with circular or elongated cells; groups of small and large, usually up to 35 µ size stone cells and occasionally, rosettes of calcium oxalate crystals up to 30 µ, are scattered in the secondary cortex; cortex and phloem also have single or groups of characteristic thick walled, long, straight or tortuous, branched and un-branched fibres; the medullary rays ran out into the secondary cortex to form funnel like patches.

Powder –Brown, coarse, fibrous and fluffy, taste bitter; odour not distinct; microscopy shows characteristic thick walled, long, straight or tortuous, branched and un- branched fibres, and groups of cork cells.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	- Not more than	1	per cent, Appendix 2.2.2
Total ash	- Not more than	7	per cent, Appendix 2.2.3
Acid-insoluble ash	- Not more than	0.5	per cent, Appendix 2.2.4
Alcohol-soluble extractive	- Not less than	11	per cent, Appendix 2.2.6
Water-soluble extractive	- Not less than	9	per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract on silica gel 'G' F_{254} plate using mobile phase *butanone: ethyl acetate: acetic acid: water* (3:5:1:1), on spraying the plate with NP/PEG reagent, shows spots at R_f. 0.44 and 0.53 (both fluorescent blue) and at R_f. 0.82 (dark zone) at 366 nm.

CONSTITUENTS – D-mandelonitril-β-glucoside (prunasin), D-mandelonitrile-β-gentiobioside dehydrowogonin 7-glucoside and chrysin 7-glucoside are main components. Tectochrysin, apigenin 5-glucoside, genkwanin 5-glucoside and neosakuranine are the minor components.

PROPERTIES AND ACTION-	
Rasa	: Kaṣāya, Tikta
Guṇa	: Laghu
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	Kaphahara, Pittahara, Śukraśodhana,Vamana, Vedanāsthāpana
IMPORTANT FORMULATIONS – Evavaluka Guna, Elavālukaḥ, Balukam Guna, Balukam Phalam Guna, Elavālukaguṇaāh, Valukam(Trapusa Visesa) Guna	
THERAPEUTIC USES- Arśa (Piles), Aruci (Tastelessness), Hṛdroga (Heart disease), Kaṇḍu (Itching), Kṛmi (Worm infestation), Kuṣṭha (Leprosy / diseases of skin), Mūtra roga (Urinary diseases), Rakta-pitta (Bleeding disorder), Vraṇa (Ulcer)	
DOSE - Cūrṇa (Powder): 1 to 3 g.	

ERAṆḌAKARKAṬĪ (Fruit)

Eraṇḍakarkaṭī consists of dried pericarp of mature and unripe fruits of *Carica papaya* L. (Fam. Caricaceae), a small, fast growing tree, cultivated throughout India for its fruits and latex, which is a commercial source of enzyme papain.

SYNONYMS - Mdhukarkaṭī, Gopālakarkaṭī

REGIONAL LANGUAGE NAMES-

Ben.	:	Papeyaa, Pappiyaa
Eng.	:	Papaya, Melon tree, Pawpaw
Guj.	:	Erandakaakadi, Papaiyu, Papita
Hin.	:	Papitaa
Kan.	:	Pirangi, Pappaay
Mal.	:	Karmaasu, Pappaay, Karumatti
Mar.	:	Papaayaa, Papai
Pun.	:	Erandakharbujaa
Tam.	:	Pappali
Tel.	:	Boppayi, Bobbaasi, Paringi

DESCRIPTION -

a) Macroscopic:

Pericarp of fruit in pieces measuring upto 6 cm in length, 1.5 cm in width and 1 to 2 mm. thick; surface shrunken, epicarp portion dark greenish-brown, mesocarp cream to yellowish brown, leathery, odour characteristic; taste, bitter and mucilagenous.

b) Microscopic:

Epicarp shows single layer of thin walled cells covered externally with thick cuticle; mesocarp a wide zone consisting of circular to oval parenchyma cells with scattered vascular bundles and unbranched laticiferous ducts, endocarp 2 or 3 layers of compact thin walled parenchyma cells; some of the parenchyma cells of mesocarp contain rosettes of calcium oxalate crystals.

Powder -Shows fragments of parenchyma cells with adjoining laticiferous ducts, parenchyma cells containing rosettes of calcium oxalate crystals, scalariform and spiral xylem vessels, parenchyma cells with overlapping vessels, epidermal cells with anomocytic and anisocytic stomata and a few scattered rosettes of calcium oxalate crystals.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 14 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 2 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 25 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract on precoated silica gel 'G' plate using *toluene: ethyl acetate: acetic acid: methanol* (4.5:1:0.7:0.3) as mobile phase, on spraying the plate with *ethanolic sulphuric acid* (10%) *reagent* and heating at 110^{o} for 10 minutes spots appear at R_f. 0.14,0.45,0.51,0.70, 0.75 and 0.80 and 0.23 (blue).

CONSTITUENTS -β-carotene, papain, carpaine.

PROPERTIES AND ACTION -

Rasa : Tikta, Madhura
Guṇa : Laghu
Vīrya : Uṣṇa
Vipāka : Madhura
Karma : Pittahara, Kaphahara, Dīpana, Vātakara, Stanya, Hṛdya, Bṛṁhaṇa

IMPORTANT FORMULATIONS – Pakvavātakumbhaguṇāḥ, Vātakumbhaguṇāḥ

THERAPEUTIC USES - Kṛmi (Worm infestation), Kāsa (Cough), Raktavīkāra (Disorders of blood), Śvāsa (Asthma), Vātararakta (Gout)

DOSE - Cūrṇa (Powder): 10 to 20 g.

ERAṆḌAKARKAṬĪ (Root)

Eraṇḍakarkaṭī consists of dried roots of *Carica papaya* L. (Fam.Caricaceae), a small fast growing tree, cultivated throughout India for its fruits and for latex, which is a commercial source of the enzyme papain, extracted from it.

SYNONYMS - Mdhukarkaṭī, Gopālakarkaṭī

REGIONAL LANGUAGE NAMES-

Ben.	:	Papeyaa, Pappiyaa
Eng.	:	Papaya, Melon tree, Pawpaw
Guj.	:	Erandakaakadi, Papaiyu, Papita
Hin.	:	Papitaa
Kan.	:	Pirangi, Pappaay
Mal.	:	Karmaasu, Pappaay, Karumatti
Mar.	:	Papaayaa, Papai
Pun.	:	Erandakharbujaa
Tam.	:	Pappali
Tel.	:	Boppayi, Bobbaasi, Paringi

DESCRIPTION -

a) Macroscopic:

Roots cylindrical, in cut pieces upto 10 cm. long and 1.5 cm. thick; surface pale brown with longitudinal wrinkles and scars of rootlets; fracture, short and horny; odour and taste indistinct.

b) Microscopic:

Root shows narrow cork consisting of rectangular and tangentially elongated cells; phellogen single layered, phelloderm consists of tangentially elongated parenchyma cells, some of them containing rosettes of calcium oxalate crystals; phloem consists of sieve tubes, companion cells, phloem parenchyma and fibres; both xylem and phloem are traversed by multiseriate medullary rays; vessels show reticulate thickening except vessels all the xylem elements are thin walled and non-lignified.

Powder -Powder shows thin walled parenchyma cells, some of them containing rosette of calcium oxalate crystals, fragments of cork cells, fibres with solid tapering or blunt ends and vessels with reticulate thickenings.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**:**	Not more than 2 per cent, Appendix 2.2.2
Ash value	**:**	Not more than 18 per cent, Appendix 2.2.3
Acid Insoluble ash	**:**	Not more than 1.5 per cent, Appendix 2.2.4
Alcohol soluble extractive	**:**	Not less than 3.0 per cent, Appendix 2.2.6
Water soluble extractive	**:**	Not less than 15.0 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of alcololic extract on precoated silica gel 'G' plate using *toluene: ethyl acetate: methanol: acetic acid* (4:5:2:0:2) as mobile phase, on spraying the plate with *ethanolic sulphuric acid* (10%) *reagent* and heating at 110^{o} for 10 minutes; spots appear at R_f. 0.17,0.27,0.64,0.70, and 0.74.

CONSTITUENTS - Carpesanine, carpaine.

PROPERTIES AND ACTION -

Rasa : Kaṭu, Tikta
Guṇa : Laghu, Rūkṣa, Tīkṣṇa
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Kaphahara, Mūtrala

IMPORTANT FORMULATIONS -Aśmarīharakaṣāya Cūrṇa, Pakvavātakumbhaguṇāḥ, Vātakumbhaguṇāḥ

THERAPEUTIC USES - Aśmarī (Calculus), Arśa (Piles), Aruci (Tastelessness), Kṛmi roga (Worm infestation), Mutraroga (Urinery diseases), Raktapitta (Bleeding disorder), Raktapradara (Menorrhagia or metrorrhagia or both), Tvak roga (Skin diseases), Udaraśūla (Pain in the abdomen), Vātararakta (Gout), Vraṇa (Ulcer)

DOSE -Cūrṇa (Powder): 2 to 6 g.

GANDHAŚIPHĀ (Whole Plant)

Gandhaśiphā consists of the whole plant of *Pavonia odorata* Willd. (Fam. Malvaceae), a pubescent herb found in the plains of India.

SYNONYMS – Picchila lomaśaḥ

REGIONAL LANGUAGE NAMES-

Ben.	: Sugandha-bala
Guj.	: Kalowalo
Hin.	: Sugandha-bala
Kan.	: Balarakkasi-gidaa
Mal.	: Kuruntotti
Mar.	: Kaalaavaalaa
Tam.	: Peramutti
Tel.	: Chitti benda

DESCRIPTION -

a) Macroscopic:

Root –Pale brown, well developed, with lateral roots upto 0.75 cm in thickness, length variable, no characteristic odour; taste, slightly bitter.

Stem **–**Green in colour, slightly hairy, variable in length and thickness; leaves intact, no characteristic odour; taste, slightly bitter.

Leaf –Petiole upto 5 cm long with prominent midrib on both surfaces; leaf 2.5 to 5 cm long, roundish cordate, 3 to 5 lobed, lobes acute, distantly toothed, hairy on both surfaces, mildly aromatic, taste bitter.

b) Microscopic:

Root **–**Outer cork crushed, inner cork 5 or 6 layered, cells rectangular, tangentially elongated; cortex parenchymatous, inner one or 2 layers discontinuously collenchymatous; groups of sclereids scattered in the cortex; endodermis indistinct; pericyclic fibres present; xylem consists of circular vessels and lignified parenchyma; uniseriate and multiseriate rays present; pith absent; druses and simple as well as compound starch grains present in all the regions.

Stem **–**Epidermis single layered; cuticle present; unicellular slightly curved trichome present; cortex consists of 2 or 3 layers of hypodermal parenchyma followed by 1 or 2 layers of collenchyma with remaining 1 or 2 layers of parenchymatous cells; inner region of cortex showed alternating sclereids and fibres; endodermis indistinct; pericyclic fibres present; stele shows phloem and solitary, medium sized, many circular vessels embedded in lignified parenchyma; uniseriate or multiseriate rays filled with starch grains present; pith parenchymatous; druses, abundant particularly in phloem and simple as well as compound starch grains present throughout the ground tissues.

Leaf –

Petiole – Circular in outline; epidermal cells single layered with cuticle; cortex consists of 1 or 2 layers of hypodermal chlorenchyma followed by 2 or 3 layers of collenchyma and 2 or 3 layers of parenchyma cells; isolated, collateral vascular bundles arranged in a circle, each capped by sclerenchyma; druses present in the phloem region; xylem vessels circular with lignified parenchyma; pith parenchymatous; simple and compound starch grains present throughout the cortex and pith.

Midrib **–**Shows a protrusion on the adaxial side and a hemispherical projection on the abaxial side; epidermis single layered with cuticle; stellate hair as well as uniseriate, multicellular trichomes upto 14 cells in length with conical tip, and unicellular trichomes present on both sides; hypodermal layer consists of 2 to 4 layers of collenchyma cells; rest of the region parenchymatous; 4 or 5 big mucilage cells present on both the adaxial and abaxial side; collateral crescent shaped median vascular bundle present, showing xylem towards adaxial and phloem on abaxial side; druses present in the phloem region.

Lamina **–**Dorsiventral; epidermis single layered with cuticle; palisade parenchyma single layered; 2 or 3 layers of spongy parenchyma cells present; mucilage cells present in the mesophyll region; stomata anomocytic on both surfaces; cell walls wavy; stomatal number 10 to 15 / mm^2 on adaxial epidermis, 30 to 35 / mm^2 on abaxial epidermis; stomatal index 9 to 11 for adaxial epidermis and 15 to 17 for abaxial epidermis; palisade ratio 8 to 10; veinlet termination number 10 to 15; vein islet number 10 to 12.

Powder –Brown, stellate, unicellular as well as uniseriate multicellular trichomes as described above present, druses 10 to 40 µ in size; starch grains simple and compound, individual starch grains measuring 5 to 10 µ in diameter; length of fibres 300 to 700 µ; and cork cells also seen.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 4 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 9 per cent, Appendix 2.2.7
Fixed oil	-	Not less than 4 per cent, Appendix 2.2.8

T.L.C. –

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} of 0.2 mm thickness using *toluene : ethyl acetate* (5:1.5) under UV 254 nm shows spots at R_f. 0.18, 0.22, 0.40, 0.64, 0.71, 0.76, 0.80 and 0.87 (all green). Under UV 366 nm fluorescent zones appear at R_f. 0.18 (blue), 0.22, 0.31, 0.38, 0.44, 0.58 (all pink), 0.64 (blue), 0.73, 0.80 (both pink) and 0.93 (blue). On exposure to *iodine vapour* spots appear at R_f. 0.54, 0.71 and 0.77 (all brown). On dipping the plate in *vanillin-sulphuric acid reagent* and on heating at 105° for 5 minutes spots appear at R_f. 0.15, 0.18 (both grey), 0.24 (violet), 0.43, 0.52, 0.62, 0.67 (all grey), 0.75 (yellow) 0.83 (green) and 0.94 (blue).

CONSTITUENTS – β–sitosterol; palmitic, stearic, oleic, linoleic, isovaleric and *n*-caproic acids; α- pinene and methyl eptenone, isovalaraldehyde, aromadendrin, azulene, pavonene, pavonenol**.**

PROPERTIES AND ACTION -	
Rasa	: Tikta
Rasa	Tikta
Guṇa	: Rūkṣa, Laghu, Sugandhi
Vīrya	: Śita
Vipāka	: Kaṭu
Karma	: Balya, Dīpana, Jvaraghna, Kaphahara, Keśya, Mūtrala, Pācana, Pittahara
IMPORTANT FORMULATION – Hrivera Guna	
THERAPEUTIC USES -Aruci (Tastelessness), Atisāra (Diarrhoea), Chardi (Emesis), Dāha (Burning sensation), Hṛdroga (Heart disease), Hṛllāsa (Nausea), Jvara (Fever), Kuṣṭha (Leprosy / diseases of skin), Raktapitta (Bleeding disorder), Śvitra (Leucoderma / Vitiligo), Tṛṣṇā (Thirst), Visarpa (Erysepales), Vraṇa (Ulcer)	
DOSE- Cūrṇa (Powder): 3 to 6 g.	

GRĪṢMACHATRAKA (Whole Plant)

Grīṣmachatraka consists of dried whole plant of *Mollugo cerviana* Seringe (Fam. Aizoaceae), an erect, slender annual, upto 20.0 cm high, found in dry and sandy areas commonly in Indian plains.

SYNONYMS – Uṣṇasundara

REGIONAL LANGUAGE NAMES-

Ben.	:	Ghimasak
Hin.	:	Jimasaka
Kan.	:	Parpataka
Mal.	:	Parpatakapullu
Mar.	:	Pada
Ori.	:	Pitta Sag
Tam.	:	Parpadangam
Tel.	:	Parpatakamu

DESCRIPTION –

a) Macroscopic:

***Root* -** Tap root yellow, thin, cylindrical and brittle.

***Stem* –** Branched, branches arises from the node, nodes upto 18 mm thick nodal distance of the stem ranges from 4 to 5.0 cm.

***Leaf* -**Radical leaves present, tufted, linear-spathulate or obovate; cauline leaves, in whorls of 4 to 8 at each node of the branches, linear oblong or subspathulate.

***Flower* -** Numerous in cymes; pedicel long filiform; perianth small, oval to oblong, obtuse with membrenous margin; stamens 3 to 5; ovary globose, 3 to 5 celled; style very small; capsule as long as perianth, globose with many pink or yellowish seeds.

b) Microscopic:

***Root* –** TS root wavy in outline, epidermal cells vary in size and covered by a thin cuticle; cortex 4 to 5 cells deep, cells parenchymatous, laterally compressed without intercellular spaces; endodermis distinct, single layered of barrel-shaped parenchymatous cells; cells of pericycle smaller than endodermis; followed by 3 or 4 cells deep phloem; cambium 3 or 4 cells deep; xylem consists of vessels, tracheids, fibres and parenchyma.

***Stem* –** TS stem circular in outline; exhibits a thin cuticle covering the single layered epidermis followed by a parenchymatous hypodermis; cortex 5 to 8 cells deep, sclerenchymatous with narrow lumen; in the stelar region, alternate rings of phloem and xylem separated by 1 or 2 layered cambium; phloem narrow 2 or 3 cells deep and consists of sieve tubes, companion cells and phloem parenchyma; xylem consists of vessels, tracheids and fibres, the central portion occupied by sclerenchymatous pith.

***Leaf* –** TS of leaf consists of a single layered large rectangular upper and lower epidermis, covered with thin cuticle, interrupted by unicellular thick walled, lignified trichomes followed by single layered palisade cells on both the surfaces; in surface view the epidermal cells sinuous; stomata a few, anisocytic and paracytic present on

lower side; spongy parenchyma 4 or 5 cells deep, cells angular; the whole leaf consists of 9 amphicribral vascular bundles, one in the midrib which is large and oval, while others smaller located in the mesophyll; all vascular bundles surrounded with a single layer of chlorenchymatous bundle sheath; xylem and phloem consists of usual elements.

Powder – Powder greenish brown, microscopical examination shows, patches of wavy epidermal cells with stomata; parenchymatous cells of hypodermis; sclerenchymatous cell with narrow lumen of cortex, tracheids; thick walled, lignified, unicellular trichomes; many small oval shaped yellowish brown coloured seeds; very minute, tricolpate pollen grains and groups of fibres.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 9.5 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 4 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 14 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *ethyl acetate : formic acid : acetic acid : water* (10:1:1:2) shows spots at R_f. 0.13, 0.19, 0.27, 0.31, 0.39 and 0.47 under UV 254 nm. On spraying with *anisaldehyde-sulphuric acid reagent* and heating the plate at 105^o for 10 minutes, spots appear at R_f. 0.11 (blue), 0.19 (blue), 0.24 (green), 0.37 (blue), and 0.46 (yellow).

CONSTITUENTS – Flavonoid: orientin, vitexin and their 2´-*O*-glucosides.

PROPERTIES AND ACTION -

Rasa	: Tikta
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Dīpana, Jvaraghna, Tṛṣṇāhara, Virecana

IMPORTANT FORMULATIONS- Used as single drug

THERAPEUTIC USES - Agnimāndya (Digestive impairment), Jvara (Fever), Dāha (Burning sensation), Kāmalā (Jaundice), Prameha (Metabolic disorder)

DOSE- Cūrṇa (Powder): 3 to 6 g.

GOKṢURA (Whole Plant)

Gokṣura consists of dried whole plant of *Tribulus terrestris* L. (Fam. Zygophyllaceae), an annual, rarely perennial, prostrate herb and a common weed of the pasture lands, roadsides and other waste lands, chiefly growing in hot, dry and sandy regions throughout India and upto 3,000 m in Kashmir.

SYNONYMS – Gokṣuraka, Kṣuraka, Trikaṇṭaka, Svādukaṇṭaka, Śvadaṁṣṭrā

REGIONAL LANUAGE NAMES-

Ass.	: Gokshura, Gokshuraka
Ben.	: Gokshur, Gokhuree
Eng.	: Small caltrops, Land caltrops, Puncture vine
Guj.	: Nhana gokhru, Bethagokhru
Hin.	: Gokhru, Chhotaagokshru, Hathichikar
Kan.	: Neggilumullu, Neglu
Mal.	: Nerunji
Mar.	: Sarate, Kate gokhru
Ori.	: Gakhura, Gokshra, Gokharaa
Pun.	: Bhakhada, Bhakhar
Tam.	: Nerinzil, Nerunjee
Tel.	: Palleru
Urd.	: Khar-e-khasak khurd

DESCRIPTION -

a) Macroscopic:

***Root* -** Cut pieces 7 to 18 cm long and 0.3 to 0.7 cm in diameter, slender, cylindrical, fibrous, frequently branched bearing a number of small rootlets, tough, woody and yellow to light brown in colour; surface becomes rough due to presence of small nodules; fracture, fibrous; odour, aromatic; taste, sweet and astringent.

***Stem* -** Stem pieces cylindrical, distinct into nodes and internodes measuring about 1 to 5 cm in length and 0.5 to 2 cm in thickness; surface rough, creamish white to light yellow externally; transversely cut smooth surface is light yellow towards periphery and creamish white in the centre; fracture short, fibrous; odour, unpleasant; taste, mucilaginous.

Leaf - Leaves paripinnately compound, leaflets in 3 to 7 pairs, commonly 5 pairs; each leaflet oblong with mucronate tip, entire margin, and short petiole, about 1.5 cm long and 0.3 to 0.5 cm broad; upper surface greyish-green and lower surface light green, appressed with dense white hairs; margin entire; odour not distinct, taste, slightly bitter.

***Fruit* -** Fruit stalked, light or greenish-yellow, five-ribbed or angled, more or less spherical in structure and covered with short stiff or pubescent hairs, 1 cm in diameter with five pairs, of prominent short stiff spines, pointed downwards, about 0.5 cm in length; tips of spines almost meet in pairs, whole together forming pentagonal frame-work around fruit; ripe fruit separates into five segments of each cocci and each appears as single-fruit, each coccus semi-lunar or plano-convex in structure, one chambered, armed with a pair of spines, starting from its middle, containing four or more seeds; taste, slightly astringent.

b) Microscopic:

Root **-** TS of primary root show a layer of epidermis followed by 4 to 5 layers of thin-walled parenchymatous cortex, endodermis distinct; pericycle enclosing diarch stele, in mature root, cork 4 to 6 layered, cork cambium single layered followed by 6 to 14 layers of thin-walled parenchymatous cells with varying number of fibres, distributed throughout; some secondary cortex cells show secondary wall formation and reticulate thickening; fibres found in groups resembling those of phloem; secondary phloem divided into two zones, outer zone characterized by presence of numerous phloem fibres with a few sieve tubes slightly collapsed, inner zone frequently parenchymatous, devoid of fibres often showing sieve tubes and companion cells; phloem rays distinct, a few cells get converted into fibres in outer region; cambium 3 to 5 layered; wood composed of vessels, tracheids, parenchyma and fibres and transversed by medullary rays; vessels scattered, arranged in singles or double towards inner side, in groups of three to four on outer side having bordered pits; tracheids long, narrow with simple pits; xylem parenchyma rectangular or slightly elongated with simple pits and reticulate thickening; xylem fibres a few; tracheids elongated with simple pits; medullary rays heterogeneous, 1 to 4 cells wide; starch grains and rosette crystals of calcium oxalate present in secondary cortex, phloem and medullary rays cells; a few prismatic crystals also present in xylem ray cells.

Stem **-** TS shows, single-layered epidermis of rectangular or isodiametric parenchyma cells with thick tangential walls; 5 to 8 layered cortex of round or oval parenchyma cells containing a few rosette crystals and pericyclic fibres in sporadic patches; phloem region narrow and conspicuous; xylem composed mainly of large, round xylem vessels and tracheids; medullary rays uniseriate to biseriate in continuation with phloem and consist of small radially arranged rectangular cells; pith consists of large round parenchyma cells; the cells of cortex, pith and medullary rays filled with round to oval, simple starch grains measuring 5 to 10 µ in diameter.

Leaflet **-** TS of leaflet shows an isobilateral structure with a single layered upper and bilayered, cuticularized lower epidermis of isodiametric parenchyma cells interrupted at places by stomata and unicellular trichomes having swollen bases; palisade is a single layer of columnar cells present on both dorsal and ventral side of spongy mesophyll and upper one is continued over midrib region; spongy mesophyll consists of tightly packed oval parenchyma cells containing few large rosette crystals of calcium oxalate; vascular bundle in lamina and midrib enclosed within bundle sheath.

Midrib contains single meristele consisting of radially arranged xylem, phloem and patches of collenchyma cells on both dorsal and ventral side and 2 or 3 layers of large circular parenchyma cells inside lower epidermis.

Fruit **-** TS of fruit shows small epidermal cells of each coccus rectangular; unicellular trichomes abundance; mesocarp 6 to 10 layers of large parenchymatous cells, rosette of calcium oxalate crystals abundantly present; mesocarp followed by 3 to 4 compact layers of small cells containing prismatic crystals of calcium oxalate.

Powder - Light green, shows fragments of leaf and stem epidermis in surface view; sclereids of different shapes from fruit; simple unicellular trichomes; groups of fibres; pitted and spiral vessels, round to oval, simple starch grains measuring 5 to 10 µ in diameter and rosette crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix 2.2.2
Total ash	**-**	Not more than	17	per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than	4	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than	2	per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than	12	per cent,	Appendix 2.2.7

T.L.C. -

T.L.C. of acetone extract (cold maceration at room temperature) of the drug on precoated silica gel 'G' 60 F_{254} TLC plate of 0.2 mm thickness using solvent system *toluene: ethyl acetate* (7.5:2.5) shows spots at R_f 0.22 (pale yellow), 0.37 (purple), 0.50 (violet), 0.55 (magenta), 0.71 (light yellow) and 0.77 (yellowish-green), on spraying with *anisaldehyde-sulphuric acid reagent* followed by heating at 105º for 10 minutes.

CONSTITUENTS - Alkaloids: Terrestriamide, tribulusamide A, B; steroidal saponins: terrestrosin C, D, E, F, G, H, I, J and K, terrestroneoside A and F, terreside A and B, terrestroside F; tribulosaponin A and B, tribulosin, protodioscin saponin C, prototribestin, terrestrosin J, isoterrestrosin B; flavonoid glycosides: isorhamnetin-3-gentiotrioside, quercetin-3-gentiobioside-7-glucoside; amide: moupinamide.

PROPERTIES AND ACTION –

Rasa	: Madhura, Tikta
Guṇa	: Guru, Snigdha
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Balya, Bṛṁhaṇa, Dīpana, Kaphahara, Keśya, Mūtrala, Pittahara, Śothahara, Vṛṣya, Vātahara, Vedanāsthāpana

IMPORTANT FORMULATIONS - Aguruvādi Taila, Cyavanaprāśa Avaleha, Daśamūla Kvātha, Gokṣurādi Guggulu, Kāmadeva Ghṛta, Mahārāsnādi Kvātha, Pancanimba Cūrṇa, Rāsnāsaptaka Kvātha

THERAPEUTIC USES - Āmavāta (Rheumatism), Amlapitta (Hyperacidity), Antravṛddhi (Hernia), Aśmarī (Calculus), Ardita (Facial palsy), Arśa (Piles), Hṛdroga (Heart disease), Indralupta (Alopecia), Jvara (Fever), Kāsa (Cough), Mūtrāghāta (Urinary obstruction), Mūtrakṛcchra (Dysuria), Pakṣāghāta (Paralysis / Hemiplegia), Pradara (Excessive vaginal discharge), Prameha (Metabolic disorder), Raktapitta (Bleeding disorder), Śūla (Pain / Colic), Śotha (Oedema), Śvāsa (Asthma), Sūtikāroga (Pueroeral fever), Sītapitta (Urticaria), Vātarakta (Gout)

DOSE -Cūrṇa (Powder): 3 to 6 g.
Kvātha (Decoction): 50 to 100 ml.

GRANTHIMŪLA (Rhizome)

Granthimūla is the rhizome of the plant *Alpinia calcarata* Rosc. (Fam. Zingiberaceae) which is often cultivated and seen as an escape in eastern and southern India.

SYNONYMS- Śvetakulañjana

REGIONAL LANUAGE NAMES-

Ass. : Sugandhi bach
Hin. : Safed Kulanjana
Mal. : Chittaratha
Ori. : Toroni
Tam. : Nattarattai
Tel. : Dumparastramu

DESCRIPTION-

a) Macroscopic:

Rhizome horizontal and branched; individual pieces tortuous, size ranging from 3 to 10 cm in length and 5 to 10 mm diameter in cross section; deep brownish orange externally, pale buff colour internally; prominently marked with wavy annulation at the nodes with scaly leaf bases; internodal length ranges from 6 to 12 mm, fracture is very tough, uneven and fibrous: odour, pungent; taste, spicy.

b) Microscopic:

TS circular in outline; epidermis single layered; yellowish oil globules present in many cells of the inner rows of the cortex of polygonal thin walled parenchyma of different sizes; parenchymatous cells of the inner cortex contain plenty of oval or circular starch grains with faint concentric striations; vascular bundles many, scattered, more, grouped towards the centre; sclerenchymatous bundle sheath present.

Powder- Reddish brown, microscopy shows following structures: oval to elliptic starch grains 10 to 20 µ in size; parenchymatous tissue fragments with polygonal and elongated cells; elongated pitted stone cells with a narrow lumen of 50 to 200 µ in length and a few thin walled pitted stone cells with larger lumen; reddish brown and light yellow resinous pieces; cells with densely compact masses of starch granules; annular, reticulate, scalariform and spiral vessels.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 7 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 3 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 5 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 6 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *n-hexane: ethyl acetate* (8.6:1.4) as mobile phase, after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^{o} for 5 minutes shows spots at 0.21 (pink), 0.27 (pink), 0.37 (yellow), 0.40 (light violet), 0.46 (grey), 0.53 (pink) and 0.75 (grey).

CONSTITUENTS- Volatile oil rich in methyl cinnamate, cineol, camphor.

PROPERTIES AND ACTION -

Rasa : Kaṭu, Tikta
Guṇa : Laghu, Rūkṣa, Tīkṣṇa
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Kaphaghna, Śvarya, Śothahara, Śūlaghna

IMPORTANT FORMULATIONS- Used as single drug

THERAPEUTIC USES - Āmavāta (Rheumatism), Hikkā (Hiccup), Kāsa (Cough), Prameha (Metabolic disorder), Śvāsa (Asthma), Sandhiśūla (Joint pain), Śūla (Pain / Colic)

DOSE - Cūrṇa (Powder): 1 to 3 g.

GULADĀUDĪ (Leaf)

Guladāudī consists of dried leaves of *Chrysanthemum indicum* L. (Fam. Asteraceae), a perennial, shrubby, erect plant with pinnately parted leaves. The plant is widely grown in gardens as an ornamental, and for worship in temple groves in the south. The various cultivated hybrids and their varieties are not included or used as a source of this drug.

SYNONYMS - Chinnapatrā

REGIONAL LANGUAGE NAMES-

Ben. : Chandramukhi
Eng. : Chrysanthemum
Guj. : Guldaaudi
Hin. : Guldaaudi
Kan. : Chamanti
Mar. : Shevanti
Pun. : Bagaura
Tam. : Chamanti
Tel. : Chamanti
Urd. : Gule-dawoodi

DESCRIPTION –

a) Macroscopic:

Leaves usually 5 to 8 cm long, 4 to 7 cm broad, thin, dull green to light brown, crumpled, papery; lamina simple, pinnatifid or partite, venation reticulate, margin entire, apex obtuse, base entire; petiole short, slightly winged; odour, aromatic; taste, slightly tingling.

b) Microscopic:

***Petiole* -**A transverse section of petiole reveals a roughly hemispherical or cup shaped outline with slightly winged upper corners and gently concave upper margin; epidermis composed of rounded cells lined with cuticle and bearing scattered, multicellular trichomes with or without a 2-armed terminal cell; inner to epidermis are present 1 or 2 layers of chlorenchyma followed by ground tissue composed of parenchymatous cells and containing a few, scattered air cavities; the central, main vascular bundle is hemispherical or rounded in shape; xylem adaxial, containing mostly parenchyma; phloem abaxial; each wing contains one rounded, accessory bundle each with xylem facing obliquely towards inner side and phloem outside.

***Midrib* -**Midrib convex on the lower side showing a cup like protuberance, and nearly plane on the upper with collenchyma patches adjacent to the epidermis on both sides; xylem vessels and parenchyma present towards the upper side while pholem oriented towards the lower side; vascular bundle surrounded by parenchyma which is more developed towards upper and lower sides.

***Lamina* -**A transverse section through the leaf shows a dorsiventral structure; outer epidermis made of thin walled, parenchymatous, rounded or squarish cells; epidermis bears uniseriate, multicellular trichomes eccentrically with a two-armed terminal cell, and also bicellular glandular hairs; a surface preparation reveals upper epidermal cells with straight anticlinal walls and lower epidermal cells with slightly sinuous anticlinal walls, surfaces also show eccentric cicatrices and typical bicellular glands; anomocytic stomata present on both surfaces; stomatal index for upper surface 1 to 3 and that for lower surface 17 to 21; only one layer below the upper epidermis palisade like,

rest of the lamina composed of almost rounded, loosely arranged cells with intercellular spaces and rich in chloroplasts, and occasional rudimentary vascular bundle; palisade ratio ranges from 3 to 5.

Powder –Yellowish green, fine, odour aromatic, taste slightly tingling, under microscopy shows epidermal fragments with characteristic bi-armed trichomes with stalk up to 150 µ long and arm cells up to 350 µ long, and bicellular glandular trichomes.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 21 per cent, Appendix 2.2.3
Acid- insoluble ash	-	Not more than 4 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 22 per cent, Appendix 2.2.7

T.L.C –

T.L.C of alcoholic extract of the drug is developed on silica gel 'G' 60 F_{254} plate using mobile phase *toluene: ethyl acetate: acetic acid* (5:4:1), at 366 nm shows spots at R_f. 0.27 (flourescent cream), 0.40 (flourescent yellow) and 0.50 (light pink), 0.53 (light pink), and 0.56 (purple-pink) on spraying the plate with *Natural Products-Polyethylene Glyco reagent.*

CONSTITUENTS– Sesquiterpene lactones – angeloylcumambrin B, arteglasin A and angleloylajadin. Essential oil from aerial parts contain di and sesquiterpenoids α-copaene, β-elumene, β - carophyllene, β – farnesene, β – humulene, germacrene-D. α-silenene, curcumene, calamenene, γ-cadinene and T-murolol, and monoterpenoids myrcene, 1,8-cineol and bornyl acetate. Chrysanthenone and chrysanthenine glucoside. Aerial parts also contain lignans sesamin and fargesin, and flavonoid penduletin.

PROPERTIES AND ACTION –

Rasa **:** Tikta, Kaṣāya
Guṇa **:** Laghu, Rūkṣa
Vīrya **:** Śīta
Vipāka **:** Kaṭu
Karma **:** Pittahara, Ropaṇa, Śūlapraśamana, Hṛdya

IMPORTANT FORMULATION – Satapatri Guna

THERAPEUTIC USES - Ardhavabhedaka (Hemicrania / Migraine), Mukhasphota (Ulcer in the mouth), Śirahśūla (Head ache), Tvakroga (Skin diseases), Vraṇa (Ulcer), Yavanpidika (Pimples / Acne vulgaris)

DOSE – Cūrṇa (Powder)**:** 3 to 6 g daily.

HARITAMAÑJARĪ (Whole Plant)

Haritamañjarī consists of the dried whole plant of *Acalypha indica* L. (Fam. Euphorbiaceae), an annual herb up to 120 cm, occurring throughout the plains and hotter parts of India, as a weed.

SYNONYMS – Muktavarcā

REGIONAL LANGUAGE NAMES-

Ass. : Patrasaki, Mukuta manjari
Ben. : Muktajhuri
Eng. : Indian Acalypha
Guj. : Vanchi Kanto
Hin. : Kuppi, Aamaabhaaji
Kan. : Kuppigida
Mal. : Kuppameni
Mar. : Khokli, Khajoti
Ori. : Indramaris, Nakachana
Pun. : Kuppi
Tam. : Kupaaimeni
Tel. : Kuppichettu, Kuppinta, Muripindi

DESCRIPTION –

a) Macroscopic:

Root - Vertical and branched; 2 to 8 mm in thickness, tortuous, rough; colour varies from grey to brown when dry, broken surface creamy yellow; fracture giving rise to a cloud of dusty particles; no characteristic smell; bitter.

Stem - Mature stem brownish and younger parts green, sparsely hairy, terete, 2 to10 mm in thickness.

Leaf - Simple and alternate, dull to dark green to brownish; brittle when dry; petiole 1 to 7 cm, lower leaves with longer petiole, pubescent; lamina 2 to 5 cm long and 1 to 4 cm broad, ovate to rhombic ovate, tip acute, base cuneate, pale green below and dark green above, margin serrate and hairy; veins 5 to 7 pairs, generally alternate, usually 3 veins arising from the base, prominent and hairy below; midrib slightly raised on the upper surface, and prominent on the lower surface.

Inflorescence - Axillary, stalked, spike, 1 to 7 cm long; flowers unisexual, green, subsessile and encircled by a leafy, orbicular serrate bract of about 4 mm long and 5 to 8 mm broad; female flowers 5 to 15, basal, 2 mm across; male flowers numerous, minute; spike usually terminating in an allomorphic flower; fruits capsules, small and green; seeds minute, ovoid and pale brown.

b) Microscopic:

Root - TS of the root circular in outline; cork consists of 8 to 10 rows of rectangular to tangentially elongated cells; secondary cortex consists of a few layers of slightly elongated, polygonal cells, followed by a broken ring of pericycle with sporadic sclerenchymatous patches, followed by small patches of phloem; xylem consists of vessels, tracheids and xylem parenchyma, all thick walled and lignified; medullary rays prominent, mostly uni or biseriate,

rarely multiseriate; calcium oxalate crystals and laticiferous ducts absent, distinction from *A. fruticosa*, where both are present.

Stem - TS cylindrical in outline; uniseriate, multicellular trichomes with elongated cells and a tapering terminal cell and uni cellular trichomes present; below the epidermis 3 or 4 layers of collenchyma followed by 4 to 7 layers of cortical parenchyma present; pericycle of discontinued patches of sclerenchyma with 3 or 4 layers, capping the phloem; xylem continuous as a ring and consists of vessels, tracheids and parenchyma, thick walled and lignified; pith consists of polygonal parenchymatous cells; abundant rosettes of calcium oxalate present throughout cortex and pith, ranging from10 to 20 µm in diameter.

Leaf -

Petiole - TS of the petiole circular in outline; epidermal hairs are multicellular and uniseriate; epidermis followed by 6 to 7 layers of small angular parenchyma; 5 or 6 vascular bundles in variable sizes present as a broken ring; phloem a small patch over the xylem; pith consists of large parenchyma cells, some containing cluster crystals of calcium oxalate.

Midrib - TS of midrib shows a ridge on the adaxial side with a cap of three layered collenchyma cells just below the upper epidermis and a similar band of collenchyma on the abaxial side above the lower epidermis; below the collenchymatous patch is a single row of palisade tissue, which continues in the lamina; cortex consists of circular to polygonal parenchyma; vascular system consists of about 8 groups of bundles, consisting of xylem vessels above phloem elements.

Lamina - Dorsiventral, cuticle present, upper epidermis followed by a single layer of palisade tissue; mesophyll shows a series of clusters of calcium oxalate crystals; spongy mesophyll contains irregular polygonal cells; lower epidermal cells are similar to the upper epidermis; epidermal cells with slightly wavy walls in surface view; paracytic stomata on lower surface; stomatal index 2; palisade ratio 5 or 6; unicellular multiseriate trichomes are sparingly seen.

Powder - Powder light brown and slightly bitter, no odour; microscopic study shows rosettes and clusters of calcium oxalate crystals 10 to 20 µ diameter; multicellular uniseriate trichomes of 150 to 200 µ length and unicellular trichomes of about 120 to 160 µ length; orange brown resinous pieces; irregular granular masses; patch of epidermal parenchyma with paracytic stomata; fragments of pitted, scalariform, annular, and spiral vessels and wood parenchyma.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 14 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 3 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.7

T.L.C.-

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *n-hexane: chloroform: methanol* (1.5:7.5:1) as mobile phase, after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105° for 5 minutes shows spots at R_f 0.32 (light violet), 0.38 (pink), 0.43 (pink), 0.48 (light pink), 0.66 (light pink), 0.73 (light violet), 0.81 (pink) and 0.88 (pink).

CONSTITUENTS – Alkaloids: acalyphine, quinine, amides such as acalyphamide, sterols, kaempferol and cyanogenic glycoside.

PROPERTIES AND ACTION –

Rasa : Tikta, Kaṭu
Guṇa : Laghu, Rūkṣa
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Kaphaghna, Vāmaka, Śransana, Kṛmighna, Mūtrala, Tvakdoṣahara, Amadoṣahara

IMPORTANT FORMULATIONS- Punarnavādi Cūrṇa

THERAPEUTIC USES- Agnimāndya (Digestive impairment), Dantaśūla (Tooth ache), Karṇaśūla (Otalgia), Kāsa (Cough), Sandhiśotha (Arthritis), Śvāsa (Asthma), Vibandha (Constipation)

DOSE- Cūrṇa (Powder): 3 to 5 g.
Svarasa (Juice): 5 to 10 ml, 1 to 3 in Karṇaśūla.

HASTIŚUṆḌĪ (Aerial Part)

Hastiśuṇḍī consists of dried aerial parts of *Heliotropium indicum* L. (Fam. Boraginaceae), an annual herb, 15 to 60 cm in height with densely hirsute ascending branches, found throughout the hotter parts of India along roadside and on waste lands.

SYNONYMS - Bhūraṇḍī, Śrihastini, Aśmariripu, Mahāśuṇḍī

REGIONAL LANGUAGE NAMES-

Ben.	:	Haathishundaa
Eng.	:	Indian Turnsole
Guj.	:	Haathisudhaan
Hin.	:	Haathisuondha, Haathisundha
Kan.	:	Chelubaaladgidh
Mal.	:	Telkkat, Terkkat, Tekkit
Mar.	:	Bhurundi
Tam.	:	Telkodukkai
Tel.	:	Kodikki, Naagdanti

DESCRIPTION -

a) Macroscopic:

Stem -Cut pieces 7 to 13 cm long and 0.3 to 1.1 cm in thickness, stout, hollow, pubescent with white stiff spreading hairs and longitudinal ridges; colour, brown; fracture, short; no odour; taste, bitter and astringent.

Leaf -Cordate, obtuse with sub-serrate margins; 2.5 to 10 cm long and 2.5 to 5 cm broad; rough, sparsely hairy; brownish, surface wrinkled, veins, prominent on lower surface; no odour; taste, bitter

b) Microscopic:

Stem -TS shows, single-layered epidermis covered with thick cuticle with a few cells modified into unicellular trichomes; collenchymatous hypodermis; thick-walled parenchymatous cortex; a narrow zone of phloem containing patches of non-lignified phloem fibres; a comparatively larger zone of xylem composed mainly of tracheids and a few vessels, solitary or in groups of 2 or 3; rays uniseriate of radially elongated pitted parenchymatous cells; collapsed pith with a few remnants of parenchymatous cells attached to the xylem.

Leaf -

Petiole -TS of petiole shows an epidermis consisting of thick-walled rectangular cells interrupted at places by unicellular warty trichomes and glandular trichomes with unicellular head and 1 to 3 celled stalk; ground tissue composed of outer 8 to 10 layers of small, thick-walled oval parenchyma filled with brownish contents and inner 5 to 8 layers of large oval parenchyma cells; vascular bundles present in ground tissue unequal in size, collateral with abaxial phloem; central vascular bundle being large, with arc-shaped xylem and facing the concave side of the petiole while two small vascular bundles present in the wings.

Midrib -TS through midrib region shows a single layered upper and lower epidermis covered with thick cuticle and possessing a few long, tubercled unicellular trichomes with bulbous base; central zone of vascular bundles containing arc shaped xylem and covered by collenchymatous layer on upper and lower side.

Lamina **-**Dorsiventral; mesophyll composed of single layered palisade and 6 to 8 layers of spongy parenchyma; tanniniferous sacs in the mesophyll and around the vascular bundles; stomata anomocytic; stomatal index 17 to 20.

Powder -Greenish-brown, shows vessels with spiral thickenings; numerous tracheids, entire or in pieces; pitted parenchymatous cells from medullary rays; long, unicellular trichomes; leaf epidermis in surface view with anomocytic stomata and unicellular trichomes.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than 2 per cent,	Appendix 2.2.2
Total ash	**-**	Not more than 12 per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than 2 per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than 4 per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than 12 per cent,	Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract of the drug on precoated silica gel 'G' 60 F_{254} TLC plate (E. Merck) of 0.2 mm thickness using *chloroform : methanol : ammonia* (80:13:2) shows spots at R_f. 0.12 (violet), 0.27 (grey), 0.37 (grey), 0.51 (violet), 0.76 (violet), 0.86 (maroon), 0.90 (green) and 0.94 (red) on spraying with *anisaldehyde-sulphuric acid reagent* followed by heating at 105º for 10 minutes.

CONSTITUENTS- Pyrrolizidine alkaloids (heliotrine, indicine N-oxide), tannins.

PROPERTIES AND ACTION -

Rasa : Kaṭu, Tikta
Guṇa : Tīkṣṇa, Laghu
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Jvaraghna, Vedanahara

IMPORTANT FORMULATIONS - Hastisundi, Hastisundi Guna

THERAPEUTIC USES - Sannipatajivara (High fever due to vitiation of all dosas), Śūla (Pain / Colic)
DOSE – Cūrṇa (Powder): 3 to 6 g.

INDĪVARA (Rhizome)

Indīvara consists of the rhizomes of *Monochoria vaginalis* Presl. Syn. *Pontederia vaginalis* Burm.f (Fam. Pontederiaceae), an aquatic herb with short, sub erect spongy root stock found in rice fields, ditches, margins of tanks and pools, swamps and marshes almost throughout India, ascending upto 1,500 m in the hills.

SYNONYMS- Bhagapatrā

REGIONAL LANGUAGE NAMES-

Mal.	: Karinkuvvalam
Tam.	: Karunkuvalam, Cenkalunir kilanku
Tel.	: Nirkanca

DESCRIPTION-

a) Macroscopic:

Rhizome-clothed with leaf sheath, spongy roots, light in weight, size variable, dark greenish pink in colour; no odour; taste, salty.

b) Microscopic:

Rhizome – Epidermis single layered; a cortical region distinct from the stelar region present; cortical region prominently aerenchymatous with large air chambers due to parenchymatous trabeculae; several small patches of tissues present among the trabeculae, some of which are of undifferentiated parenchyma while some show a strand or two of xylem and phloem; several of the air chambers show partition by a thin diaphragm of one or two layers of thin walled cells with minute intercellular spaces and cross- wall perforations; occasionally, a cortical bundle with well developed vascular tissues within a distinct endodermis and air chambers seen, beneath which a thick walled parenchymatous sheath of 6 or 7 layers of cells enclosing the xylem, phloem and parenchyma is present; cortical region also shows raphides, starch grains and amber coloured amorphous bodies staining bright red with Sudan III in fair amounts, most of them displaced from their original positions; stelar region surrounded by endodermis, within which numerous patches of reduced vascular bundles containing a few xylem and phloem strands are seen; air spaces also sporadically present; starch grains similar to cortex present.

Powder –Blackish pink, shows raphides, starch grains, parenchyma, vessel elements scalariform or pitted; non septate fibres 500 to 1000 µ; circular starch grains 8 to 12 µ in diameter.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more than	1	per cent, Appendix 2.2.2
Total ash	-	Not more than	15	per cent, Appendix 2.2.3
Acid - insoluble ash	-	Not more than	5	per cent, Appendix 2.2.4
Alcohol - soluble extractive	-	Not less than	7	per cent, Appendix 2.2.6
Water - soluble extractive	-	Not less than	10	per cent, Appendix 2.2.7
Fixed oil	**-**	Not less than	1	per cent, Appendix 2.2.8

T.L.C. –

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} of 0.2 mm thickness using *toluene : ethyl acetate* (6:1) and 6 drops of *formic acid* viewed under UV 254 nm spots appear at R_f. 0.21, 0.26, 0.32, 0.42, 0.60 and 0.72 (both green). Under UV 366 nm fluorescent zones appear at R_f. 0.11, 0.21 (all white), 0.29 and 0.70 (navy blue), 0.34, 0.42, 0.60, 0.63 (all red orange), 0.47 (violet) and 0.55 (pale blue). On exposure to *iodine vapour* spots appear at R_f. 0.21, 0.29 (both yellowish brown), 0.37 (brown), 0.52, 0.69, 0.74 and 0.86 (all yellowish brown). When the plate is dipped in *vanillin-sulphuric acid reagent* and heated at 105° for 5 minutes, spots appear at R_f 0.21 (pale pink), 0.26 (red orange), 0.34(grey), 0.37 (pink), 0.47 (violet), 0.55 (pale violet), 0.63 (reddish brown), 0.72 (pale violet), 0.78, 0.86 (both grey) and 0.95 (violet).

CONSTITUENTS- Stigmasterol 3-O-beta-D-glucopyranoside.

PROPERTIES AND ACTION –	
Rasa	: Madhura
Guṇa	: Guru, Snigdha
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Bṛṁhaṇa, Balya, Dāhapraśamana, Pittaśāmaka, Vṛṣya, Vāta-Kaphavardhaka
IMPORTANT FORMULATION – Indivara Guna	
THERAPEUTIC USES- Dāha (Burning sensation), Daurbalya (Weakness), Dhātukṣya (Tissue wasting), Raktapitta (Bleeding disorder), Yakṛtvikāra (Disorder of liver)	
DOSE -Cūrṇa (Powder) : 3 to 6 g.	

JALAKUMBHĪ (Whole Plant)

Jalakumbhī consists of dried whole plant of *Pistia stratiotes* L. (Fam. Araceae), an aquatic monoecious stemless plant, rarely anchored by roots, and spreading with the heip of stolons; found in water bodies in tropical and sub-tropical regions of India.

SYNONYMS – Kumbhikā, Vāriparṇī

REGIONAL LANGUAGE NAMES

Ben.	: Tokaapaanaa
Eng.	: Water lettuce
Guj.	: Jalakumbhi, Jalashamkhala
Hin.	: Choti Jala-kumbhi, Jalakumbhi
Kan.	: Antara gange
Mal.	: Akasa thamara, Kudapayal, Muttapayal
Mar.	: Prasni, Gondali
Ori.	: Borajhanji
Tam.	: Akasa tamarai, Koditamarai
Tel.	: Antara-Tamara, Nirubuduki
Urd.	: Jalakumbhi

DESCRIPTION –

a) Macroscopic:

Drug consists of rosette leaves arising on a condensed stem connected through short, soft, whitish, horizontal stolons and having long thin, wiry, fibrous branched roots arising in tuft from the lower portion of condensed stem opposite the leaves; roots dark brown or blackish in colour with dense, fine, filiform branches arising all along their length; length 5 to 10 cm, apical region covered over by root pockets, root hair poorly developed; aerial parts pale green to yellowish brown; rosette consisting of 5 leaves on a condensed axis; apetiolate, exstipulate, cauline, hairy, soft, shiny; margin smooth; roughly spathulate, apical portion expanded; proximal part strap shaped; veins parallel divergent, 3 to 6, usually 1 or 2, bifurcating towards the top portion; no fruits or flowers present.

b) Microscopic:

Leaf –TS passing through the proximal part of leaf shows it to be isobilateral and flattened; ventral surface slightly ridged, while the dorsal side is fully convex; epidermal cells thin walled squarish or polygonal; cuticle absent: epidermis bearing abundant multicellular hair varying widely in length from proximal to distal end of leaf but generally about 200 to 400 µ long and 29 to 36 µ wide, uniseriate with a characteristic bulbous base, which assumes a saucer like form in dried samples; terminal cell of hair when present drawn out or conical but more often incomplete and broken off; hair more abundant on the ventral side; stomata absent, mesophyll lacunate with some cells having spindle shaped raphides and star like druses of calcium oxalate crystals; occasionally some sub epidermal cells have brown pigments in them; circular groups of undifferentiated vascular tracts and mechanical tissues generally present in vertical rows of three; xylem and phloem cells poorly developed; leaf thinner towards the distal end; transection of the distal end shows ridges at regular intervals corresponding with main veins on both the surfaces; those on the lower surface more prominent; strands of mechanical tissue associated with the ridges,

one occupying the centre of the upper ridge while another in the lower ridge; upper ridge become inconspicuous towards the distal tip of the leaf; in the lamina portion, 3 to 4 layers of subepidermal, thin walled cells are

PROPERTIES AND ACTION-	
Rasa	: Madhura, Tikta, Kaṭu
Guṇa	: Laghu, Rūkṣa, Sara
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Balya, Mūtrajanana, Śothahara, Tridoṣahara
IMPORTANT FORMULATIONS- Balāśvagandhālākṣādi Taila, Jalakumbhībhasmaprayogaḥ, Vāriparṇī	
THERAPEUTIC USES- Arśa (Piles), Dāha (Burning sensation), Galagaṇḍa (Goitre), Jvara (Fever), Kuṣṭha (Leprosy / diseases of skin), Mūtrakṛcchra (Dysuria), Śoṣa (Emaciation), Raktapitta (Bleeding disorder)	
DOSE- Cūrṇa (Powder): 3 to 5 g. Svarasa (Juice): 10 to 20 ml.	

compactly arranged below the upper epidermis and have abundant and prominent chloroplasts; parenchymatous ground tissue towards the lower epidermis lacunate; druses and spindle shaped groups of raphides present in this region also.

Stolon **–** The stolon is characterized by a ground tissue supporting longitudinal strands of undifferentiated mechanical elements and lacunae centrally; the outer 4 or 5 layers below the epidermis are without lacunae.

Powder –The powder reveals multicellular trichomes with characteristics bulbous basal cells and fragments of parenchyma cells; raphides upto 170 µ long and druses upto 40 µ in diameter are abundant.

IDENTITY, PURITY AND STRENGTN –

Foreign matter	**-**	Not more than	6	per cent,	Appendix 2.2.2
Total ash	**-**	Not more than	52	per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than	35	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than	5	per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than	2	per cent,	Appendix 2.2.7
n **-Hexane -soluble extractive**	**-**	Not less than	1	per cent,	Appendix 2.2.8

T.L.C.-

T.L.C. of the alcoholic extract on pre-coated silica gel 'G' plate (0.2 mm thickness) using *toluene: ethyl formate: formic acid* (5:4:1), under UV 366 nm shows spots at R_f. 0.36 (pink), 0.40 (pink). Spraying the plate with *anisaldehyde: sulphuric acid reagent* and on heating for ten minutes at 105^o under UV 366 nm shows spots at R_f. 0.34 (cream) 0.38 (orange brown), 0.59 (green), 0.88 (green).

CONSTITUENTS -Vicenin, lucenin, cyanidine-3-glucoside.

JĪVANTĪ (Root)

Jīvantī consists of dried roots of *Leptadenia reticulata* W. & A. (Fam. Asclepiadaceae), a much branched twining shrub, distributed throughout the plains of India, along hedges.

SYNONYMS – Jīvantī, Śākaśreṣṭha, Jīvanī

REGIONAL LANGUAGE NAMES-

Ben.	:	Jiwanti
ng.	:	Cork Swallow-wort
Guj.	:	Dodee
Hin.	:	Dodi Shak, Jivanti
Mal.	:	Atapatiyan
Mar.	:	Kheerakhodee
Tam.	:	Palalkkodi
Tel.	:	Palatige, Mukkutummudu

DESCRIPTION-

a) Macroscopic:

Roots cylindrical, 5 to 7 cm in length and 1 to 3 cm in thickness, surface light brown to greyish brown with longitudinal wrinkles; fracture, tough; fractured surface creamish and horny; odour and taste indistinct.

b) Microscopic:

Root shows cork consisting of rectangular and tangentially elongated cells, phellogen 1 to 2 layered; phelloderm consists of thin walled parenchyma cells with groups of stone cells and fibres scattered in the central and lower regions; phloem made up of sieve tubes, companion cells, parenchyma, fibres and stone cells being transversed by uni to multiseriate medullary rays, groups of fibres and stone cells present in outer phloem region, stone cells are about 60 µ in length and 20 µ in width, fibres are upto 1300 µ in length; xylem represented by vessels, tracheids, fibres, parenchyma, interxylary phloem and uni to multi seriate medullary rays, all xylem elements except interxylary phloem thick walled and lignified; vessels drum shaped or elongated with bordered pits or scalariform thickenings, bordered pitted tracheids, fibres elongated with tapering or bifurcated ends present; xylem parenchyma simple pitted; rosettes of calcium oxalate crystals present in some of the parenchyma cells of phloem and phelloderm.

Powder - Powder shows rectangular to polygonal stone cells, vessels with bordered pits or scalariform thickenings, border pitted tracheids, fibres with tapering or bifurcated ends, thick walled parenchyma cells with simple pits and thin walled parenchyma cells with rosettes of calcium oxalate crystals.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 2 per cent,	Apprndix 2.2.2
Total ash	-	Not more than 14 per cent,	Apprndix 2.2.3
Acid-insoluble ash	-	Not more than 1.5 per cent,	Apprndix 2.2.4
Alcohol-soluble extractive	-	Not less than 5 per cent,	Apprndix 2.2.6
Water-soluble extractive	-	Not less than 3 per cent,	Apprndix 2.2.7

T.L.C.-

T.L.C. of alcoholic extract on precoated silica gel 'G' plates using *chloroform: methanol:water* (4:3:1) as mobile phase under UV 254 nm shows spots at R_f. 0.01, 0.21, 0.26 (all blue), 0.54, and 0.75 (both white).

CONSTITUENTS - Hentriacontanol, α- and β-amyrin, stigmasterol, β-sitosterol and flavonoids-diosmetin and luteolin.

PROPERTIES AND ACTION -

Rasa : Madhura, Kaṣāya
Guṇa : Laghu, Snigdha
Vīrya : Śīta
Vipāka : Madhura
Karma : Rasāyana, Balya, Cakṣusya, Grahi, Vrsya, Bṛṁhaṇa, Stanyajanana, Visaghna, Tridosahara

IMPORTANT FORMULATIONS - Cyavanaprāśa, Brāhmarasāyana, Amrtaprāśaghṛta, Aśokaghṛta, Bṛhatmāṣataila, Marmaguṭikā, Mānasamitravaṭaka, Śvsahara kaṣāyacūrṇa, Guḍūcyāditaila

THERAPEUTIC USES- Atisāra (Diarrhoea), Dāha (Burning sensation), Jvara (Fever), Kṣaya (Pthisis), Kāsa (Cough), Śoṣa (Cachexia), Mukharoga (Disease of mouth), Naktāndhya (Night blindness), Netraroga (Diseases of the eye), Raktapitta (Bleeding disorder), Tṛṣṇā (Thirst), Urhksata (Pulmonary cavitation), Vraṇa (Ulcer)

DOSE- Cūrṇa (Powder): 3 to 6 g.

KAṆṬAKĪGULMA (Aerial Part)

Kaṇṭakīgulma consists of aerial parts of *Lycium barbarum* L. Syn. *L. europeaum* (Fam. Solanaceae), a spinous shrub growing upto one metre or above, with small leaves and flowers, and occurs in the drier plains of central and southern peninsula.

SYNONYMS - Sitakāṇda, Chatrakeśara

REGIONAL LANGUAGE NAMES-

Guj.	Gangro
Hin.	Chiritta
Mar.	Gangro
Pun.	Ganger, Chirchitta
Urd.	Chirchitta

DESCRIPTION -

a) Macroscopic:

Bulk drug consists of broken leaves, pieces of thorny twigs and pieces of stem 2 to 4 inches long and 0.3 to 0.6 cm thick; flowers and fruits may be present.

Stem **-**White or grey, angular to almost squarish in shape, with four prominent ridges, armed with sharp conical, short thorns, and occasional long ones which may bear leaves.

Leaf **-**Solitary or more commonly in fascicles, variously shaped as oblong-spathulate to linear-lanceolate measuring 4.5 to 6 cm long and 0.6 to 1.5 cm wide; attenuated into a short petiole which is continuous as the midrib in the leaf; obtuse tip; glaborous.

Flower **-**Flowers are solitary or in fascicles, regular, bisexual on a small pedicel about 1 or 2 cm long; calyx – sepals 5, united to form a bell shaped or tubular calyx, 0.4 to 0.6 cm; corolla – petals 5, lavender to purplish, light purple to white in colour, united to more than half of the length towards the base to form a funnel shaped corolla tube, the rest of the portion spreading as free lobes, about 0.7 to 1.5 cm long; androecium – stamens 5, free, adnate to the corolla tube, anther lobes united, filaments long; gynoecium – carples 2, united, ovary superior, two celled, ovules numerous in each locule.

Fruit **–A** berry with persistent calyx; ovoid to oblong; bright red, dark red, or orangeish yellow in colour; about 0.8 to 2 cm long and 0.6 to 0.8 cm in diameter; seeds somewhat flat or discoid in shape, about 2 mm in diameter, embedded in the fleshy pulp of the fruit.

b) Microscopic:

Stem **-**Transversely cut section almost squarish in outline with four prominent ridges at the corners and four minor ridges at the centre of each side; epidermis made up of single layer of barrel shaped cells covered by cuticle; cortex composed of 4 or 5 layers of collenchyma and 3 to 4 layers of parenchyma; idioblasts present, several filled with large rosettes of calcium oxalate and a few packed with microsphenoidal crystals of calcium oxalate; patches of pericyclic fibres present; vascular bundles present below the ridges, consists of an outer ring of 5 or 6 rows of phloem, 2 or 3 layered cambium, a xylem with large groups of xylem vessels, xylem fibres, xylem parenchyma and interxylary phloem, alternating with smaller bundles with xylem vessels, xylem fibres, and xylem parenchyma; two vascular bundles opposite to each other present in the parenchymatous pith which also shows idioblasts filled with microsphenoidal crystals of calcium oxalate.

Leaf -

Midrib – TS shows four vascular bundles; cortex made up of collenchyma and parenchyma; a few cells of idioblast in the ground tissue are filled with large rosettes of calcium oxalate; epidermis made up of barrel shaped cells covered by a cuticle and long warty trichomes

Lamina **-**Dorsiventral; upper epidermis followed by 2 or 3 layers of palisade tissue; a few idioblast present in palisade containing large rosettes of calcium oxalate, followed by 2 or 3 layers of spongy tissue.

Powder -Light green, taste slightly astringent; odour characteristic; shows fragments of lamina, rosettes of calcium oxalate crystals, long trichomes ranging from 48 to 105 mm in length, made up of two to three cells out of which the apical one is long, warty and caducous whereas the lower ones are small with smooth walls; xylem vessels, upper and lower epidermis made up of slightly way walls covered by paracytic stomata and trichomes or base of trichomes; epidermis of the stem in sectional view, radially cut medullary rays, fibres with thick walls and narrow lumen, non-septate, lignified, ranging from 35 to 70 mm in length.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix	2.2.2
Total ash	**-**	Not more than	15	per cent,	Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	2	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not less than	4.5	per cent,	Appendix	2.2.6
Water-soluble extractive	**-**	Not less than	20	per cent,	Appendix	2.2.7

T.L.C. –

Take 2 g of the powdered drug and extract with methanol (2 x 25 ml), by refluxing on a water bath. Filter and concentrate the pooled extract. Adjust the volume to 10 ml with ethanol and apply about 20 µl on precoated silica gel 'G' 60 F_{254} plate (thickness 0.2 mm).

Developed T.L.C. plate using *chloroform: methanol* (9:1) as mobile phase, spray with *anisaldehyde sulphuric acid reagent* followed by heating at 105º for 5 min, shows bands at R_f. 0.13 (blue), 0.26 (light purple), 0.30 (light purple), 0.39 (light purple), 0.52 (light purple), 0.60 (light purple), 0.78 (light pink), 0.87 (pink) and 0.96 (pink).

CONSTITUENTS – Atropine, diosgenin, quercetin, rutin.

PROPERTIES AND ACTION –	
Rasa	: Tikta
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Cakṣuṣya, Dīpanīya, Mūtrala
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES - Agnimāndya (Digestive impairment), Dantaśūla (Tooth ache), Jalodara (Ascites), Kaṇḍu (Itching), Raktārśa (Bleeding piles)	
DOSE -Cūrṇa (Powder) : 2 to 5 g.	

KARAPHSĀ (Root)

Karaphsā consists of dried roots of *Apium graveolens* L. (Fam. Apiaceae), an erect herb with conspicuously jointed stems grown in Punjab, Haryana and Uttar Pradesh.

SYNONYMS - Dīpyaka

REGIONAL LANGUAGE NAMES-

Ass.	: Bonjamani, Bonajain, Yamani, Ajowan
Ben.	: Randhuni, Banyamani
Guj.	: Bodi Ajamo, Ajamo
Hin.	: Ajmuda, Ajmod
Kan.	: Oma, Ajavana, Omakki
Mal.	: Ayamodakum, Oman
Mar.	: Ajmoda Oova
Ori.	: Banajuani
Pun.	: Valjawain, Ajmod
Tel.	: Nuranji vamu
Urd.	: Karafs

DESCRIPTION –

a) Macroscopic:

Root- Numerous, upto 15 cm long and 1.5 cm thick, filiform, tapering, rougn, wrinkled, having root hairs; externally dirty white, internally pale in colour; fracture smooth; odour none; taste none.

b) Microscopic:

TS root shows outer layer of periderm composed of cork cells, phellogen and phelloderm; followed by loosely arranged, thin walled parenchymatous cortex; secondary phloem region consists of sieve elements, phloem rays and phloem parenchyma, cells thin walled and hexagonal; cambium composed of a few layers which separate secondary phloem from secondary xylem; secondary xylem consists of tracheids, vessels, xylem region traversed by uniseriate and beseriate medullary rays.

Powder –Shows under microscope, vessels, some tailed, elongated walls with pits arranged in a scalariform manner; simple perforation; tracheid walls bear elongated pits; fibres elongated, pointed at both the ends, length ranging from 140 to 550 µ and breadth between 12 to 22 µ.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	**-**	Not more than	5	per cent,	Appendix	2.2.2
Total ash	**-**	Not more than	10	per cent,	Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	2	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not less than	9	per cent,	Appendix	2.2.6
Water-soluble extractive	**-**	Not less than	10	per cent,	Appendix	2.2.7
Volatile oil	**-**	Not less than	0.05	per cent,	Appendix	2.2.10

T.L.C.-

T.L.C. of essential oil and methanolic extract on silica gel 'G' precoated plate, using *ethyl acetate: hexane* shows spots at R_f. 0.81 (pink to purple fouorescence), on spray with 2% *vanillin-sulfuric acid* and at R_f. 0.20 on spraying with Dragendroff's reagent – 50% *sulfuric acid, with 2:4 dinitrophenylthydrazine* and UV light (365 nm).

CONSTITUENTS –α-Pinene, β-pinene, limonene, pentylbenzene, β-selinen, 3-*n*-butyl phthalide.

PROPERTIES AND ACTION –	
Rasa	: Kaṭu, Kaṣāya
Guṇa	: Laghu, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Dīpana, Kaphahara, Mūtrala, Svedajanana, Vātahara
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES - Aśmarī (Calculus), Bastiroga (Diseases of urinary system), Gṛdhrasī (Sciatica), Hikkā (Hiccup), Jalodara (Ascites), Kaphaja Śiroroga (Catarrhal Siro-roga / Sinusitis), Kaphajvara (Fever due to Kapha dosa), Mūtrāghāta (Urinary obstruction / Retention of urine), Mastiṣkadaurbalya (Neurosthenia), Pṛṣṭhaśūla (Lumbago), Pārśvaśūla (Intercostal neuralgia and pleurodynia), Sarvāṅga śopha (Anasarca), Śūla (Pain), Udaraśūla (Pain in the abdomen), Udararoga (Diseases of abdomen), Vātarakta (Gout), Yakṛtplīhā Vikāra (Diseases of liver and spleen)	
DOSE – Cūrṇa (Powder) : 5 to 7 g.	

KAṬUGULMA (Whole Plant)

Kaṭugulma is the whole plant of *Toddalia asiatica* (L.) Lam. Syn. *Toddalia aculeata* Pers. (Fam. Rutaceae), a scandent, prickly large shrub found in almost all parts of peninsular India.

SYNONYMS – Hemamūlā

REGIONAL LANGUAGE NAMES-

Ben.	: Kada-todali
Eng.	: Wild orange tree, Lopez tree, Forest pepper
Hin.	: Jangli-kalimirch, Dahan, Kanja
Kan.	: Kaadumenagu, Mullumastige
Mal.	: Kaka toddali
Mar.	: Limri, Manger
Ori.	: Tundpora
Tam.	: Milagaranai, Kattumilagu, Milagu, Charanai
Tel.	: Mirapagandra

DESCRIPTION -

a) Macroscopic:

Root **-**Branched and woody; 8 to 20 mm in thickness; yellowish brown externally and cream coloured on cut surface; inner side of the root bark brown in colour; fracture hard and splintery; bitter and slightly aromatic.

Stem -Cylindrical, prickly, green, puberulant and more prickly when young, dark brown when mature; prickles greyish brown, stiff, recurved, 1 to 3 mm long; young prickles with reddish brown tip; young stem olive green when dry; mature stem brownish with lenticels, 4 to 10 mm in thickness; internodes 2.5 to 4 cm long.

Leaf **-**Palmately compound, alternate, with three leaflets, gland dotted; straw yellow to olive green; leathery; petiole 1 to 4 cm long and have 1 to 4 prickles at the base; lamina 4 to 9 cm long and 1 to 4 cm broad, glabrous; margin entire to crenate, base cuneate and sometimes slightly oblique, tip acute and notched; veins 15 to 26 pairs, midrib prominent and with a few prickles abaxially; highly aromatic.

Inflorescence -Axillary racemes or panicles of 6 cm length; peduncles armed, solitary or paired; flowers creamy yellow, 4 mm across; fruit a pea sized berry, globose, orange-red when ripe, seeds 1 to 3, hard and shiny.

b) Microscopic:

Root –TS shows cork consisting of 10 to 20 layers of elongated, lignified cells; cortex made of irregular or polyhedral parenchymatous cells; phloem not prominent; xylem thick walled, with pitted vessels, tracheids and xylem parenchyma; some cortical cells and xylem parenchyma contain resin; medullary rays usually bi or uniseriate and occasionally multiseriate, having starch grains.

Stem -TS of the stem is circular in outline; epidermis with small rectangular cells and a thick cuticle; followed by a cortex of 4 to 6 polygonal cells, some of which are yellowish brown having oil globules; some cortex cells also contain many small starch grains; cortex followed by a discontinuous ring of sclerenchyma of 3 or 4 layers forming pericycle; phloem consists of phloem parenchyma, companion cells and sieve tubes; xylem vessels often in

multiples of 3 to 8 in radial rows; medullary rays prominent, pith parenchymatous; some pith cells contain small, cluster crystals of calcium oxalate and most peripheral pith cells contain many small starch grains.

Leaf –

Petiole **-**TS almost circular in outline; epidermal cells thick walled, small and rectangular; cuticle present, a single layer of collenchyma followed by 6 to 8 layers of angular parenchyma; pericycle sclerenchymatous as a discontinuous ring; stele is a ring; the phloem layer surrounds the xylem; pith parenchymatous.

Midrib **-**TS of the midrib shows an epidermis with a thin cuticle; it is followed by a small group of polygonal parenchymatous cells of 5 to 8 layers, with a part of palisade from the lamina on either side; stele is an interrupted ring, with vascular bundle in a crescent shape on the abaxial side and smaller one forming an arc on the adaxial side, parenchymatous patches in between; both have a sclerenchymatous cap followed by phloem and xylem; the protoxylem faces towards the central parenchymatous pith, 5 to 7 layers of parenchymatous cells form the ground tissue between stele and the abaxial epidermis.

Lamina -Upper epidermis followed by 2 or 3 layers of palisade cells; the mesophyll tissue has loosely arranged circular cells with lot of intercellular spaces; small cluster crystals of calcium oxalate present throughout the lamina; some cells of the lamina contain yellowish brown oil droplets; stomata anomocytic.

Powder -Yellowish brown, microscopy shows rosettes of calcium oxalate crystals 24 to 30 µ across and prisms; globular starch grains of about 7 µ across; brownish and yellowish brown resinous pieces; stone cells of 35 to 75 µ length; fibres of about 15 µ width; spiral, annular, reticulate, scalariform and simple and bordered pitted vessels; fragments of tracheids and epidermis with anomocytic stomata.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	6	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than	0.4	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	5	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than	3	per cent,	Appendix 2.2.7

T.L.C. -

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *hexane:chloroform:methanol* (7.5:2:0.5) after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^{o} for 5 minutes shows spots at R_f 0.14 (grey), 0.2 (light violet), 0.32 (pink), 0.52 (light brown), 0. 66 (violet), 0.73 (pink) and 0.88 (light pink).

CONSTITUENTS –Alkaloids; toddaline, toddalinine, skimmianine and berberine. Other constituents include citric acid, an oil, resin, pectin and starch.

PROPERTIES AND ACTION -	
Rasa	: Kaṭu, Tikta
Guṇa	: Laghu, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Pācana, Dīpana, Śītapraśamana, Śothaghna,

	Svedana
IMPORTANT FORMULATIONS –Used as single drug	
THERAPEUTIC USES - Agnimāndya (Digestive impairment), Kaphavātavyādhi (Disorders due to Kapha and Vata), Angamarda (Body ache), Atisāra (Diarrhoea), Jvara (Fever), Kṛmi (Worm infestation), Kuṣṭha (Leprosy / diseases of skin), Viṣamajavara (Intermitten fever)	
DOSE -Cūrṇa (Powder): 0.5 to 2 g.	

KEṢARĀJA (Whole Plant)

Keśarāja consists of dried whole plant excluding root of *Wedelia chinensis* Merril Syn. *Wedelia calendulacea* Less (Fam. Asteraceae), a procumbent, perennial herb with light camphor-like odour, 0.3-0.9 m height, distributed in wet places throughout the country in plains.

SYNONYMS – Pitabhṛṅgarāja, Avanti

REGIONAL LANGUAGE NAMES -

Ben.	: Bhrangaraja
Hin.	: Pilaabhangraa
Kan.	: Kalsarji, Gargari
Mal.	: Mannakkannunni
Ori.	: Kesandara
Tam.	: Manjalkarilaamkanni, Paatalai Kayyaantakarai
Tel.	: Paccha guntagalijeru

DESCRIPTION -

a) Macroscopic:

Stem- 2 to 4 mm in diameter; flat, nodes and internodes prominent, rooting at the lower nodes; slightly hairy; blackish brown in colour; fracture, short; slightly pungent in taste.

Leaf- Opposite, subsessile, linear-oblong, oblanceolate, margin entire, scabrous with short white hairs or more or less glabrous; base tapering; dark green, odourless, tasteless; both fresh and dry leaves leave black stain on the fingers, when crushed as such or with water.

Flower- Heads solitary on long slender axillary peduncles with ray and disc florets, involucre bracts large, oblong obtuse, much longer than the disc floret; ray florets female, ligulate, ligule 2 or 3 toothed, yellow, style long acute and recurved; fruit achene, triquetrous, tip truncate, disc floret bisexual, tubular, limb elongated, five toothed, anther syngenceous, epipetalous, filament fine with hairy tips, style long, acute and fruit characters are the same as in ray floret; no pappus.

b) Microscopic:

Stem – TS almost circular in outline, cuticle thin, some epidermal cells filled with yellowish contents, followed by 3 to 5 layers of collenchymatous hypodermis; cortex aerenchymatous, with large intercellular spaces, endodermis and pericycle distinct, latter in the form of sclerenchymatous cap over vascular bundles, cambium distinct, phloem consists of sieve tubes, companion cells and phloem parenchyma, xylem in the form of a continuous ring, pith large, collenchymatous with cells showing a little thickening at the angles.

Leaf –

Midrib - TS slightly convex in outline on the upper side, more convexed on the lower side, upper and lower epidermis covered by thin cuticle, 4 to 6 and 2 or 3 layers of collenchyma present adjacent to upper and lower epidermis respectively, bicollateral vascular bundles, 3 to 5 in number one median large and 2 or 4 lateral small,

distinct sclerenchymatous bundle sheath present top and bottom of the bundle, xylem and phloem consist of usual elements, mesophyll parenchymatous, some cells filled with druces and rhomboidal crystals of calcium oxalate.

Lamina - Dorsiventral; both upper and lower epidermis covered with thin cuticle, in surface view both epidermis show an isocytic to anisocyctic stomata, 2 types of trichomes, (i) long, unicellular, walls warty, with 9 to 12 radiating basal epidermal cells, (ii) small 3 to 5 celled, basal epidermal cells not differentiated; upper epidermis followed by single layered palisade parenchyma, spongy parenchyma 6 to 8 layered, loosely arranged; mesophyll traversed by a large number of veins, idioblasts containing druses and rhomboidal crystals of calcium oxalate present in this region, palisade ratio 3 or 4 vein islet 2 to 5 /mm^2 and vein termination numbers 5 to 9 /mm^2 while trichome numbers 3 to 9 and stomatal index 12 to 14 on upper surface and 22 to 25 on lower surface of the leaf.

Powder –Yellowish green, pleasant smell and bitter taste, on microscopic examination unicellular and multicellular trichomes; patches of epidermal cells of leaf with anisocytic stomata, idioblasts containing druses and prismatic crystals of calcium oxalate, palisade cells, groups of papillate epidermal cells of petals and bracts, endothelial cells, parenchymatous cells of anther lobe, pollen grains, acolpate, upto 10 µ in diameter with spinous exine, fibres of bundle sheath and pericycle, tracheids and vessels with spiral, scalariform and reticulate secondary wall thickenings.

IDENTITY PURITY AND STRENGTH –

Foreign matter	**-**	Not more than	2	per cent,	Appendix 2.2.2
Total ash	**-**	Not more than	9.5	per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than	1	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than	17	per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than	31	per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of methanolic extract on silica gel 'G' plate (0.2 mm thick) using *ethyl acetate : methanol : water* (7:3:1) and on spraying with *anisaldehyde-sulphuric acid reagent* and heating the plate at 105° for 10 min., spots appear at 0.47 (light yellow), 0.58 (light grey), 0.75 (blackish grey), 0.81 (light grey), 0.89 (yellowish organge), 0.92 (light grey).

CONSTITUENTS – *Coumestan, norwedelic acid, norwedelolactone, tri-O-methylwedelolactone and β-amyrin.*

PROPERTIES AND ACTION -	
Rasa	: Kaṭu, Tikta, Kaṣāya
Guṇa	: Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Katu
Karma	: Vātahara, Kaphahara, Mūtrala, Hṛdya, Vṛṣya, Svedakara, Keśya, Balya
IMPORTANT FORMULATIONS -Grahaṇīmihira taila, Aśokaghṛta, Bṛhat Viṣamajvarāntaka lauha	
THERAPEUTIC USES- Arśa (Piles), Atisāra (Diarrhoea), Daurbalya (Weakness), Hṛdroga (Heart disease), Indralupta (Alopecia), Jvara (Fever), Kṛmi (Helminthiasis), Kāmalā (Jaundice), Kāsa (Cough), Pāṇḍu (Anaemia), Plīhāvṛddhi (Splenomegaly), Sirahśūla (Head ache), Slipada (Fliariasis), Striroga, Śūla (Pain / Colic), Śvāsa (Asthma), Vraṇa (Ulcer)	
DOSE - Cūrṇa (Powder) : 3 to 6 g.	

KETAKĪ (Stilt Root)

Ketakī consists of the stilt roots of *Pandanus odoratissimus* Roxb. Syn. *P. fascicularis* Lamk. *P. tectorius* Soland. ex Parkinson (Fam. Pandanaceae), a densely branched shurb, rarely erect, found along the coasts of India and in Andaman islands, forming a belt of dense, impenetrable vegetation above the high water mark.

SYNONYMS – Ketaka, Rajaḥpuṣpa, Sūcipuṣpa, Tṛṇaśūnya

REGIONAL LANGUAGE NAMES-

Ben.	: Keya, Keori
Eng.	: Fragrant Screwpine, Screwpine, Caldera Bush
Guj.	: Kewado
Hin.	: Keora, Kevadaa, Kewda
Kan.	: Thaale hou, Kedagi
Mal.	: Tazha,Taalampu
Mar.	: Kevdaa
Ori.	: Ketoki, Kia
Pun.	: Kevda
Tam.	: Tazampu,Tazhai,Talai
Tel.	: Mogali, Mogili
Urd.	: Kewdaa

DESCRIPTION –

a) Macroscopic:

Drug consists of chopped pieces of thick stilt roots, surface smooth bearing projections of circular root scars; colour ashy brown, cut surface pale brown; fracture fibrous; no characteristic odour or taste.

b) Microscopic:

Stilt root - Cuticle thick; epidermis a single layer of tabular cells; cortex wide, outer zone of cortex consisting of irregular, loose, small polygonal, fairly thick walled parenchyma cells; inner zone consists of larger thin walled, circular, more compact parenchyma cells with small to wide scattered air chambers; numerous group of fibres present; stele consists of a distinct endodermis and a pericyclic layer, followed by phloem; ground tissue parenchymatous, numerous circular scattered xylem elements.

Powder - Brownish powder, revealing the presence of parenchyma cells, fibres with 400 to 600 μ length, lumen 12 to 16 μ width, some upto 700 μ in length; occasionally broad and narrow vessel elements with elongated pits are also seen.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than 2 per cent, Appendix 2.2.2
Total ash	**-**	Not more than 4 per cent, Appendix 2.2.3
Acid - insoluble ash	**-**	Not more than 0.1 per cent, Appendix 2.2.4
Alcohol - soluble extractive	-	Not less than 4 per cent, Appendix 2.2.6
Water - soluble extractive	**-**	Not less than 8 per cent, Appendix 2.2.7
Fixed oil	**-**	Not less than 2 per cent, Appendix 2.2.8

T.L.C. –

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} of 0.2 mm thickness using *toluene: ethyl acetate* (5:1.5) under UV 254 nm shows spots at R_f 0.13, 0.47, 0.71, 0.76 and 0.80 (all green). Under UV 366 nm fluorescent zones appear at R_f. 0.27, 0.31, 0.36, 0.44 0.56, 0.71, and 0.76 (all blue). On exposure to *iodine vapours* shows spots at R_f. 0.13, 0.21, 0.50, 0.61, 0.73 and 0.98 (all brown). On dipping in *vanillin -sulphuric acid reagent* and on heating at 105° for 5 minutes spots appear at R_f. 0.16, 0.22, 0.27, 0.32, 0.48, 0.54, 0.70, 0.75, 0.89 and 0.96 (all grey).

CONSTITUENTS -Physcion; *p*-hydroxybenzoic acid, cirsilineol, *n*-triacontanol, β-sitosterol, Stigmasterol, campesterol, daucosterol, stigmast-4-en-3,6-dione, andamarine, piperidine.

PROPERTIES AND ACTION –	
Rasa	: Tikta, Kaṣāya, Madhura
Guṇa	: Laghu, Snigdha
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Balya, Dehadārḍhyakara, Hṛdya, Pittaśāmaka, Rasāyana, Stambhana
IMPORTANT FORMULATIONS – Ketakī, Ketaki Pakvaphala Guna, Ketaki guna, Ketaka	

Gunah, Kevika Guna
THERAPEUTIC USES- Gulma (Abdominal lump), Jvara (Fever); Mūtrakṛcchra (Dysuria), Pradara (Excessive vaginal discharge), Raktapitta (Bleeding disorder), Tvakroga (Skin diseases)
DOSE – Cūrṇa (Powder): 1 to 2 g. Kvātha (Decoction): 30 to 50 ml.

KĪṬAMĀRĪ (Leaf)

Kīṭamārī consists of the leaves of *Aristolochia bracteolata* Lam. Syn. *A. bracteata* Retz. (Fam. Aristolochiaceae), a slender, decumbent, glabrous perennial, occurring in plains throughout India.

SYNONYMS - Śṛṅgapuṣpī, Kītāri, Dhūmrapatrā

REGIONAL LANGUAGE NAMES-

Ben.	:	Kiramar
Eng.	:	Bracteated birthwort
Guj.	:	Kidaamaari
Hin.	:	Kitmaar, Kiramar, Kitmaari, Kidaamaari
Kan.	:	Kathhekirubanagida
Mal.	:	Aduthinapalai, Atu-tinlap
Mar.	:	Kidaamaari, Kidemaar
Ori.	:	Paaniri
Pun.	:	Kitamar
Tam.	:	Aadu-tinna-paalai
Tel.	:	Gadida gadapa, Tella iswari

DESCRIPTION –

a) Macroscopic:

Leaves very variable in size, reniform or broadly ovate, cordate at base with a wide shallow sinus, crenulate, undulate, glabrous above and glaucous beneath, finely reticulately veined; petiole 1 to 2.5 cm long, nerves impressed; taste bitter, feebly aromatic when crushed, but not characteristic.

b) Microsocopic:

Leaf-

Petiole - TS almost angular in outline, with one depression on the upper and two depressions on the lower surface; epidermis single layered followed by 3 or 4 rows of collenchyma; below the ridges about 4 or 5 layers of chlorenchyma present; vascular bundles five in number arranged in a shallow arc; ground tissue parenchymatous.

Midrib - Midrib shows a slightly convex outline adaxially, and almost circular abaxially; epidermal cells single layered; the upper and lower sub-epidermal region composed of 2 to 4 layers of collenchyma; a single vascular strand present; ground tissue is made up of parenchyma cells; unicellular epidermal hairs present on abaxial epidermis.

Lamina - TS shows dorsiventral structure; epidermis single layered, composed of rectangular cells; trichome occasional on upper surface, simple and unicellular; palisade single layer; spongy tissue composed of loosely packed circular to oval cells; vascular strands present; stomata anomocytic, present on both epidermis; in surface view, adaxial epidermal cells straight walled, but abaxial cells rather wavy; stomatal number 6 to 9 /

mm^2 for adaxial epidermis and 23 to 27 / mm^2 for abaxial epidermis ; stomatal index for adaxial epidermis 6 to 12 and for abaxial epidermis 16 to 24; palisade ratio 5 or 6; vein islet number 8 to 12.

Powder -Greyish green, shows the presence of palisade cells, fragments of epidermis with straight or slightly wavy walls and anomocytic stomata, parenchyma and collenchyma cells seen, vessels with helical, mostly scalariform and occasionally pitted thickenings on walls observed.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than	2	per cent, Appendix 2.2.2
Total ash	-	Not more than	10	per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than	1.3	per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	12.8	per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than	25.5	per cent, Appendix 2.2.7
Fixed oil	-	Not less than	5.3	per cent, Appendix 2.2.8

T.L.C. –

T.L.C. of methanolic extract on precoated aluminium silica gel 'G' 60 F_{254} plate of 0.2 mm thickness using *toluene: ethyl acetate: formic acid* (5:1.5:0.5) under UV 366 nm shows fluorescent spots at R_f. 0.15 (blue), 0.20 (white), 0.26 (white), 0.36 (blue), 0.43 (pink), 0.46 (pink), 0.49 (blue), 0.56 (light pink), 0.62 (bluish pink), 0.66 (dark blue), 0.74 (blue), 0.79 (pink), 0.86 (pink), 0.91 (pink), 0.96 (dark blue). Under UV 254 nm spots appear at R_f 0.20, 0.36, 0.49, 0.56, 0.75, 0.86, 0.96 (all green). On dipping in *vanillin - sulphuric acid* and heating the plate for 5 minutes at 105° shows spots at R_f. 0.15, 0.20, 0.26, 0.36, 0.43, 0.46, 0.49, 0.56,0.62, 0.66, 0.74,0.79, 0.86,0.91, 0.96 (all grey).

CONSTITUENTS- Aristolochic acid; magnoflorine; *N*-acetylnornuciferine; aristolactam; β-sitosterol and ceryl alcohol.

PROPERTIES AND ACTION-	
Rasa	: Tikta
Guṇa	: Laghu, Rūkṣa, Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Dīpana, Garbhāsayottejaka, Kapahara, Kāsahara, Kṛmighna, Kuṣṭhaghna, Rucya, Vātahara, Virecana, Viṣaghna, Vraṇaśodhana
IMPORTANT FORMULATIONS- Kitamari Gunah, Kīṭamārīguṇaḥ	
THERAPEUTIC USES- Kṛmi (Worm infestation), Kaṣṭārtava (Dysmenorrhoea), Sandhiśūla, Śītapitta (Urticaria), Śotha (Oedema), Tvakroga, Viṣamajvara (Intermittent fever), Vicarcika (Dry and weeping eczema), Vraṇa (Ulcer)	
DOSE - Cūrṇa (Powder): 1 to 3 g.	

KUMĀRĪVETRA (Rhizome)

Kumārīvetra consists of the rhizomes of *Calamus thwaitesii* Becc. (Fam. Arecaceae), an unarmed, erect or high climbing cane palm without stout stem, common in the evergreen forests of Western Ghats.

SYNONYMS – Suṣira kāṇḍaḥ

REGIONAL LANGUAGE NAMES-

Kan.	: Jeddu betta, Kumaari bettha
Mal.	: Valiya chural
Mar.	: Veta
Tam.	: Vanchi

DESCRIPTION-

a) Macroscopic:

Drug consists of chopped pieces of rhizome with a few intact roots; bark dark brown and smooth; external surface shows remnants of root scars; cut surface reddish brown; fracture, fibrous; no characteristic taste or odour.

b) Microscopic:

Rhizome – Epidermis single layered, followed by a hypodermis of 5 to 6 layers of sclerenchymatous fibres; cortex shows 3 regions of parenchyma zones; a few outer layers are loosely arranged and circular; in most of the middle layers, they are elongated with scattered groups of fibres and those in the inner most layers again circular and loosely arranged similar to the outermost; cortex separated from the stelar region by 2 or 3 layers of laterally elongated parenchymatous cells; stelar region is made up of parenchymatous ground tissue; vascular bundles present in patches, with a large cap of sclerenchyma fibres towards peripheral side and a smaller patch of thick walled parenchyma towards interior; phloem tissue present above vessels; silica bodies also observed in the phloem region; starch grain present throughout the parenchymatous ground tissue.

Powder- Brownish, parenchyma cells circular, elongated or irregular shaped; scalariform vessels elements, tubercled silica bodies, simple circular starch grains up to 35 µ present; fibres thick walled with narrow lumen and thin walled with broad lumen observed.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	**-**	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	6	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than	3	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not more than	8	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not more than	7	per cent,	Appendix 2.2.7
Fixed oil	-	Not more than	0.98	per cent,	Appendix 2.2.8

T.L.C. -

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' F_{254} of 0.2 mm thickness using *toluene : ethyl acetate* (9:1) under UV 254 nm shows spots at R_f. 0.13, 0.18, 0.27, 0.33, 0.49, 0.56 and

0.82 (all green). Under UV 366nm fluorescent zones appear at R_f. 0.29, 0.38, 0.49, 0.60 and 0.98 (all blue). On dipping *vanillin-sulphuric acid* and heating at 105° for five minutes, spots appear at R_f. 0.16 (pink), 0.26 (grey), 0.33 (blue), 0.44 (pink), 0.56 (pink) 0.62 (grey), 0.76 (grey), 0.80 (pink) and 0.88 (blue).

CONSTITUENTS – No report on the chemical consitituents of the rhizome is available.

PROPERTIES AND ACTION -	
Rasa	: Kaṣāya, Tikta
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Dāhapraśamana, Grāhī, Jvaraghna, Kuṣṭhaghna, Pittahara, Vraṇya
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES - Atisāra (Diarrhoea), Jvara (Fever), Kuṣṭha (Leprosy / diseases of skin), Prameha (Metabolic disorder), Raktapitta (Bleeding disorder), Visarpa (Erysepales), Vraṇa (Ulcer)	
DOSE -Cūrṇa (Powder): 3 to 6 g.	

KUSUMBHA (Fruit)

Kusumbha consists of dried fruits of *Carthamus tinctorius* L. (Fam. Asteraceae), an erect annual herb, 30 to 90 cm high with spinously serrate leaves, cultivated throughout India for the oil from fruits and a dye from flowers.

SYNONYMS – Pāvakam, Vahniśikham, Vastrarañjana

REGIONAL LANGUAGE NAMES -

Ben.	: Kusum, Barre
Eng.	: Safflower, Parrot seed, Bastard saffron
Guj.	: Kusumbo, Kusumbi, Karad
Hin.	: Kusum, Barre
Kan.	: Kusubeegida, Kusumekalu
Mal.	: Chendurakam, Kuyimpu
Mar.	: Kardai, Kardi
Ori.	: Kusum
Pun.	: Kusam, Kartum
Tam.	: Kusumbaa, Sendurakam, Senturakam
Tel.	: Kusuma
Urd.	: Qurtum

DESCRIPTION –

a) Macroscopic:

Fruit 8 to 12 mm long and 5 to 8 mm broad achenes, compressed, faintly ribbed, muriculate, creamy, tapering into a beak which is suddenly dilated into a whitish cup-like disc beneath the pappus; seed small, albuminous, oval, slightly flattened on lateral sides 6 to 10 mm long and 4 to 6 mm broad, enclosed in the achene with a thin and papery seed coat; surface rough, orangeish brown and slightly acrid in taste.

b) Microscopic:

TS oval in outline, pericarp enclosing the seed; pericarp differentiated into epicarp consisting of a single layer of thick walled, pitted, lignified cells with semilunar thickening on outer radial walls; mesocarp consists of stone cells of varying shapes and sizes, 5 to 6 cells deep in the middle and 18 to 20 cells deep at the chalazal end; endocarp 3 or 4 cells deep and differentiated from mesocarp by a single layered oil containing cells; testa single layered with thick palisade like cells, with prominent linea lucida, followed by tegmen; tegmen consists of a single layered parenchymatous outer epidermis, followed by 4 to 6 cells deep reticulated parenchymatous mesophyll with prismatic crystals; inner epidermis of tegmen lignified and single layered; a single vascular bundle extends upto the micropyle; the endosperm cells rectangular.

Powder– Creamish brown, microscopy shows, pitted cells of epicarp, patches of sclerenchymatous stone cells of varying shapes and sizes from pericarp, reticulate parenchyma of mesophyll; parenchymatous cells of endosperm containing aleurone grains; oil cells, palisade like cells of testa; thick walled epidermal cells of inner epidermis of tegmen.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	4.5	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than	1	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	7	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than	8	per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of methanolic extract on silica gel 'G' plate (0.2 mm thick) using *toluen : ethyl acetat : formic acid* (7:3:0.5) under UV light 254 nm shows spots at R_f. 0.26, 0.38 0.53 and 0.70. On spraying with *anisaldehyde sulphuric acid reagent* and heating the plate for 10 minutes at 105°, spots appear at R_f. 0.27 (grey), 0.35 (brown), 0.48 (faint grey), 0.52 (grey), 0.70 (brown), 0.73 (bluish black) and 0.81(bluish black).

CONSTITUENTS – Lignan glucoside (matairesinol, monoglucoside), glucose, maltose, raffinose, luteolin-7-O-glucoside, N-(P-coumaroyl) tryptamine, campesterol, cholesterol, ß-sitosterol and its glucoside, Δ^7 –stigmasterol, myristo-oleo-linolein, myristodilinolein, palmitooleolinolein, palmito-dilinolein, stearo-oleolinolein, stearo-dilinolein, dioleolinolein, oleo-dilinolein, trilinolein.

PROPERTIES AND ACTION –

Rasa	: Madhura, Kaṣayā, Tikta, Kaṭu
Guṇa	: Snigdha, Guru
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Mūtrala, Sarvadoṣaprakopaka, Svedajanana, Vidāhī, Virecana
IMPORTANT FORMULATIONS – Kusumbham Guna, Kusumbhatailaguṇa, Kusumbha Tail Guna, Kusumbha Guna, Kusumbh Guna	
THERAPEUTIC USES - Āmavāta (Rheumatism), Aśmarī (Calculus), Daurbalya (Weakness), Kāmalā (Jaundice), Kaṣṭārtava (Dysmenorrhoea), Mūtrakṛcchra (Dysuria), Pratiśyāya (Coryza), Raktapitta (Bleeding disorder)	
DOSE - Cūrṇa (Powder): 2 to 4 g.	

KUSUMBHA (Leaf)

Kusumbha consist of dried leaves of *Carthamus tinctorius* L. (Fam. Asteraceae), an erect annual herb, 30 to 90 cm high with spinously serrate leaves, cultivated throughout India, for its fruits that yield edible oil and a dye from flowers.

SYNONYMS – Pāvaka, Vastrarañjana, Kausumbha

REGIONAL LANGUAGE NAMES-

Ass. : Akharij, Jhartam
Ben. : Kusum phool
Eng. : Safflower, Bastard saffron
Guj. : Kusumbo
Hin. : Kusum, Kusumb
Kan. : Kusubbi, Kasube
Mal. : Kuyimpu, Chentukam
Mar. : Kardi, Kardai
Ori. : Kusum
Pun. : Kusum
Tam. : Senturkam
Tel. : Kusumulu
Urd. : Kusum

DESCRIPTION –

a) Macroscopic:

Leaf– Sessile, oblong or ovate-lanceolate, spinously serrate, waxy, entire, dark green on upper side and pale green on lower side.

b) Microscopic:

Midrib- TS shows an outline that is deeply convex on the abaxial side and slightly convex, on the adaxial side; 1 or 2 layered upper and a single layered lower epidermis covered externally with striated, thick cuticle and interrupted by glandular and non-glandular trichomes; glandular trichomes more on the lower side; ground tissue differentiated into 3 or 4 layered collenchymatous tissue followed by 2 or 3 layered parenchyma on both upper and lower sides of vascular bundle; vascular bundle single, median, closed, followed by 3 or 4 and 8 to 10 layers of thick sclerenchymatous cells capping the vascular bundle on upper and lower side respectively; xylem vessels in radial rows on upper side; phloem 3 or 4 layered in sclerenchymatous region; idioblasts filled with rosette crystal of calcium oxalate.

Lamina- Isobilateral; both upper and lower epidermis covered with thick striated cuticle; surface views of both epidermis show unicellular to multicellular ordinary trichomes with acute apex as well as glandular trichomes that are club shaped with single celled stalk and 4 to 8 celled, head; cell walls of both the epidermis straight; anisocytic stomata present on lower side; palisade parenchyma 2 or 3 layered; spongy parenchyma 3 to 6 layers deep and loosely arranged; mesophyll traversed by a number of veins; showing the vascular bundles surrounded by sclerenchymatous bundle sheath. Palisade ratio 3 or 4, vein islet no. 6 to 11 /mm^2 and vein termination 6 to 14/mm^2 respectively, stomatal index 23 to 30 on the upper surface and 25 to 33 on the lower surface of the leaf.

Powder – Green in colour, on microscopic examination shows non glandular unicellular to multicellular trichomes with acute apex; club shaped grandular trichomes with single celled stalk and 4 to 8 celled head; lower epidermis

with anisocytic stomata; idioblast with rosette crystals of calcium oxalate; patches of sclerenchyma from bundle sheath; fibres; vessels with scalariform thickenings and palisade cells.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more than	2	per cent,	Appendix 2.2.2
Total ash	**-**	Not more than	19	per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than	2	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than	20	per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than	23	per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *toluene: ethyl acetate* (8:2) shows fluorescent zones of red colour at R_f. 0.32, 0.40, 0.54, 0.69, 0.83 under UV 366 nm.

CONSTITUENTS –Hinesol-β-D-fucopyranoside, 1-pentadecene.

PROPERTIES AND ACTION -

Rasa	: Madhura, Kaṣāya
Guṇa	: Rūkṣa, Laghu
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātakara, Pittakara, Kaphahara, Dīpana, Madanāśaka, Balya

IMPORTANT FORMULATIONS – Kusumbham Guna, Kusumbhatailaguṇa, Kusumbha Tail Guna, Kusumbha Guna, Kusumbh Guna

THERAPEUTIC USES - Aśmarī (Calculus), Badhirya (Deafness), Daurbalya (Weakness), Mūtrakṛcchra (Dysuria), Mutravikara (Urinary diseases), Netraroga (Diseases of the eye), Pralapa (Delirium), Prameha (Metabolic disorder), Raktavīkāra (Disorders of blood), Yoniroga (Disease of female genital tract), Pradara (Excessive vaginal discharge)

DOSE- Cūrṇa (Powder): 2 to 4 g.

KUSUMBHA (Flower head)

Kusumbha consist of dried flower heads of *Carthamus tinctorius* L. (Fam. Asteraceae), an erect annual herb, 30 to 90 cm high with spinously serrate leaves, cultivated throughout India, for its fruits that yield edible oil and a dye from flowers.

SYNONYMS – Pāvaka, Vastrarañjana, Kausumbha

REGIONAL LANGUAGE NAMES-

Ass. : Akharij, Jhartam
Ben. : Kusum phool
Eng. : Safflower, Bastard saffron
Guj. : Kusumbo
Hin. : Kusum, Kusumb
Kan. : Kusubbi, Kasube
Mal. : Kuyimpu, Chentukam
Mar. : Kardi, Kardai
Ori. : Kusum
Pun. : Kusum
Tam. : Senturkam, Kusumb
Tel. : Kusumulu
Urd. : Kusum

DESCRIPTION –

a) Macroscopic:

Orangeish yellow, cylindrical capitulum 1 to 3 cm long, usually sessile, solitary or sometimes in small distant clusters on long, slender, leafless branches; outer involucral bracts, green 2 to 3 cm in length and 1 to 2 cm in breadth, ovate, acute, with broad scarious margins; inner bracts linear – oblong, subobtuse, with scarious margins; ligules narrow, shortly and bluntly 5-toothed at apex; flowers differentiated into three types of florets-ray, disc and neuter; ray florets – 3.0 to 4.0 cm long, peripheral, sessile, bracteate, pistillate, petals 5, gamopetalous with valvate aestivation, ovary bicarpellary, syncarpous, unilocular, with single ovule, placentation basal, style simple, 2 to 3.0 cm long; disc florets – calyx and corolla similar to rayflorets, usually male, 5 stamens, epipetalous, alternating with petals, anther syngenesious, introrse, longitudinally dehiscing; neuter florets – peripheral, 3.0 to 4.0 cm long, calyx pappus like on base, petals 5, 0.5 to 0.6 cm long, gamopetalous, linear in shape, androecium and gynoecium as rudimentary organs; fruit achene upto 1 cm in length, compressed, faintly ribbed, muriculate, tapering into a beak which is suddenly dilated into a whitish cup-like disk beneath the pappus.

b) Microscopic:
Bracts-

Midrib- TS shows an outline deeply convex on the abaxial and slightly convex on the adaxial side; 1 or 2 layered upper and a single layered lower epidermis covered externally with striated, thick cuticle and interrupted by glandular and non-glandular trichomes; glandular trichomes more on the lower side; mesophyll differentiated into 3 or 4 layered collenchymatous tissue followed by 2 or 3 layered parenchyma on both the upper and lower sides of vascular bundle; vascular bundle single, median, closed; sclerenchymatous cells cap the vascular bundle on upper and lower side; xylem in radial rows on upper side; phloem 3 or 4 layered; idioblast filled with rosette crystal of calcium oxalate in the sclerenchymatous region.

Lamina- Isobilateral; both upper and lower epidermis covered with thick striated cuticle surface views of both epidermis show non-glandular, unicellular trichome with acute apex and club shaped glandular trichome with single celled stalk and 4 to 8 celled head, cell walls of both the epidermis straight, anisocytic stomata present on lower side; palisade parenchyma 2 or 3 layered; spongy parenchyma 3 to 6 layer deep and loosely arranged, mesophyll traversed by number of veins with vascular bundles surrounded by a sclerenchymatous bundle sheath.

Powder- Yellowish green, on microscopic examination shows groups of angular epidermal cells with stomata of bracts, unicellular non-glandular, unicellular trichome with acute apex and club shaped glandular trichome with single celled stalk and 4 to 8 celled head; trichomes; round, tetraporate, pollen grains 22 to 27 µ in dia.; oil cells from seeds, and wavy epidermal cells of petals; stone cells, thin walled and reticulate parenchyma from seed, thick walled parenchyma of peduncle and vessels; pollen grains round, tetraporate, 20 to 27 µ in dia.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more than 2 per cent, Appendix 2.2.2
Total ash	**-**	Not more than 7 per cent, Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	**-**	Not less than 14 per cent, Appendix 2.2.7

T.L.C. –

T.L.C of methanolic extract on silica gel 'G' plate (0.2 mm thick) using *toluene: ethyl acetate : formic acid* (7:3:0.5) under UV light 254 nm shows spots at R_f. 0.13, 0.22 0.27, 0.38 and 0.45. On spraying with *anisaldehyde-sulphuric acid reagent* and heating the plate for 10 min. at 105°, spots appear at R_f. 0.19 (yellow) 0.37 (blue) 0.56 (purple), 0.67 (purple) and 0.89 (purple).

CONSTITUENTS – Contains a dye of flavonoid, Carthamin.

PROPERTIES AND ACTION –

Rasa	: Madhura, Kaṣāya
Guṇa	: Rūkṣa, Laghu
Vīrya	: Kaṭu
Vipāka	: Uṣṇa
Karma	: Kaphahara, Svedajanana, Dīpana, Keśarañjana, Viṣaghna

IMPORTANT FORMULATIONS- Godhāviṣacikitsā, Yoga Kusumbḥa Yoga, Kusumbham Guna, Kusumbhatailaguṇa, Kusumbha Tail Guna, Kusumbha Guna, Kusumbh Guna

THERAPEUTIC USES- Kaṣṭārtava (Dysmenorrhoea), Kāsa (Cough), Mūtrakṛcchra (Dysuria), Pratiśyāya (Coryza), Raktapitta (Bleeding disorder), Romantika (Measles), Śvāsa (Asthma), Visphotake (Blisterous eruption), Yoniroga (Disease of female genital tract)

DOSE- Cūrṇa (Powder): 2 to 4 g.

LAGHU HARITAMAÑJARĪ (Root)

Laghu haritamañjarī consist of roots of *Acalypha fruticosa* Forsk.(Fam. Euphorbiaceae), a strong smelling pubescent bushy shrub upto 2.5 m in height covered with yellow waxy glands commonly found in plains from Orissa to Tamilnadu, Karnataka and Kerala.

SYNONYMS - Laghu-Kuppī

REGIONAL LANGUAGE NAMES -

Hin.	: Chinni-Ka Jhar, Chinni
Kan.	: Chinni, Chinnnimara, Chinnigida
Mal.	: Sinni-maram
Mar.	: Khokali
Tam.	: Chinni
Tel.	: Chinna kuppi

DESCRIPTION –

a) Macroscopic:

Root consists of long unbranched tap root with lateral roots, cut into pieces of 3 to 5 cm in length and 0.75 to 1.5 cm in diameter; dark brown outside and cut surface yellowish; fracture, short; no characteristic odour and taste.

b) Microscopic:

Root - Epiblema crushed; parenchymatous cortical cells shows the presence of laticifers and large druses; stone cell patches present; phloem narrow, phloem parenchyma occasionally having druses; vessel circular, mostly solitary, sometimes in radial groups of 2 to 4 widely spaced in a large zone of xylem parenchyma; rays uniseriate to occasionally biseriate; pith parenchymatous, some cells contain large druses.

Powder- Light brown, taste bitter, reticulate and pitted vessels, druses, stone cells, fibres and xylem parenchyma present.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than	2	per cent, Appendix 2.2.2
Total ash	-	Not more than	4	per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than	0.5	per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	2	per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than	5	per cent, Appendix 2.2.7
Fixed oil	-	Not less than	1	per cent, Appendix 2.2.8

T.L.C. -

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} of 0.2 mm thickness, using *toluene:ethyl acetate:formic acid* (5:1.5: 0.5) under UV 366 nm shows spots at R_f. 0.5 (blue), 0.67

(fluorescent blue), 0.83 (fluorescent green). Under UV 254 nm spots appear at R_f. 0.33, 0.39 (both green), 0.67 (pale blue), 0.89, 0.94 (both green).

CONSTITUENTS - Arjunolic acid.

PROPERTIES AND ACTION-

Rasa	: Tikta, Kaṭu
Guṇa	: Laghu, Snigdha
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Dīpana, Kaphahara, Pācana, Sraṁsana, Vamana, Vraṇa ropaṇa

IMPORTANT FORMULATIONS – Used as single drug

THERAPEUTIC USES - Agnimāndya (Digestive impairment), Vraṇa (Ulcer)

DOSE - Cūrṇa (Powder): 3 to 6 g.

LAGHUPATRA VARṢĀBHŪ (Whole Plant)

Laghupatra varṣābhū consists of the whole plant of *Trianthema decandra* L. (Fam. Ficoidaceae (Aizoaceae), a much branched prostrate, procumbent annual herb, occurring as a weed all over peninsular India.

SYNONYMS – Dvijāyāṅgī

REGIONAL LANGUAGE NAMES -

Ben.	: Gadabani, Goda-cani
Hin.	: Gadabani
Kan.	: Bilikomme, Gaija soppu
Mal.	: Vellutha thazhuthama
Mar.	: Tultuli
Ori.	: Puruni saga
Tam.	: Vellai caranai
Tel.	: Tellagalijeru

DESCRIPTION –

a) Macroscopic:

Root **-**Cylindrical, gradually tapering, measuring upto 8 cm long and upto 0.5 cm in thickness, surface brown, smooth, lateral roots sparse; fracture entire, fractured surface smooth with a thin bark and central whitish wood; odour and taste indistinct.

Stem **-**Herbaceous, sparsely branched, procumbent, angular and striate, surface glabrous, fracture entire; odour and taste indistinct.

Leaf **-**Simple, opposite, unequal, petiolate, petioles 0.6 to 1.4 cm long, puberulous, amplexicaul at the base; lamina obovate, 1.5 to 25. cm broad and 2.0 to 2.5 cm long apiculate, tapering towards the base, margin entire, unicostate pinnate reticulate venation with 3 to 5 pairs of lateral veins, adaxial surface dark green and the abaxial one light green, glabrous, odour and taste indistinct.

b) Microscopic -

Root **-**TS of root shows anomalous secondary growth with 6 to 8 seriate cork with rectangular, tangentially elongated cells; cork cambium present; cortex 3 or 4 seriate, composed of isodiametric, parenchymatous cells with intercellular spaces and containing rosettes of calcium oxalate crystals; vascular tissue contains 5 to 6 rings of xylem, alternating with a ring of phloem; phloem rings comparatively narrower; composed of sieve tubes with compound sieve plates, companion cells, phloem parenchyma and phloem fibres; xylem composed of vessels, and parenchyma; numerous xylem fibres measuring 10 to 15 µ in width and 200 to 310 µ in length; simple pits present; xylem parenchyma scanty.

Stem **-**TS shows no secondary growth and has epidermis single layered, composed of rectangular, tangentially elongated thin walled compactly arranged parenchymatous cells; cortex made of 10 to 16 layers of thin walled, parenchymatous cells with intercellular spaces; some of the cortical cells contain rosettes of calcium oxalate crystals; stele large with a narrow ring of vascular bundles and a wide central pith; 20 to 25 vascular bundles are

arranged in the form of a ring; vascular bundles conjoint, collateral, open and endarch., phloem present with sieve tubes, companion cells, phloem parenchyma and phloem fibres; xylem fibres and parenchyma scanty; pith is composed of thin walled, isodiametric, parenchymatous cells possessing intercellular spaces; some containing rosettes; medullary rays narrow.

Leaf -

Midrib -TS shows a notch in the adaxial side and ridge on abaxial surface; epidermis with cuticle, cell walls nearly straight or slightly wavy in surface view; ground tissue parenchymatous; vascular bundle arranged in an arc, phloem abaxial and xylem adaxial, both xylem and phloem contain fibres, parenchyma, xylem vessels with annular and spiral thickenings;

Lamina -TS of lamina shows the presence of cuticle, an epidermis of tabular cells, palisade in a single row, spongy cells loosely arranged, parenchymatous; vascular bundle with a bundle sheath, cells filled with eccentric starch grains; rosettes present in spongy layer, trichomes absent; stomata present on both upper and lower epidermis, more on lower epidermis, paracytic; epidermal cells in surface view polygonal, with straight or slightly wavy walls; stomatal index of adaxial epidermis 16 or 17 and that of abaxial surface 18 or 19, costal cells elongated and narrow.

Powder -Greenish grey, freely flowing, and contains polygonal epidermal cells with slightly wavy walls as seen in surface view, paracytic stomata, xylem elements with annular and spiral thickenings, calcium oxalate rosettes (roots of *T. portulacastrum* contain rosettes of calcium oxalate, and roots of *Boerhaavia diffusa* show raphides, and prisms of starch grains).

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IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent, Appendix	2.2.2
Total ash	**-**	Not more than	22	per cent, Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	8	per cent, Appendix	2.2.4
Alcohol-soluble extractive	-	Not less than	12	per cent, Appendix	2.2.6
Water-soluble extractive	-	Not less than	27	per cent, Appendix	2.2.7

T.L.C. -

T.L.C. of alcoholic extract on silica gel 'G' plate using *n-hexane : ethyl acetate* (9:1) shows under UV 366 nm spots at R_f. values 0.16 (blue), 0.39 (violet), 0.69 (blue) and 0.74 (blue); on exposure to *iodine vapour* spots appear at R_f. values 0.16, 0.20, 0.39, 0.50, 0.69, 0.78 and 0.82, and on spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° spots appear with R_f. values 0.16, 0.20, 0.39, 0.50, 0.58, 0.69, 0.74, 0.78 and 0.82.

CONSTITUENTS - Saponins and alkaloid punarnavine.

PROPERTIES AND ACTION –	
Rasa	: Tikta
Guṇa	: Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphahara, Mūtrala, SrAṁsana, Śūlaghna
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES- Āmavāta (Rheumatism), Apasmāra (Epilepsy), Ardhāvabhedaka (Migrain / Hemicranin), Hṛdayaroga (Heart disease), Kāmalā (Jaundice), Kāsa (Cough), Pāṇḍu (Anaemia), Śotha (Oedema), Śvāsa (Asthma), Uraḥkṣata (Chest wound), Vraṇa (Ulcer)	
DOSE – Cūrṇa (Powder) : 3 to 6 g.	

LOHITANIRYĀSA (Exudate)

Lohitaniryāsa consists of exudate of stem of *Dracaena cinnabari* Balf. f. (Fam. Agavaceae), a tall tree reaching upto to 8 m, found in the Indian Ocean island of Suqutra (Socotra), off the coast of Somalia in Africa. It is imported into India.

SYNONYMS – Śonitavarṇā, Lohita kṣīrī

REGIONAL LANGUAGE NAMES -

Eng.	: Dragon´s blood
Guj.	: Hiraadakhana
Hin.	: Hiraadokhi, Khoonkharaabaa
Kan.	: Khunkhaaraa
Mal.	: Kandamurgarittam
Mar.	: Khunkharaabaa
Pun.	: Khoonakharaabaa
Tam.	: Kandamurgarittam
Urd.	: Damm-ul- Akhwain

DESCRIPTION -

Macroscopic:

Bright red coloured powder; odour and taste nil.

IDENTITY, PURITY AND STRENGTH –

Foreign matter **:** Not more than 2 per cent, Appendix 2.2.2
Total ash **:** Not more than 2 per cent, Appendix 2.2.3
Acid-insoluble ash **:** Not more than 8 per cent, Appendix 2.2.4
Alcohol-soluble extractive **:** Not less than 95 per cent, Appendix 2.2.6
Water-soluble extractive **:** Not less than 2 per cent, Appendix 2.2.7

T.L.C. –

Take 2 g of the powdered drug and extract with methanol (2 x 25 ml), by refluxing on a water bath. Filter and concentrate the pooled extract. Adjust the volume to 10 ml with ethanol and apply about 20 µl on precoated silica gel 60 F_{254} plate (thickness 0.2 mm).

T.L.C. of alcoholic extract on silica gel 'G' plate using *choloroform:methanol* (9.5:05) under UV 254 nm shows spots at R_f. 0.15, 0.25 , 0.36,0.69,0.79 and 0.84; under 360nm shows spots at 0.16 (blue), 0.27 (blue), 0.38 (blue) 0.44 (green), 0.73 (blue) and 0.79 (dark); and on spraying with *anisaldehyde sulphuric acid reagent* and heating the plate for 5 minutes at 105° spots appear at $R_{f0.}$ 0.18 (purple), 0.27(yellow), 0.35 (orange), 0.45 (orange), 0.57 (orange) 0.67 (orange), 0.78 (orange) and 0.82 (orange).

CONSTITUENTS–2-Hydroxychalcone,7-hydroxy-3-(3-hydroxy-4-methoxybenzyl)chroman, (2S)- 7,3'-dihydroxy-4'-methoxyflavan and 4-hydroxy-2-methoxtdihydrochalcone

PROPERTIES AND ACTION –	
Rasa	: Kaṣāya
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Raktastambhana, Saṅgrāhī, Vraṇaropaṇa
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES- Atisāra (Diarrhoea), Pravāhikā (Dysentery), Raktārśa (Bleeding piles), Raktapitta (Bleeding disorder), Rakta-Pradara (Menorrhagia or Metrorrhagia or both), Raktasrāva (Haemmorrhage), Vraṇa (Ulcer)	
DOSE -Cūrṇa (Powder): 1 to 2 g.	

MĀDHAVĪ (Flower)

Mādhavī consists of the dried flowers of *Hiptage benghalensis* L. (Fam. Malpighiaceae), a large woody, much branched climbing shrub with young parts silky, growing widely, chiefly in damp places, throughout India and Andaman Islands, up to an altitude of 1,500 m.

SYNONYMS- Atimuktā, Atimuktaka, Mādhaīlata

REGIONAL LANGUAGE NAMES-

Ben. : Maadhivilataa
Eng. : Clustered Hiptage
Guj. : Maadhavi, Ragatpiti
Hin. : Maadhavi, Anetaa
Kan. : Maadhavivasantadhuti
Mal. : Sitaampu
Mar. : Madhumaalati, Haladvel
Ori. : Boromali
Pun. : Benkar
Tam. : Maadhavi, Kurukkathi
Tel. : Maadhavi

DESCRIPTION-

a) Macroscopic:

Drug consists of a mixture of entire, shrivelled flowers and detached floral parts; flower bisexual, regular, 1.2 to 2.0 cm across, racemes terminal and axillary, pedicellate, pedicel 1.5 to 2 cm in length; calyx 5, persistent, polysepalous, externally densely pubescent, lobes oblong, obtuse, 6 to 9 mm long and 3 to mm broad, central fleshy and thin near margin with a large oblong basal gland measuring 5 to 7 mm in length and 2 to 3 mm in breadth; corolla 5, polypetalous, 1.5 to 2 cm broad and 2 to 2.5 cm long, smooth, silky, orbicular, clawed, fringed on the margin; uppermost fragment broader and yellowish; stamens 10 encircling the disc, one being larger than other nine, anther bilobed, pistil one, consisting of swollen ovary, with three winged like appendages one being larger and hairy; carpels 3, syncarpous, style one, longer than stamens, stigma 1, ovules3.

b) Microscopic:

Powder- Creamish grey, shows fragments of rectangular shaped epidermal cells of calyx in the surface view along with multicellular, uniseriate trichomes, and their detached broken pieces scattered as such; fragments of epidermal cells of petals in surface view with stright, polygonal walls and diacytic stomata, abundant spherical pollen grains exhibiting 3 to 5 germ pores and distict smooth exine and intine; fragments of parenchyma of petals containing rosette crystals of calcium oxalate; abundant pitted lignified fibrous sclereids with broad lumen and pointed or blunt apex often exhibiting occasional swelling at places, and twisted or bifurcating ends; fibrous layer and papillose epidermis of anther.

IDENTITY, PURITY AND STRENGHT-

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 10 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractvie	-	Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 30 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract on silica gel 'G' plate (0.2 mm using *toluene-ethyl acetate* (9:1) shows spots at R_f. 0.27, 0.43, 0.49 and 0.96 on spraying with *vanillin sulphuric acid reagent* and heating the plate for about 10 minutes at 110^o.

CONSTITUENTS- No report on the chemical consitituents of the flower is available.

PROPERTIES AND ACTION –

Rasa	: Madhura, Kaṭu, Tikta
Guṇa	: Laghu
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Tridoṣahaṭa, Kuṣṭhaghna

IMPORTANT FORMULATIONS- Candrakalā- rasa, Madhvi, Vasanti Guna, Atimukta Guna, Mādhvī Taila

THERAPEUTIC USES - Agnimāndya (Digestive impairment), Kṛmi roga (Worm infestation), Kaṇḍu (Itching), Pama (Eczema), Raktapitta (Bleeding disorder), Sthaulya (Obesity), Tvakroga (Skin diseases)

DOSE- Cūrṇa (Powder): 3 to 6 g.

MATSYAPATRIKĀ (Whole Plant)

Matsyapatrikā is the whole plant of *Merremia tridentata* (L.) Hall. f. Syn. *Ipomoea tridentata* (L.) Roth. (Fam. Convolvulaceae), a prostrate herb occurring widely in the plains throughout India as a weed.

SYNONYMS - Prasārinī Keralīya

REGIONAL LANGUAGE NAMES-

Mal. : Talaneeli
Ori. : Bhuin Kumdda
Tam. : Mutiyarkunthal, Irippanpul, Savolikkoti
Tel. : Sitasavaram

DESCRIPTION -

a) Macroscopic:

Root -Yellowish brown, individual pieces tortuous, 2 to 4 mm dia., with a brownish bark and creamy wood; broken surface yellowish; fracture fibrous; no odour or taste.

Stem -Yellowish brown and brittle, minutely hairy; internodes 1 to 2 cm in length; fracture fibrous, broken surface yellow; pith hollow.

Leaf -Simple, alternate, dull green to brown, rarely brittle; petiole 1 to 2 mm long, minutely hairy; lamina 1 to 5 cm long and 0.2 to 0.6 cm broad, linear lanceolate, mucronate, generally glabrous, but base minutely hairy, 3 to 4 lobed, hastate to lobed-hastate, lobe tips mucronate; margin entire; veins 5 to 7 pairs, alternate, rarely opposite, prominent below.

Flower – Inflorescence cymose, rarely solitary, axillary, peduncle 1.5 to 3 cm, base hairy, brownish; pentamerous, funnel shaped; about 1.5 cm across, sepals five, stamens five and unequal, style slender, stigma bifid, ovary globose, bicarpellate.

Fruit -Capsule, dry dehiscent, up to 6 mm across, globose, yellowish brown, surface smooth; seeds 4, angularly ovate, 2 to 3 mm. glabrous, dark brown to black in colour.

b) Microscopic:

Root -TS shows cork tissue composed of transversely elongated cells; the cortex consists of 7 to 10 layers of tangentially elongated, narrow and thin walled cells containing many, simple, small, rounded starch grains and clusters of calcium oxalate crystals; latex present in thin walled, brown coloured, circular cells; cortex followed by phloem with sieve tubes, companion cells and phloem parenchyma, some of which contain small starch grains; xylem continuous as a ring; medullary rays mostly uniseriate and rarely biseriate.

Stem -TS shows an outline slightly 4 angled; epidermis a layer of rectangular cells, followed by a cortex of polygonal parenchymatous cells with small intercellular spaces; some show yellowish brown latex; cortex followed by a layer or two of a broken pericycle of small stone cells; vascular bundles 7 to 8; external phloem continuous and wavy; xylem consists of wide vessels and tracheids; internal, perimedullary phloem not continuous; pith, where present, with irregular thin walled polygonal cells having plenty of starch grains.

***Leaf* -**

Midrib -TS shows a depression on the adaxial side; epidermis of rectangular cells followed by 4 to 6 layers of thick walled parenchymtous cells, many of which contain cluster crystals of calcium oxalate; xylem with 4 to 7 rows of xylem vessels arranged in a semicircle; phloem seen just below the xylem, followed by about 5 layers of polygonal parenchyma cells; just above the lower epidermis a single layer of chlorenchyma present. The lower epidermal cells broader and thick walled.

Lamina -Upper epidermis followed by 2 to 3 layers of elongated palisade cells; spongy mesophyll with loosely arranged 2 to 3 layers of cells; stomata anomocytic; unicellular and multicellular uniseriate trichomes present at the leaf base and at the junction of the petiole, on upper surface only.

Powder -Brown, has no characteristic odour and slightly bitter the microscopic observation shows compact rectangular parenchyma; globular and clustered starch grains of about 5 µm across; granular crystals of calcium oxalate; reddish brown resinous masses; irregular colourless masses; multicellular uniseriate trichomes of about 180 µm in length; unicellular trichomes of about 40 to 150 µm; long wiry fibres; patches of polygonal epidermal parenchyma with anomocytic stomata; spiral vessels; reticulate vessels; bordered pitted vessels and tracheids.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent,	Appendix	2.2.2
Total ash	-	Not more than 10 per cent,	Appendix	2.2.3
Acid-insoluble ash	-	Not more than 1 per cent,	Appendix	2.2.4
Alcohol-soluble extractive	-	Not less than 5 per cent,	Appendix	2.2.6
Water-soluble extractive	-	Not less than 14 per cent,	Appendix	2.2.7

T.L.C. -

T.L.C of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *n-hexane: ethylacetate: methanol* (5:4:1) as mobile phase, after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^{o} for 5 minutes shows spots at R_f. 0.10 (grey), 0.28 (pink), 0.35 (pink), 0.42 (pink), 0.47 (pink), 0.55 (pink), 0.67 (pink), 0.73 (yellow) and 0.8 (pink).

CONSTITUENTS– Flavonoids like diosmetin, luteolin, diosmetin-7-*O*-β– glucoside and luteolin -7-*O*-β glucoside.

PROPERTIES AND ACTION –

Rasa	: Tikta, Kaṣāya
Guṇa	: Guru, Sara
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Arśoghna, Bhedana, Sandhānīya, Sara, Vṛṣya

IMPORTANT FORMULATIONS - Prasāranīda- taila (keraliya)

THERAPEUTIC USES - Arśa (Piles), Dhātukṣya (Tissue wasting), Pakṣāghāta (Paralysis / Hemiplegia), Sandhisotha (Arthritis), Śotha (Inflammation), Vibandha (Constipation), Vraṇa (Ulcer)

DOSE - Cūrṇa (Powder): 3 to 6 g.
Svarasa (Juice) :: 5 to 10 ml.

MEDĀ (Rhizome)

Medā is the dried rhizome of *Polygonatum cirrhifolium* Royle (Fam. Liliaceae), a stout herb found in temperate Himalayas from Shimla eastward to Bhutan and Manipur upto an altitude of 1500 to 3300 m.

SYNONYMS- Manichidrā, Dharā, Sutrāgrapatrā

REGIONAL LANGUAGE NAMES -

Ass.	: Meda
Ben.	: Meda
Guj.	: Meda
Hin.	: Medaa
Kan.	: Medhaa
Mal.	: Meda
Mar.	: Meda
Ori.	: Meda
Pun.	: Meda
Tel.	: Meda

DESCRIPTION –

a) Macroscopic:

Rhizome tuberous, branched or show large circular scars where they have broken off, outer surface smooth, greyish in colour, longitudinally wrinkled when dried, marked with transverse rings of leaf scars and also shows scars of aerial stem on upper side; numerous roots arise from surface; fracture short, fibrous; odour, aromatic, taste, bitter.

b) Microscopic:

Rhizome- TS shows about 10 layers of cork cells with thick cuticularised outer wall, followed by ground tissue, with numerous scattered vascular bundles; vascular bundles collateral, each associated with a group of fibres, usually arc-shaped or occasionally nearly surrounding the bundle; cells of the ground tissue small, loosely arranged and contain numerous rounded to oval starch grains measuring 8 to 14 µ in diameter and raphides and prismatic crystals of calcium oxalate; endodermis not distinct.

Powder - Light brown, taste bitter, starch grains simple, rounded to oval measuring 8 to 14 m in diameter; variable size of prismatic crystals of calcium oxalate and raphides; border- pitted and reticulately thickened vessels; fibres elongated, thick walled, measuring about 550 to 800 µ long and 12 to 26 µ wide, tracheids with lumen width 8 to 12 µ..

IDENTITY, PURITY AND STRENGTH–

Foreign matter	**-**	Not more than	2	per cent, Appendix	2.2.2
Total ash	**-**	Not more than	5	per cent, Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	1	per cent, Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not less than	25	per cent, Appendix	2.2.6
Water–soluble extractive	**-**	Not less than	62	per cent, Appendix	2.2.7

T.L.C. –

T.L.C. of the alcoholic extract of the drug on silica gel 'G' plate using *chlorofor : glacial acetic acid:methanol : water* (50:20:20:10) under UV light 365 nm shows fluorescent zones at R_f. 0.54, 0.71 & 0.85 (all greenish). On spraying with *anisaldehyde sulphuric acid reagent* and heating the plate for 10 minutes at 105° spots appear at R_f. 0.44 (bluish), 0.56 (bluish), 0.73 (black), 0.85 (brownish).

CONSTITUENTS - Steroidal saponins (diosgenin), proteins and resins.

PROPERTIES AND ACTION –

Rasa	: Madhura
Guṇa	: Snigdha, Picchila, Guru
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Balya, Bṛṁhaṇa, Garbhadā, Jīvanīya Kaphavardhaka, Pauṣṭika, Pittahara, Stanyajanana,Vṛṣya
IMPORTANT FORMULATIONS - Daśamūlāriṣṭa, Śatāvarī Taila, Triphalā ghṛta, Meda Guna, Mahameda, Meda - mahameda Guna	
THERAPEUTIC USES - Bālaroga (Disease of children), Bhagandara (Fistula-in-ano), Gulma (Abdominal lump), Kāmalā (Jaundice), Kārśya (Emaciation), Kāsa (Cough), Kṣaya (Pthisis), Naktāndhya (Night blindness), Netrasrāva (Chronic dacrocystitis or epiphora), Rājayakṣmā (Tuberculosis), Raktapitta (Bleeding disorder), Śoṣa (Emaciation), Śvāsa (Asthma), Timira (Cataract), Visarpa (Erysepales)	
DOSE – Cūrṇa (Powder): 3 to 6 g.	

NĀḌĪHIṄGU (Exudate)

Nāḍīhiṅgu is the dried resinous exudation from the shoot tip of *Gardenia gummifera* L. f. Syn. *G. arborea* Roxb. (Fam. Rubiaceae), a large shrub occurring in moist deciduous forests of India.

SYNONYMS- Hiṅgunāḍikā

REGIONAL LANGUAGE NAMES-

Ben.	Dikamali
Eng.	Gummy Gardenia
Guj.	Dikaamaari, Maaladi
Hin.	Naadihingu, Dikaamaali
Kan.	Dikkaamalli
Mal.	Somanaadikaayam, Gandharaajan
Mar	Dikemaali
Pun.	Dikaamaali
Tam.	Tikka malli
Tel.	Tellamanga, Karinguva
Urd.	Dikkamali

DESCRIPTION-

Macroscopic:

Globular droplets between 1 and 3 mm in size, shiny, smooth and translucent; sulphur yellow to golden yellow in colour, gradually turning brown with age, broken surface shiny and smooth; fracture brittle when dry but sticky when fresh; has a characteristic smell of asafoetida and tastes slightly bitter.

IDENTITY, PURITY AND STRENGTH –

Foreign matter : Not more than 2 per cent, Appendix 2.2.2

Solubility : Insoluble in water and slightly soluble in most of the organic solvents; dissolves in strong acids, turning brown to reddish brown, as it gets charred.

Identification test-

1. 0.1g of the droplets of the gum when treated with 1ml conc. hydrochloric acid gradually turns brownish. It dissolves slightly on keeping and the solution becomes yellow.

2. 0.1g of the droplets of the gum on treatment with 1ml conc. nitric acid turns red with evolution of effervescence. The solution turns reddish brown on keeping and the gum gradually dissolves in it.

3. 0.1g of the droplets of the gum on treatment with 1ml conc. sulphuric acid gradually dissolves in it turning the solution reddish brown.

T.L.C. -

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *n-hexane:chloroform:methanol* (4:5:1) as mobile phase, after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^{o} for 5 minutes shows spots at R_f. 0.2 (deep yellow), 0.22 (yellow), 0.31 (yellow), 0.37 (pale yellow), 0.43 (light pink), 0.55 (yellow), 0.63 (light pink) and 0.81 (pale yellow).

CONSTITUENTS-Gardenin, 3',4',5' apigenin, demethoxysudachitin and 3',5'-dihydoxy-4'-methoxywogonin.

PROPERTIES AND ACTION -	
Rasa	: Kaṭu
Guṇa	: Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Dīpana, Vātānulomaka, Pācana
IMPORTANT FORMULATIONS –Pippālyadidhūpana Kṛmikuṭhara Rasa, Nadi Hingu Guna, Vanaspatri Arka Gunah, Vaspika Guna	
THERAPEUTIC USES- Ādhmāna (Flatulance with gurgling sound), Agnimāndya (Digestive impairment), Ajīrṇa (Indigestion), Āmadoṣa (Products of impaired digestion and metabolism), Aruci (Tastelessness), Gulma (Abdominal lump), Hikkā (Hiccup), Kṛmi (Helminthiasis), Medoroga (Obesity), Udaraśūla (Pain in the abdomen)	
DOSE - Cūrṇa (Powder) : 1 to 3 g.	

NĀHĪ (Whole Plant)

Nāhī consists of the whole plant of *Enicostemma axillare* (Lam.) A. Raynal. Syn. *E. littorale* Blume, *E. hysoppifolium* (Willd.) Verd. (Fam. Gentianaceae), an erect herb, 50 to 60 cm high, found throughout the greater parts of India upto an altitude of 500 metres, more commonly in coastal areas and damp habitats.

SYNONYMS – Māmajjaka, Nāgajihvā

REGIONAL LANGUAGE NAMES-

Guj.	:	Maamijvaa, Maamejvaa
Hin.	:	Naay, Naai, Chhotaa Kiraayataa
Kan.	:	Karibandit, Sogade
Mal.	:	Vellaruku, Vellari
Mar.	:	Kadvi naai
Pun.	:	Bahuguni
Tam.	:	Vellaruku
Tel.	:	Chhevvu-kurti, Gulvidi
Urd.	:	Naay

DESCRIPTION -

a) Macroscopic :

Root - Root 2 to 4 mm in diameter, taproot dull white in colour surface slightly rugose; lateral roots not abundant; odour not specific; taste, bitter.

Stem - Provided with many erect or procumbent branches, readily rooting at nodes, bearing small white flowers in whorled axillary clusters; no odour; taste, bitter.

Leaf - Leaves opposite, sessile, shape and size very variable, midrib depressed on adaxial and prominent on abaxial side, upto 6 to 7cm long and about 1.25cm, broad, narrow linear or linear oblong, glaucous; odour nil; taste, bitter.

b) Microscopic:

Root - TS shows circular outline; epidermis single layered, with large and smaller cells; trichomes unicellular; cortex parenchymatous with large irregular airspaces; endodermis and a few layers of pericycle well defined; stele nearly circular in the central region with scattered vessels among thick walled parenchyma cells; medullary ray uniseriate; pith absent.

Stem - Stem is quadrangular in outline with narrow wings; epidermis single layered with barrel shaped cells; winged corners show outer collenchyma and inner parenchyma; a cortical zone consisting of circular parenchymatous cells with intercellular spaces; endodermis well developed; vascular bundle bicollateral; xylem vessels arranged singly or in radial rows in a circle along with xylem parenchyma; medullary rays uniseriate; pith parenchymatous; starch grains present.

Leaf-

Midrib - TS shows prominent bulge abaxially, consisting of collenchymatous cells; collateral vascular bundle present; ground tissue consists of thin walled parenchymatous cells, more loosely packed on the abaxial side.

Lamina **-** Epidermis single layered; papillae occur occasionally on both the epidermis; walls in surface view wavy, more so in the lower epidermis; stomata anisocytic; mesophyll consists of slightly vertically elongated palisade cells below the upper epidermis followed by loosely packed layers of spongy cells; stomatal number for adaxial epidermis 1 to 3/mm^2 and for abaxial epidermis 2 to 4/mm^2; stomatal index for adaxial epidermis 18 to 22, and for abaxial epidermis 20 to 24; palisade ratio 20 to 22; vein islet number 12 to 14 and veinlet termination number 7 or 8.

Powder - Greenish, epidermal fragments with anisocytic stomata; ray cells present; vessel elements, and starch grains upto 5 μ in size present; fibres with wide lumen also seen.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than 1 per cent, Appendix 2.2.2
Total ash	**-**	Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than 3 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 16 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 28 per cent, Appendix 2.2.7
Fixed oil	**-**	Not less than 5 per cent, Appendix 2.2.8

T.L.C. –

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene: ethyl acetate* 6:1 + 6 drops of formic acid, under UV 254 nm shows spots at R_f. 0.27, 0.30, 0.40,0.51, 0.54, 0.62 and 0.70 (all green). Under UV 366 nm fluorescent zones shows at R_f. 0.22, 0.27 (both white), 0.34 (pink), 0.38 (violet), 0.40, 0.51 (both magenta), 0.58 (blue), 0.62 (dark magenta), 0.66 (magenta) 0.70 (navy blue) are seen. On exposure to *iodine vapours,* spots are observed at R_f. 0.18, 0.25, 0.32 (all yellowish brown), 0.40, 0.47, 0.51 (all green), 0.58 (yellowish brown), 0.64 (green), 0.72, 0.80, and 0.94 (all yellowish brown). On dipping the plate in *vanillin - sulphuric acid reagent* and heating at 105° for 5 minutes, spots appear at R_f. 0.22 (blue), 0.27 (pink), 0.34 (violet), 0.44 (green), 0.51, 0.58 (both violet), 0.62 (green), 0.68, 0.76, 0.80 (all violet), 0.86 (blue) and 0.94 (violet).

CONSTITUENTS – Genkwanin, apigenin, isovitexin, swertisin, saponarin, swertiamarin, betulin, enicoflavin, gentiocrucine, gentianine, erythrocentaurine, ephelic acid glycoside, sylswertisioside, isoswertisin-5-*O*-glucoside; sylswertisin-5-*O*-glucoside.

PROPERTIES AND ACTION -

Rasa	: Tikta
Guna	: Laghu, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātānulomaka, Pittahara, Kaphahara, Dīpana, Pācana, Viṣaghna

IMPORTANT FORMULATIONS- Vāyucchaya Surendra Taila

THERAPEUTIC USES- Kṛmi (Worm infestation), Śotha (Oedema), Madhumeha (Diabetes mellitus), Medoroga (Obesity), Prameha (Metabolic disorder), Raktavīkāra (Disorders of blood), Tvak roga (Skin diseases), Viṣamajvara (Intermittent fever), Vibandha (Constipation), Yakrtdaurbalya (Poor function of liver)
DOSE- Cūrṇa (Powder): 1 to 3 g.

NIKOCAKA (Kernel)

Nikocaka consists of kernels of *Pinus gerardiana* Wall. (Fam. Coniferae), a medium sized tree growing in North-Western Himalayan region between 5,800 to 12,000 feet. It is removed from the pine nut known as Chilgoza in trade.

SYNONYMS – Cilagoja

REGIONAL LANGUAGE NAMES-

Eng.	: Chilgoza pine, Edible pine, Neosa pine
Guj.	: Chilgojhaa
Hin.	: Chilgozaa, Neoza, Gunobar, Rhee
Kan.	: Chilgojha
Mal.	: Chilgojha
Mar.	: Chilgoza, Galgoja
Ori.	: Chilgojha
Pun.	: Mirrigalgoj, Mirri, Chiri, Chirrigalgoja
Tel.	: Chilgoja
Urd.	: Chilgozah

DESCRIPTION –

a) Macroscopic:

Off-white in colour; oval in shape and pointed at the micropylar end; ranging from 1.5 to 2 cm long; oleaginous; possess a delicate terebinthine flavour; odour sweet.

b) Microscopic:

Diagrammatic TS is circular in outline shows epidermis covered with cuticle followed by wide ground tissue; collapsed layer; inner parenchymatous region which has 8 to 10 vascular bundles arranged in a ring, cells of the ground tissue are filled with starch grains and oil globules; vascular bundles consist of a centrally located xylem encircled by a phloem, with an external bundle sheath.

Powder -Yellowish white, polygonal, thin walled, barrel shaped epidermis in surface view; abundant simple, spherical starch grains scattered as such and in parenchyma cells of ground tissue; fragments of xylem vessels.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**:**	Not more than	2	per cent,	Appendix	2.2.2
Total ash	**:**	Not more than	3	per cent,	Appendix	2.2.3
Acid-insoluble ash	**:**	Not more than	0.2	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	**:**	Not less than	28	per cent,	Appendix	2.2.6
Water-soluble extractive	**:**	Not less than	18	per cent,	Appendix	2.2.7
Fixed oil	**:**	Not less than	43	per cent,	Appendix	2.2.8

T.L.C. -

Take 2 g of the powdered drug and extract with *n*-hexane (2 x 25 ml), by refluxing on a water bath. Filter and concentrate the pooled extract. Adjust the volume to 10 ml with ethanol and apply about 20 µl on precoated silica gel 60 F_{254} plate (thickness 0.2 mm).

T.L.C. of the alcoholic extract on precoated silica gel 'G' 60 plate using *petroleum ether: diethyl ether: acetic acid* (9:1:0.1), after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105° for 5 minutes shows spots at R_f 0.10 (purple), 0.14 (purple), 0.18 (purple), 0.22 (purple), 0.37 (dark purple) and 0.87 (light purple).

CONSTITUENTS – Palmitic, stearic, oleic and linoleic acids; palmito-dilinolein, stearo-dilinolein, palmito-oleolinolein, stearo-oleolinolein, trilinolein, oleodilinolein, dioleolinolein and triolein.

PROPERTIES AND ACTION –	
Rasa	: Madhura
Guṇa	: Snigdha, Guru
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Śleṣma-niḥsāraka, Bṛṁhaṇa, Balya, Dhātuvardhana, Kaphakara, Pittakara, Raktaprasādaka, Uttejaka, Vṛṣya, Vātahara
IMPORTANT FORMULATIONS -Jīvanīya Ghṛta, Nikocaka Guna	
THERAPEUTIC USES- Āmavāta (Rheumatism), Apasmāra (Epilepsy), Ardita (Facial palsy), Hikkā (Hiccup), Kāsa (Cough), Kṣata (Wound), Kṣaya (Pthisis), Kaṭiśūla (Lower backache), Pāṇḍu (Anaemia), Pārśvaśūla (Intercostal neuralgia and pleurodynia), Pakṣavadha (Paralysis / Hemiplegia), Sandhivāta (Arthritis due to Vata dosa), Śvāsa (Asthma), Vātarakta (Gout)	
DOSE –Cūrṇa (Powder): 10 to 20 g.	

PANASA (Root Bark)

Panasa consists of dried root bark of *Artocarpus heterophyllus* Lamk. Syn. *A. integrifolia* L.f.(Fam. Moraceae), a medium to large evergreen tree common in Western Ghats and cultivated throughout India for its fruits.

SYNONYMS – Mūlaphalada, Apuṣpaphalada, Atibṛhatphala

REGIONAL LANGUAGE NAMES-

Ass.	: Kanthal
Ben.	: Katal, Kantal, Kathal, Phanas
Eng.	: Jack-fruit tree, Indian Jack fruit
Guj.	: Phanus
Hin.	: Kathar, Kathal, Katahala
Kan.	: Hebba alasu
Mal.	: Chakka
Mar.	: Phanasa
Ori.	: Panasa, Ponoso
Pun.	: Katahala
Tam.	: Pala
Tel.	: Panasa
Urd.	: Katahal

DESCRIPTION -

a) Macroscopic:

Bark upto 5 to 8 cm long, 2 to 4.5 cm wide and 4 to 12 mm thick, greyish to reddish brown with longitudinal ridges and circular to tangentially elongated lenticels; fracture, short, showing creamish interior; odour taste and indistinct.

b) Microscopic:

Bark shows cork consisting of rectangular and tangentially elongated cells; phellogen 1 to 2 layered; phelloderm shows thin walled parenchyma cells, groups of stone cells and fibres present in lower phelloderm region; phloem a wide zone consisting of sieve tubes, companion cells, phloem parenchyma, fibres and stone cells being traversed by multiseriate medullary rays; stone cells and fibres in groups of varying dimensions scattered throughout the phloem region; the stone cells are upto 70 µ long and upto 30 µ wide and fibre measuring about 1450 µ in length ; a large number of prismatic and rhomboidal crystals of calcium oxalate scattered in parenchyma cells of phloem and phelloderm.

Powder -Shows rectangular to polygonal stone cells with wide lumen and simple pits, fragments of fibres with tapering ends, thin walled parenchyma cells with prismatic and rhomboidal crystals of calcium oxalate, fragments of cork cells and numerous scattered rhomboidal and prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	2	per cent, Appendix	2.2.2
Total ash	-	Not more than	19	per cent, Appendix	2.2.3
Acid-insoluble ash	-	Not more than	10	per cent, Appendix	2.2.4
Alcohol-soluble extractive	-	Not less than	7	per cent, Appendix	2.2.6
Water-soluble extractive	-	Not less than	3	per cent, Appendix	2.2.7

T.L.C. –

T.L.C. alcoholic extract on precoated silica gel 'G' plate using *toluene: chloroform: ethyl acetate* (2:2:1), on spraying with *ethanolic sulphuric acid* and heating the plate at 105° for 10 minutes shows spots at R_f. 0.30, 0.36, 0.43, (all light green), 0.52 (purple), 0.67 (green) and 0.87 (purple).

CONSTITUENTS - β-sitosterol, cycloartenone, cycloartenol; tannins.

PROPERTIES AND ACTION –	
Rasa	: Kaṣāya, Tikta
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Grāhī, Pittahara, Stambhana, Tvakdoṣahara, Vātavardhaka, Viṣṭambhakāraka
IMPORTANT FORMULATIONS – Panasa Guna, Apakva Panasa Guna, Panasa, Panasa bija Guna	
THERAPEUTIC USES - Atisāra (Diarrhoea), Dāha (Burning sensation), Rakta-pitta (Bleeding disorder), Śotha (Inflammation), Tvak roga (Skin diseases)	
DOSE – Cūrṇa (Powder): 3 to 6 g.	

PĀPAṬAḤ (Root)

Pāpaṭaḥ consists of the root pieces of *Pavetta indica* var. *tomentosa* Hook. Syn. *P. tomentosa* Roxb. (Fam. Rubiaceae), a stout bushy shrub, reaching about 9 m. high, occurring throughout the deciduous forests of India, as an under growth.

SYNONYMS – Pāpaḍī

REGIONAL LANGUAGE NAMES-

Ass.	: Gobor sitha
Ben.	: Kukurchuda, Jui
Eng.	: White Pavetta
Guj.	: Papat
Hin.	: Kankra, Papari, Kathachmpa
Kan.	: Pavati, Pappadi, Paavatlegida
Mal.	: Pavatta
Mar.	: Papadi, Kakra
Ori.	: Katha pengu
Pun.	: Papadi
Tam.	: Pavattai
Tel.	: Konda papata, Duyi papata, Papata kammi

DESCRIPTION -

a) Macroscopic:

Root pieces measuring 4 to 12 cm long and 1 to 3 cm in thickness, outer surface smooth, light brown; fracture entire, fractured surface smooth with very thin, dark brown easily detachable bark and a central light yellowish, tough, wood; odour and taste indistinct.

b) Microscopic:

TS of the mature root shows a thin, stratified bark and an extensive wood; bark composed of cork, 3 to 8 layers of thick walled isodiametric, compactly arranged cells interrupted by lenticels; cork cambium uniseriate, cells tangentially elongated-thin walled; cortex, parenchymatous, cells isodiametric, compactly arranged; secondary phloem with sieve tubes, abundant phloem parenchyma and thick walled lignified phloem fibres, solitary or in groups, wood hard, close grained, pores very small, vessels numerous, arranged singly in radial rows; with circular bordered pits arranged alternately in vertical rows; xylem parenchyma thick walled, filled with rhomboid crystals of calcium oxalate; xylem fibres abundant, polygonal with thick lignified pitted walls, surrounding the xylem vessels, lumen very narrow; medullary rays short, numerous, fine to very fine.

Powder -Brownish-grey, patches of cork tissue with stratified cells, vessels with bordered pits, phloem and xylem fibres, ray cell fragments in tangential view and rhomboid calcium oxalate crystals.

IDENTITY, PURITY AND STRENGH -

Foreign matter - Not more than 2 per cent, Appendix 2.2.2
Total ash - Not more than 3 per cent, Appendix 2.2.3
Acid-insoluble ash - Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive - Not less than 5 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 9 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract on silica gel 'G' plate using *n-hexane: ethyl acetate* (8:2) under UV 366 nm shows fluorescent spots at R_f. 0.5, 0.64, 0.93 and 0.97 (all blue) on exposure to *iodine vapour* spots appear at R_f. values 0.15, 0.28, 0.50, 0.64, 0.93 and 0.97 (yellow), on spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° shows spots at R_f. values 0.15, 0.46, 0.64, 0.75, 0.93 and 0.97.

CONSTITUENTS - Fixed oil.

PROPERTIES AND ACTION -	
Rasa	: Tikta
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Balya, Kaphaghna, Mūtrala, Varṇya, Virecana
IMPORTANT FORMULATIONS –Used as single drug	
THERAPEUTIC USES- Kāmalā (Jaundice), Kaṇḍū (Itching), Mūtraroga (Urinary diseases), Śotha (Inflammation), Udararoga (Diseases of abdomen), Vibandha (Constipation), Visphoṭa (Blister)	
DOSE - Cūrṇa (Powder): 3 to 6 g	

PARṆAYAVĀNĪ (Leaf)

Parṇayavānī consists of the leaves of *Coleus amboinicus* Lour. Syn. *C. aromaticus* Benth. (Fam. Lamiaceae), an aromatic, succulent perennial herb commonly cultivated in gardens throughout India and found wild in Rajasthan.

SYNONYMS – Yavānīgandhā

REGIONAL LANGUAGE NAMES-

Ben.	: Paatharchur, Paterchur
Eng.	: Country borage, Indian borage
Guj.	: Ovaapaan
Hin.	: Pattaajvaayana
Kan.	: Karpurahalli, Penova
Mal.	: Kannikurukka, Panikkurukka, Navarayilla
Mar.	: Paan, Ovaa
Ori.	: Hemakedara, Amarpoi
Pun.	: Patharchura
Tam.	: Karpuravalli
Tel.	: Kapparillaku, Vamu-aku

DESCRIPTION –

a) Macroscopic:

Leaf -Leaves green, opposite, hispidly villous, broadly ovate, crenate, succulent, upto 9 cm in width, petiolate, nerves impressed, odour, pleasantly aromatic; taste, pungent.

b) Microscopic:

***Petiole* -**TS shows a slightly concave outline on the adaxial side and convex on the abaxial side, epidermis a single layer of laterally elongated cells, followed by collenchyma of 2 or 3 layers; vascular bundles collateral, four in number of which two lateral abaxial bundles are larger and two lateral adaxial are smaller; ground tissue of thin walled parenchymatous cells; glandular trichomes; unicellular, and non-glandular uniseriate multicellular.

***Midrib* -**TS shows a hemi- spherical protrusion on the abaxial side and has a light depression on the adaxial side; 2 or 3 layers of collenchyma situated just above the abaxial epidermis and below the adaxial epidermis; palisade layer continuous over the midrib also; ground tissue consists of parenchyma cells; a solitary vascular bundle present in the centre.

Lamina -Dorsiventral, adaxial and abaxial epidermis composed of rectanglular cells, the abaxial cells being distinctly smaller; stomata diacytic, lie flush with the epidermal surface; subjacent to adaxial epidermis three, or occasionally even more, layers of slightly vertically elongated, columnar, closely arranged palisade cells are seen; following the palisade 4 or 5 layered spongy tissue composed of nearly rounded closely arranged cells with intercellular spaces seen; trichomes glandular and non-glandular; uniseriate, non-glandular

trichomes 3 to 6 celled, curved and progressively tapering; glandular provided with a two celled stalk of which the lower cell is the longer and the second that subtends the globular unicellular head nearly discoid; exhausted glandular hairs smaller in size also seen; stomatal number 12 to 14 / mm^2 for adaxial epidermis and 16 to 24 / mm^2 for abaxial epidermis; stomatal index for adaxial epidermis is 11 to 14 and for abaxial epidermis 18 to 22; palisade ratio 2 or 3; vein islet number 10 to 13 and vein termination number 2 or 3.

Powder –Green, bitter to taste and characteristic odour; shows epidermal cells in surface view, with slightly wavy walls; diacytic stomata; both uniseriate as well as glandular trichomes; broad and narrow vessel elements also seen, collapsed trichomes seen in the surface view of epidermis.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	- Not more than 2	per cent, Appendix 2.2.2
Total ash	- Not more than 16	per cent, Appendix 2.2.3
Acid-insoluble ash	- Not more than 2	per cent, Appendix 2.2.4
Alcohol-soluble extractive	- Not less than 7	per cent, Appendix 2.2.6
Water-soluble extractive	- Not less than 23	per cent, Appendix 2.2.7
Fixed oil	- Not less than 2.8	per cent, Appendix 2.2.8

T.L.C –

T.L.C. of chloroform extract on precoated aluminium silica gel 'G' 60 F_{254} plate 0.2 mm thickness using *toluene : ethyl acetate* (6:1) under UV 366 nm shows fluorescent spots at R_f. 0.10 (pink), 0.14 (pink), 0.64 (pink), 0.73 (dark pink), 0.80 (dark pink). Under UV 254 nm spots appear at R_f. 0.14, 0.27, 0.33, 0.64, 0.73, 0.80 (all green) and then dipping the plate in *vanillin -sulphuric acid* and heating at 105° for 5 minutes shows spots at R_f. 0.14, 0.27, 0.33, 0.64, 0.73, 0.80 (all grey).

CONSTITUENTS -Oleanolic acid; crategolic acid; pomolic acid; euscaphic acid; tormentic acid; ursolic acid and 2α,3α,19α,23-oxalacetic acid; cirsimaritin; sitosterol glucoside; salvingenin; quercetin; 6-methoxygenkwanin; chrysoeriol;ethyl salicylate; γ-terpinene; β-salinene; luteolin; apigenin; eriodyctol; þ-cymene; α and β-pinene; taxifolin; thymol; carvacrol; myrcene, 1,8- cineole; eugenol; β-caryophyllene.

PATRASNUHĪ (Latex)

Patrasnuhī consists of the fresh or dried latex of *Euphorbia nivulia* Buch.-Ham. (Fam. Euphorbiaceae), a spiny spurge growing upto 10m high, found in the dry and rocky regions practically throughout India and is often grown in hedges. Latex is collected by draining it from freshly cut leaves and stems.

SYNONYMS – Bahukaṇṭaka, Vajrī, Patta Karie, Sehuṇḍa

REGIONAL LANGUAGE NAMES-

Ben.	: Dandaa thohara, Sij
Guj.	: Thorkantalo, Thor
Hin.	: Katthohar, Sij
Kan.	: Yela kalli
Mal.	: Ilakalli
Mar.	: Sabar, Tepari
Ori.	: Kath sigu
Tam.	: Ilaikkalli
Tel.	: Akujemudu
Urd.	: Zakum

DESCRIPTION –
a) Macroscopic:

Fresh –Milky white liquid, bitter taste, distinct and unpleasant odour.

Dry –Brown in colour, lumpy, malleable to brittle with a dusty surface, bitter to taste and odour indistinct.

b) Microscopic:

Fresh –A small portion of latex mounted in glycerin shows starch grains, oval or dumb-bell shaped with 3 lobed extremities; a few occur in clusters of 20 to 50 µ in diameter; oval shaped individual starch grains measure 5 to10 µ oil globules also seen stained in Sudan III, no associated vegetable debris found.

***Dry* -**A small portion of residue after softening over water bath and clearing with 5 % KOH and mounted in glycerin, shows oval shaped starch grains 5 to 10 µ in diameter, dumbbell shaped starch grains with 3 lobed extremities and grains occurring in clusters 30 to 40 µ in diameter; oil globules also seen.

Solubility –

Fresh latex soluble in Alcohol, 1N NaOH (aq) and 50 % H_2SO_4
Dry latex insoluble in Alcohol and 1N NaOH (aq); partially soluble in 50 % H_2SO_4
Fluorescence Analysis in Both Day and UV (254 nm) light –
Fresh latex in 1N NaOH (aq) cream in daylight and light green in UV light.
Dry latex in 1N NaOH (aq) yellow in day light and light green in UV light.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	2	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than	0.12	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	29	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than	7	per cent,	Appendix 2.2.7
Fixed oil	-	Not less than	21	per cent,	Appendix 2.2.8

T.L.C –

T.L.C of dichloromethane extract on aluminium plate precoated with silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene: ethyl acetate* (6:0.5) under UV 254 nm shows spots at R_f. 0.17, 0.20, 0.39, 0.44, 0.63, 0.71 and 0.80 (all green). On exposure to *iodine vapours* spots appear at R_f. 0.17, 0.22, 0.32, 0.44 and 0.80 (all brown). On dipping the plate in *vanillin-sulphuric acid reagent* and heating at 105º for 5 minutes, spots appear at R_f 0.16 (blue), 0.22, 0.26 (both violet), 0.32 (blue), 0.39, 0.44 (both violet), 0.56, 0.64 (both blue) and 0.82 (violet).

CONSTITUENTS- Cyclonivuliaol; cycloartenol; cycloeucalenol; cycloart-25-en-3-β-24-diol.

PROPERTIES AND ACTION –	
Rasa	: Kaṭu
Guṇa	: Laghu, Tīkṣṇa, Snigdha
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma : Bhedana, Dāhaka, Lekhana, Virecana **IMPORTANT FORMULATIONS –** Used as single drug	
THERAPEUTIC USES- Arśa (Piles), Bhagandara (Fistula-in-ano), Kuṣṭha (Leprosy/ diseases of skin), Śvāsa (Asthma), Udararoga (Diseases of abdomen)	
DOSE - Kṣīra (Latex): 125 to 250 mg.	

PIṆḌATAGARA (Rhizome)

Piṇḍatagara consists of the dried rhizomes of *Asarum europaeum* L. (Fam. Aristolochiaceae), an evergreen plant with glossy foliage, occurring in Europe and temperate Mediterranean regions. The rhizomes are imported into India.

SYNONYMS - Dvīpāntara Tagara, Kaṭupatra, Pārasika tagara

REGIONAL LANGUAGE NAMES-

Eng.	: Common Asarbacca, Foal foot
Hin. *Mar.* *Ori.*	: Tagar ganthoda, Asaarun, Upana : Gathi tagara : Rukuna, Hatapochha
Tel.	: Chepututaku
Urd.	: Asaarun, Asaroon

DESCRIPTION -

a) Macroscopic:

Rhizomes are available in the form of pieces of about 2 to 4 cm long and 0.7 to 1.5 cm in thickness, irregular in shape, hard, external appearance dark brown and warty due to scars of leaf bases, inflorescences and lateral branches; cut surface is slightly coarse, dark coloured with a layer of thin bark, and a ring of vascular tissue; odour characteristically aromatic; taste, indistinct.

b) Microscopic:

Irregular in outline, bark contains cork, cork cambium, secondary cortex and phloem; cork 3 to 6 seriate, composed of tangentially elongated, rectangular, compactly arranged, stratified, thick walled, suberised cells; cork cambium uni or biseriate, composed of rectangular, compactly arranged, thin walled cells; secondary cortex composed of tangentially elongated thin walled, loosely arranged cells containing tannin as shown by a dark brown colour upon treatment with a mixture of freshly prepared 5% w/v Ferric Chloride solutions in 90% alcohol and 25% Basic Lead Acetate solution in carbondioxide free water; endodermis and pericycle crushed; endodermis single layer, cells barrel shaped, compactly arranged, radial and tangential walls are thickened and turn reddish in phloroglucinol and also in Sudan III; pericycle 2 or 3 seriate, composed of compactly arranged isodiametric cells; secondary phloem has sieve tubes, companion cells, extensive phloem parenchyma and phloem fibres; sieve tubes short with thin walls, and simple sieve plates, one or two companion cells are associated with each sieve tube; phloem parenchymatous cells are elongated tangentially, often collapsed completely in some places leaving large spaces; cells store tannin and oil globules, xylem is smaller, with 12 to 20 in patches, arranged in the form of a ring, each patch containing vessels, parenchyma and fibres; vessels upto 80 µ in width and upto 250 µ in length, with oblique end walls and a simple perforation plate; protoxylem elements possess spiral thickenings and metaxylem vessels have bordered pits arranged alternately; xylem fibres scanty, upto 450 µ in length, lignified with thick walls; pith crushed.

Powder -Dark brown in colour, oily, fine, not free flowing, and forms clumps; shows the presence of cork tissue, parenchyma, fibres and xylem vessels; xylem fibres 225 to 350 µ in length, thick walled with simple pits; vessels 180 to 250 µ long, having spiral thickenings; pitted, wide and short vessels are also present; end walls, oblique with simple perforation plates

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	2	per cent,	Appendix	2.2.2
Total ash	-	Not more than	6	per cent,	Appendix	2.2.3
Acid-insoluble ash	-	Not more than	2	per cent,	Appendix	2.2.4
Alcohol-soluble extractive value	-	Not less than	20	per cent,	Appendix	2.2.6
Water-soluble extractive value	-	Not less than	25	per cent,	Appendix	2.2.7

T.L.C. -

T.L.C. of the alcoholic extract on silicagel 'G' plate using *n-hexane:ethyl acetate* (9:1) under UV 366 nm shows fluorescent spots (blue) R_f. 0.20 and 0.37; on exposure to *iodine vapour* spots appear at R_f. 0.20, 0.37 and 0.55 (all yellow); on spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° spots appear at R_f. values 0.20, 0.37, 0.45, 0.55 and 0.61.

CONSTITUENTS- α-Agrofuran, chalcone diglycoside, α-asarone, diasarone-1,diasarone-2, *trans* & *cis*-isoasarones, fixed oil and volatile oil**.**

PROPERTIES AND ACTION -	
Rasa	: Kaṭu, Amla, Kaṣāya
Guṇa	: Laghu
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphara, Nāḍībalya, Śirovirecana, Śvayathuvilayana, Svedajanana, Tīkṣṇavirecana, Vāmaka, Viṣaghna
IMPORTANT FORMULATIONS –Used as single drug	
THERAPEUTIC USES- Āmavāta (Rheumatism), Anārtava, Apaśmāra (Epilepsy), Ardita (Facial palsy), Avarodhajanya Kāmalā (Obstructive jaundice), Gṛdhrasi (Sciatica), Jalodara (Ascites), Mūtrāvarodha (Uninary obstraction), Netraroga (Diseases of the eye), Pakṣavadha (Paralysis / Hemiplegia), Pārśvaśūla (Intercostal neuralgia and pleurodynia), Plīhā (Splenic disease), Śūla (Pain / Colic), Yakṛtaśotha(Hepetitis)	
DOSE – Cūrṇa (Powder) : 1 to 3 g.	

PĪTA-KĀÑCANĀRA (Bud)

Pīta-kāñcanāra consists of dried, mature flower buds of *Bauhinia racemosa* Lamk. (Fam. Caesalpiniaceae), a small bushy and crooked, deciduous tree distributed throughout India, common in sub-Himalayan tract from the Ravi eastwards to Bengal, Central and South India.

SYNONYMS- Pītapuṣpakaḥ

REGIONAL LANGUAGE NAMES-

Ben.	: Bauraj, Sada Kanchana
Guj.	: Aasotaro, Asundro, Apta
Hin.	: Asanta, Ashta
Kan.	: Banne, Kadu manthara
Mal.	: Mandarum
Mar.	: Aapataa, Ashtaa
Ori.	: Kanchana
Pun.	: Kosundra, Taur
Tel.	: Ari, Are, Pacchare
Urd.	: Kachnal

DESCRIPTION -

a) Macroscopic:

Flower buds 1.5 cm to 2.5 cm in length and 3 to 7 mm in diameter, apex acute, base tapering with attached pedicel measuring up to 2 cm in length, surface light brown to greyish brown with longitudinal fine wrinkles; fragile; calyx limb spathaceous, 5 toothed, reflexed; petals oblanceolate, as long as calyx limb; stamens 10, all perfect; odour and taste indistinct.

b) Microscopic:

Calyx- TS of sepal more or less circular in outline with 5 to 6 ridges and a central hollow core; epidermis on both surfaces with anomocytic stomata, 1 to 3 celled small covering trichomes, measuring upto 150 µ in length, present on lower surface: 4 to 5 layers of collenchyma cells present below each ridges of lower epidermis; mesophyll represented by aerenchyma; numerous vascular bundles arranged in a row in the mesophyll, vascular bundles below each ridge being larger in comparison to others; rosettes of calcium oxalate crystals present in some of the cells of aerenchyma.

Corolla- Petal shows single layered epidermis followed by mesophyll composed of circular to oval parenchyma cells; a number of small vascular bundles present in a row in the mesophyll; most of the parenchyma cells adjoining vascular bundles contain yellow to yellowish orange pigments.

Powder- Powder shows fragments of epidermis of petal with straight walls, epidermis of sepal with anomocytic stomata and 1 to 3 celled covering trichomes, some cells of mesophyll containing rosettes of calcium oxalate crystals, scalariform and spiral vessels with adjoining parenchyma cells containing pigments ; covering trichomes, isolated rosettes of calcium oxalate crystals ; pollen grains circular with smooth exine and entine measuring upto 100 µ in diameter and thick walled parenchymatous antheridial cells with adjoining scalariform vascular elements.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	2	percent,	Appendix 2.2.2
Total ash	-	Not more than	6	percent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than	1	percent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than	16	percent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than	28	percent,	Appendix 2.2.7

T.L.C.-

T.L.C. of alcoholic extract on silica gel 'G' plate using *toluene: chloroform: ethyl acetate* (2:2:0.5 under UV 254 nm shows spots at R_f. 0.37, 0.54, 0.60 and 0.77 (all white), 0.40, 0.65 and 0.84 (all pink).

CONSTITUENTS -Quercetin, isoquercetin.

PROPERTIES AND ACTION-	
Rasa	Madhura, Kaṣāya
Guṇa	Snigdha, Guru
Vīrya	Śīta
Vipāka	Madhura
Karma	Pittakaphaśāmaka, Saṅgrāhī, Kaphavātahara, Pittahara
IMPORTANT FORMULATIONS – Asmantaka Guna	
THERAPEUTIC USES- Bhūtavikāra (Psychotic syndrome), Dāha (Burning sensation), Galaganḍa (Goitre), Gaṇḍamālā (Cervical lymphadenitis), Prameha (Metabolic disorder), Raktavikāra (Disorders of blood), Tṛṣṇā (Thirst), Vidāha (Burning sensation), Viṣamjvara (Intermitten fever)	
DOSE - Cūrṇa (Powder): 1 to 3 g.	

RAKTA CITRAKA (Root)

Rakta Citraka consists of the dried roots of *Plumbago indica* L. Syn. *P. rosea* L. Fam. Plumbaginaceae). The plant is a perennial undershrub, with alternate entire leaves. Flowers are rose coloured in terminal spikes with gland dotted calyx and fruit a single seeded pyxidium; occurs all over India, cultivated or as an escape; roots of the plant are harvested at maturity and are dried in shade.

SYNONYMS – Analanāmā

REGIONAL LANGUAGE NAMES –

Ass.	: Ranga agyachit
Ben.	: Rakto chita, Lal chitra
Eng.	: Lead wort, Rosy flowered lead wort
Guj.	: Lal-chitrak, Rato-chatro
Hin.	: Lal-chita, Rakta-chita
Kan.	: Kempacitramulam, Kempu chitramula
Mal.	: Chuvannakkoduveli
Mar.	: Lal chitrak
Ori.	: Rangachitaparu
Tam.	: Kotivel, Cenkotivel
Tel.	: Errachitramulam
Urd.	: Cheetaa

DESCRIPTION -

a) Macroscopic:

The roots are available in the form of thin slices and small pieces, slices 0.7 to1.2 cm in diameter and the pieces 0.2 to 0.5 cm thick 2 or 3 cm long, surface dark brown, vertically fissured, marked by transversely elongated lenticels, fracture entire, surface smooth with wide light coloured bark, and a narrow, light yellow hard central wood; odour, indistinct; taste, sweetish.

b) Microscopic:

TS shows peripheral bark and central wood, bark 1.0 to 2.0 mm in thickness and consists of cork, cork cambium, secondary cortex and secondary phloem, cork 8 to 10 seriate, composed of tangentially elongated, rectangular, compactly arranged, stratified cells with suberised walls the cells are filled with tannins, cork is interrupted by lenticels; cork cambium uniseriate, composed of tangentially elongated, barrel shaped, thin walled cells; secondary cortex scanty, containing tannins and starch grains; secondary phloem consists of usual elements and fibres, xylem consists of vessels, tracheids, fibres and parenchyma; vessels of various sizes arranged characteristically in uniseriate radiating rows with reticulate thickenings; xylem fibres 400 to 600 µ long and 20 to 30 µ wide. .

Powder -Yellowish brown, powder consists of cork cells, secondary cortex cells with tannins, sieve tubes, fibres and xylem vessels with reticulate and pitted thickenings.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	2	per cent,	Appendix	2.2.2
Total ash	-	Not more than	12	per cent,	Appendix	2.2.3
Acid-insoluble ash	-	Not more than	1	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	-	Not less than	5	per cent,	Appendix	2.2.6
Water-soluble extractive	-	Not less than	10	per cent,	Appendix	2.2.7

T.L.C. -

T.L.C. of alcoholic extract on silica gel 'G' plate using *n-hexane: ethyl acetate* (9:1) under UV 366 nm shows fluorescent spots at R_f. 0.35, 0.53, 0.82 and 0.96. On spraying with Dragendorff's reagent, spots appear at R_f. 0.53, 0.82 and 0.96. On spraying with 5% *methanolic sulphuric acid reagent* and heating the plate at 105° for 10 minutes, spots appear at R_f. 0.35, 0.53, 0.82 and 0.96.

CONSTITUENTS -Quinones and naphthaquinones such as .isoshinanolone, plumbagic acid vahillic acid and zeylanone.

PROPERTIES AND ACTION -	
Rasa	: Kaṭu, Tikta
Guṇa	: Laghu, Rūkṣa, Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Dīpana, Grāhī, Pācana, Rasāyana, Rucya
IMPORTANT FORMULATION – Citrakaguṇaḥ	
THERAPEUTIC USES- Arśa (Piles), Grahaṇī (Malabsorption syndrome), Kāsa (Cough), Kṛmi (Helminthiasis), Kuṣṭha (Leprosy / diseases of skin), Pāṇḍu (Anaemia), Sikatāmeha (Lithuria), Śotha (Oedema), Śūla (Pain)	
DOSE - Cūrṇa (Powder): 0.5 to 2 g.	

ROHITAKA (Stem Bark)

Rohitaka consists of dried stem barks of *Tecomella undulata* (Sm.) Seem. (Fam. *Bignoniaceae*), a small tree distributed in the drier parts of the North-West and Western India, ascending to an altitude of 1,200 m in the outer Himalayas and often cultivated in gardens for its beautiful flowers.

SYNONYMS- Dāḍima puṣpa, Dāḍimacchada

REGIONAL LANGUAGE NAMES-

Ben.	: Harinahada, Roda rayana
Eng.	: Rohituka tree
Guj.	: Rohido
Hin.	: Roheda
Kan.	: Mullumuntala
Mal.	: Chemmaram
Mar.	: Rohida
Pun.	: Rohira
Tam.	: Malampulvan
Tel.	: Rohitaka

DESCRIPTION -

a) Macroscopic:

Bark in curved pieces, measuring 5 to 8 mm in thickness; outer surface greyish brown with longitudinal furrows, transverse irregular cracks and vertically elongated lenticels; inner surface smooth, buff to light brown; fracture tough; fractured surface horny; taste and odour indistinct.

b) Microscopic:

Bark shows wide cork consisting of rectangular and tangentially elongated cells, rhytidoma present; phelloderm not distinguishable; phloem a wide zone comprising of sieve tubes, companion cells, phloem parenchyma and fibres, being traversed by uni to multi seriate medullary rays, fibres arranged in tangential rows extending from one medullary ray to another alternating with bands of ceratenchyma; fibres long, thickwalled, lignified with tapering or peg like or bifurcated ends and measure upto 1680 µ in length; rosettes of calcium oxalate crystals present in a large number of parenchyma cells; occasionally parenchyma cells also contain prismatic crystals of calcium oxalate and circular to oval starch grains measuring 2 to 5 µ in diameter with hilum like a point in the centre.

Powder -Shows fragments of cells of ceratenchyma, fibres with tapering or peg like or bifurcated ends, parenchyma cells containing prismatic and rosettes of calcium oxalate crystals and starch grains; isolated rosettes and prismatic crystals of calcium oxalate crystal and starch grains.

The bark of *Aphanamixis polystachya* (Wall.) Parker (Fam.Meliaceae), Syn. *Amoora rohitak*, also known as Rohitak can be distinguished by the presence of stone cells in phelloderm, uniseriate medullary rays, crystal fibres in the phloem region and absence of rosettes of calcium oxalate crystals.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 12 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 15 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract on precoated silica gel 'G' plate using *toluene: ethyl acetate: methanol: acetic acid* (4:5:2:0:2) as mobile phase under UV 254 nm shows spots at R_f. 0.15, 0.27 (both blue), 0.56 (light green), 0.62, 0.70, 0.74 and 0.82 (all fluorescent white).

CONSTITUENTS -Tecomin (veratroyl β-D-glucoside), *n*-triacontane, *n*-heptacosane, *n*-nonacosane, *n*-triacontanol, *n*-octacosanol, β-sitosterol.

PROPERTIES AND ACTION –	
Rasa	: Kaṭu, Kaṣāya, Tikta
Guṅa	: Laghu, Rūkṣa, Sara
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Rucya, Raktaprasādana, Medohara, Stanya,Viṣaghna
IMPORTANT FORMULATIONS -Rohitakariṣṭa, Rohitaka lauha, Yakṛtśūla vināśinī Vaṭikā	
THERAPEUTIC USES- Gulma (Abdominal lump), Kṛmi (Helminthiasis), Kāmalā (Jaundice), Karnaroga (Disease of ear), Kuṣṭha (Leprosy / diseases of skin), Medoroga (Obesity), Netraroga (Diseases of the eye), Plihodara (Splenomegaly), Prameha (Metabolic disorder), Raktadoṣa (Disorders of blood), Raktavīkāra (Disorders of blood), Śūla (Pain / Colic), Svetapradara (Leucorrhoea), Vibandha (Constipation), Vraṇa (Ulcer), Yakṛt (Liver)	
DOSE - Cūrṇa (Powder): 3 to 6 g. Kvātha (Decoction): 50 to 100.	

ŚĀLA (Heart Wood)

Śāla consists of dried heartwood of *Shorea robusta* Gaertn.(Fam. Dipterocarpaceae), a large sub-deciduous tree, found extensively in parts of North-East and Central India.

SYNONYMS – Sala

REGIONAL LANGUAGE NAMES-

Ben.	: Shaalgaach
Eng.	: Saltree, Shaal tree
Guj.	: Shaalvriksh
Hin.	: Saal, Sakhuaa, Saakhu
Kan.	: Kabba, Saal
Mal.	: Saalvriksham, Mulappumarutu
Mar.	: Shaalvriksh, Raalchaavriksha
Ori.	: Salva, Shaaluaagachha
Pun.	: Shala
Tam.	: Saalam
Tel.	: Guggilam

DESCRIPTION –

a) Macroscopic:

Heartwood in blocks and cut cylindrical pieces, 10 to 12 cm long, 5 to 8 cm broad and 1 to 2 cm thick, surface smooth with fine longitudional and interlocked striations; transversely cut surface finely granulated; pores larger, distinctly visible, coarse; texture very hard, strong, tough and heavy; pale brown when young and turning reddish brown with age.

b) Microscopic:

Growth ring indistinct; concentric bands of gum ducts represents false growth marks; diffuse porous, vessels scattered, large to moderately large, fairly distinct, mostly solitary in short radial multiples of 2 or 3, pitted, pits simple to bordered, sometime occluded with tylosis; xylem parenchyma scanty to abundant, distinct as thin sheath around the vessel pore or groups of vessels, often confluent connecting adjacent vessels and also diffused; fibres in tangential bands; medullary rays fine to moderately broad, heterogenous, 3 to 6 seriate and 5 to 12 celled long; vertical gum duct present in long tangential bands appearing as white concentric lines at irregular intervals.

Powder -Reddish brown, on microscopic examination shows parenchymatous cells; pitted vessels with simple and bordered pits, occluded with tyloses; fibres and gum ducts, radially cut medullary rays with large group of fibres.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	2	per cent, Appendix	2.2.2
Total ash	-	Not more than	2	per cent, Appendix	2.2.3
Acid-insoluble ash	-	Not more than	0.7	per cent, Appendix	2.2.4
Alcohol-soluble extractive	-	Not less than	6	per cent, Appendix	2.2.6
Water-soluble extractive	-	Not less than	1.5	per cent, Appendix	2.2.7

T.L.C. –

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *toluene:ethyl acetate* : *formic acid* (5:5:1), under UV 254 nm shows spots at R_f. 0.14, 0.25, 0.31, 0.41, 0.55, 0.64 and 0.72. Under UV 366 shows spots at R_f. 0.13 (brown), 0.17 (brown), 0.21 (brown), 0.26 (brown), 0.30 (brown), 0.35 (brown), 0.57 (blue), 0.60 (blue), 0.64 (blue), 0.68 (blue), 0.75 (blue) and 0.85 (blue).

CONSTITUENTS– Bergenin, shoreaphenol, chalcone, 4′-hydroxychalcone-4-*O*-β-D-glucopyranoside, 12α-hydroxy-3-oxo-olenano-28,13-lactone.

PROPERTIES AND ACTION –

Rasa	: Kaṣāya
Guṇa	: Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphahara, Medohara, Vraṇaśodhana, Grāhī, Visaghna, Vedanāsthāpana, Stambhana, Kṛmighna
IMPORTANT FORMULATIONS -Ayaskṛti, Elādi ghṛta, Sala Guna	
THERAPEUTIC USES- Agnidaha (Burns), Kaṇḍu (Itching), Kṛmi (Helminthiasis), Kuṣṭha (Leprosy / diseases of skin), Pāṇḍu (Anaemia), Prameha (Metabolic disorder), Raktavīkāra (Disorders of blood), Śotha (Oedema), Upadaṁśa (Syphilis / Soft chancre), Vātavyādhi (Disease due ot Vata dosa), Viṣavikāra (Disorders due to poison), Vidradhi (Abscess), Vraṇa (Ulcer), Yonidosa (Disease of female genital tract), Yoniroga (Disease of female genital tract), Karnaroga (Disease of ear), Bādhirya (Deafness), Asthibhagna (Bone fracture)	
DOSE - Cūrṇa (Powder): 50 to 100 g. for decoction. Kvātha (Decoction): 50 to 100 ml.	

ŚĀLAPARṆĪ (Whole Plant)

Śālaparṇī consists of dried whole plant of *Desmodium gangeticum* DC. (Fam. Fabaceae), a nearly erect undershrub, 0.6 to 2 m high, growing wild almost throughout India in the plains and Western Ghats, and upto 1500 m in the north upto Sikkim.

SYNONYMS – Sthirā, Triparṇī, Vidārigandhā, Aṁśumatī

REGIONAL LANGUAGE NAMES-

Ben.	: Shalpaani
Guj.	: Saalvan, Sameravo
Hin.	: Sarivan, Saalapaani, Salpan
Kan.	: Murelchonne, Kolakannaru
Mal.	: Orila
Mar.	: Saalvan, Sarvan
Ori.	: Saloparnni, Salpatri
Pun.	: Sarivan, Shalpurni
Tam.	: Pulladi, Orila, Moovilai
Tel.	: Kolakuponna, Kolaponna
Urd.	: Shalwan

DESCRIPTION -

(a) Macroscopic:

Root **-**Tap root, poorly developed, but lateral roots 15 to 30 cm long, and 0.1 to 0.8 cm thick, uniformly cylindrical with a number of branches; surface smooth bearing a number of transverse, light brown lenticels, bacterial nodules frequently present; light yellow; fracture fibrous; odour not characteristic; taste, sweetish and mucilaginous.

Stem **-**Stem are slender, upto 1.0 cm in diameter, branched, somewhat angular, clothed with appressed greyish hairs, external surface brown, internal pale yellow; fracture, short; taste, slightly bitter.

Leaf -Leaf unifoliate, petiolate, stipulate, linear, oblong, acute or slightly acuminate, striate at the base, about 6 to 13 cm long and 3.5 to 7 cm broad, margins somewhat wavy, upper surface glabrous and green, lower surface pale and clothed with dense, soft, whitish appressed hairs.

(b) Microscopic:

Root **-**Mature root shows cork, 3 to 7 layers of thin-walled, tangential elongated cells, having a few prismatic crystals of calcium oxalate; cork cambium single layered; secondary cortex 4 to 10 layers of thin-walled, tangentially elongated cells having a few isolated cortical fibres; secondary phloem composed of parenchyma, sieve tubes, companion cells and fibres; traversed by phloem rays; sieve tubes collapsed in outer region, but intact in inner region; phloem fibres slightly elongated, lignified; phloem rays uni to multiseriate, 4 cells wide and 4 to 15 cells high; outer xylem region having 1 or 2 growth rings, consisting of vessels, tracheids, xylem parenchyma, and xylem fibres, traversed by xylem rays; vessels, lignified, large, narrow, with both reticulate thickening or bordered pits; xylem parenchyma with rectangular or slightly elongated cells, resembling those of phloem parenchyma in shape but larger in size; xylem rays thick-walled possessing simple pits, 1 to 5 cells wide and 4 to 12 cells high; simple , round to oval starch grains measuring 7 to 25 μ in diameter and prismatic crystals of calcium oxalate present in secondary phloem and secondary xylem.

***Stem* -**TS shows, single layered epidermis of small, oval parenchyma cells covered with thick brownish cuticle and interrupted at places by multicellular trichomes; a hypodermis consisting of 3 or 4 layers of oval collenchyma cells; 4 to 6 layers of cortex of oval parenchymatous cells interspersed with groups of sclereids; a narrow zone of secondary phloem composed of parenchyma, sieve elements and a few phloem fibres present; a well developed secondary xylem consisting of large round xylem vessels occurring singly or in groups of 3 or 4, thick-walled tracheids, groups of fibres; uni- to biseriate medullary rays of radially elongated cells; a few large circular, pitted cells of pith filled with starch grains and prismatic crystals of calcium oxalate.

***Leaf* -**TS of leaf shows dorsiventral lamina consisting of a single layered cuticularized epidermis on both surfaces interrupted at places by unicellular warty trichomes; bilayered palisade of columnar cells; 3 or 4 layered spongy mesophyll of circular parenchyma cells; 1 to 4 centrally located vascular bundles in midrib region consisting of radially arranged xylem, phloem and capped by patch of sclerenchyma cells on ventral side; 2 or 3 layered patch of collenchyma below upper epidermis and 3 or 4 layers of circular parenchyma inside lower epidermis in midrib region.

Powder -Shows cork in surface view, patches of oval parenchyma cells of cortex containing starch grains; fragments of radially cut medullary rays; stone cells of different sizes; leaf epidermis in surface view showing paracytic stomata; pitted vessels; prismatic crystals of calcium oxalate and round, simple or 2 to 4 compound starch grains.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than 2	per cent,	Appendix	2.2.2
Total ash	**-**	Not more than 8	per cent,	Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than 2.5	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not less than 6	per cent,	Appendix	2.2.6
Water-soluble extractive	**-**	Not less than 10	per cent,	Appendix	2.2.7

T.L.C. -

T.L.C. of ethanolic extract (cold maceration at room temperature) of the drug on precoated silica gel 'G' 60 F_{254} TLC plate (0.2 mm thickness) using solvent system *toluen : ethyl acetate:formic acid* (6:3:1) shows spots at R_f 0.56 (brown), 0.15 (violet), 0.24 (brownish-purple), 0.38 (brownish-purple), 0.41 (brownish-purple), 0.49 (orange) , 0.73 (brown), 0.81 (red), 0.87 (green) and 0.96 (magenta) on spraying with *anisaldehyde-sulphuric acid reagent* followed by heating at 105º for 10 minutes.

CONSTITUENTS- Alkaloid: flavonoids, desmocarpin; pterocarpan, desmodin, gangetin, gangetinin; others: 2-(*N*,*N*-dimethyl amino)acetophenone.

PROPERTIES AND ACTION –	
Rasa	: Tikta, Madhura
Guṇa	: Guru, Snigdha
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Balya, Bṛṁhaṇa, Mūtrala, Rasāyna, Tridoṣahara, Vātahara, Vṛṣya
IMPORTANT FORMULATIONS – Dashmularishta, Dashmulakwatha	
THERAPEUTIC USES- Arśa (Piles), Atisāra (Diarrhoea), Chardi (Emesis), Jvara (Fever), Kāsa (Cough), Kṛmi (Worm infestation), Kṣata (Wound), Mūtrakṛcchra (Dysuria), Prameha (Metabolic disorder), Santāpa (Emotional stress), Śoṣa (Cachexia), Śotha (Inflammation), Śukradaurbalya (Seminal stress), Śvāsa (Asthma), Vātaroga (Disease due to Vata dosa), Viṣamjvara (Intermitten fever), Viṣavikāra (Disorders due to poison)	
DOSE – Cūrṇa (Powder): 6 to12 g. Kvātha (Decoction): 50 to 100 ml.	

ŚAMĪ (Leaf)

Śamī consists of the leaves of *Prosopis cineraria* Druce Syn. *P. spicigera* L. (Fam. Leguminosae – Mimosaceae), a small to moderate sized tree found in the dry and arid regions of India.

SYNONYMS – Keśahantrī, Saktuphala, Śaṅkuphalikā, Tuṅga

REGIONAL LANGUAGE NAMES-

Ben.	: Sain, Shami
Eng.	: Spunge tree
Guj.	: Kheejado, Sami
Hin.	: Chhonkar, Sami, Chhikur, Jhand, Khejra
Kan.	: Banni, Kabanni
Mal.	: Parampu, Tambu, Vahni
Mar.	: Sami, Saunder
Ori.	: Shami
Pun.	: Jand
Tam.	: Vanni
Tel.	: Jammi

DESCRIPTION –

a) Macroscopic:

Bipinnnately compound leaves with pulvinus, borne on a rachis 2 to 8 cm long; loose pinnae and pinnules present; pinnae 7 to 12 pairs, each pinna bearing 7 to 12 pairs of pinnules, pinnule oblong rounded and mucronate, 8 to 10 mm long, 2 to 3 mm broad.

b) Microscopic:

Rachis **-** Transverse section roughly triangular with abaxial side rather curved, and adaxial a blunt pyramid; cuticle thick, epidermis single layered, unicellular trichome present; cortex of large parenchymatous cells, a few outer layer being chlorenchymatous, more on the adaxial side than on abaxial side; vascular system ectophloic siphonostele consisting of a central main bundle and two adaxial accessory bundles with sclerenchyma cap; a thin parenchymatous plate present in the central bundle between the two shallow arcs of xylem surrounded by phloem; a thick sclerenchymatous bundle sheath with stone cells and fibres surrounds the stele; xylem elements generally in radial rows.

Petiole - Almost triangular, with a projection on abaxial side; trichomes unicellular, long, ground tissue chlorenchymatous, more so on adaxial side than on abaxial side, rest being parenchymatous, with minute intercellular spaces; vascular system consists of central main bundle and two adaxial lateral accessory bundles with sclerenchyma cap; a thin parnchymatous plate present in the central bundle between the two shallow arcs of xylem surrounded by phloem; 3 or 4 layers of sclerenchymatous bundle sheath present comprising stone cells and fibres the stele; vessels angular, thin walled, solitary; thick walled fibres present.

Leaf -

Midrib –Cuticle thick; epidermis single layered; palisade parenchyma of 2 or 3 layers over the midrib region, a central large vascular bundle present with xylem and a wide conspicuous patch of sclerenchyma fibres below the phloem; large parenchyma cells present on the abaxial side extend upto the lower epidermis.

Lamina –Isobilateral; cuticle thick; epidermis single layered; palisade parenchyma 3 to 5 layers on the adaxial side and 2 or 3 layers on the abaxial side; spongy parenchyma present in middle region; epidermis in surface view showed straight walls and unicellular trichome present in both the epidermis; stomata present in both surfaces with overarching subsidiary cells, stomatal number for lower epidermis 32 to 35 / mm^2, upper epidermis 29 to 32 / mm^2; stomata paracytic; palisade ratio for upper epidermis 5 to 7, lower epidermis 2 to 4, stomatal index 9 to 12, vein islet number14 to 16, veinlet termination number 28 to 32.

Powder –Greenish, no characteristic odour and taste, unicellular trichomes, stone cells and elongated stone cells from sclerenchymatous bundle sheath, fibres of upto 450 µ present, simple circular starch grains 3 to 10 in diameter seen, scalariform and pitted vessels also noticed.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than	1	per cent, Appendix	2.2.2
Total ash	-	Not more than	7	per cent, Appendix	2.2.3
Acid-insoluble ash	-	Not more than	1	per cent, Appendix	2.2.4
Alcohol-soluble extractive	-	Not less than	14	per cent, Appendix	2.2.6
Water-soluble extractive	-	Not less than	21	per cent, Appendix	2.2.7
Fixed oil	-	Not more than	4	per cent, Appendix	2.2.8

T.L.C. –

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} (0.2 mm thickenss) using *toluene:ethyl acetate* (9:1) under UV 366 nm shows fluorescent spots at R_f. 0.14, 0.20, 0.26, 0.30 (all pink), 0.33 (dark pink) 0.44 (white), 0.48 (pink), 0.54 (navy blue), 0.86 (pink) and 0.90 (white). On exposure to *iodine vapour*, spots at R_f. 0.14, 0.23, 0.26, 0.28, 0.33, 0.40, 0.44, 0.48 and 0.90 (all yellowish brown). On dipping the plate in *vanillin-sulphuric acid reagent* and heating at 105° for 5 minutes, spots appear at R_f. 0.14, 0.23, 0.33, 0.38 (all grey), 0.44 (dark blue), 0.48 (dark violet), 0.83 (blue), 0.90 and 0.95 (both violet).

CONSTITUENTS – Tannin rich foliage, volatile fatty acid.

PROPERTIES AND ACTION-	
Rasa	: Tikta, Kaṭu, Kaṣāya
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Arśoghna, Kṛmighna, Kaphapittahara, Kuṣṭhaghna, Recaka, Saṇgrāhaka,Vātakara
IMPORTANT FORMULATIONS –Used as single drug	
THERAPEUTIC USES- Arśa (Piles), Atisāra (Diarrhoea), Bālagraha (Psychotic syndrome of children), Bhrama (Vertigo), Kṛmi (Worm infestation), Kāsa (Cough), Kuṣṭha (Leprosy / diseases of skin), Netraroga (Diseases of the eye), Raktapitta (Bleeding disorder), Śvāsa (Asthma), Viṣavikāra (Disorders due to poison)	
DOSE – Cūrṇa (Powder): 3 to 5 g.	

SAURABHANIMBA (Leaf)

Saurabhanimba consists of the dried leaves of *Murraya koenigii* (L.) Spreng Syn. *M. koenigii.* Spreng (Fam. Rutaceae), a small tree reaching upto 6 m with dark grey bark and aromatic leaves, found and cultivated almost throughout India and the Andaman Islands upto an altitude of 1,500 m, for its culinary uses as a flavouring spice.

SYNONYMS – Surabhinimba, Kaiṭarya, Kaiḍarya

REGIONAL LANGUAGE NAMES-

Ass.	: Narasingha
Ben.	: Bansang, Kariaphulli
Eng.	: Curry leaf
Guj.	: Gornimb, Kadhilimdo
Hin.	: Mitha neem, Kadhi Patta, Kadi Patta
Kan.	: Karibaevu
Mal.	: Kariveppu
Mar.	: Kadhinim, Poospala, Godnimb
Ori.	: Bhursunga
Pun.	: Kadhi Patta
Tam.	: Karivempu, Karuveppilei
Tel.	: Karivepaku, Karivemu

DESCRIPTION –

a) Macroscopic:

Leaves are compound, imparipinnate, petiolate, exstipulate, rachis 11 to 20 cm long; leaflets 11 to 25, shortly petiolulate, arranged alternately on the rachis; lower pairs comparatively smaller in size, obliquely ovate, 2 to 5 cm in length and 1 to 2.5 cm in width, tip acute to obtuse, margin crenate-dentate, glabrous adaxially and pubescent abaxially with interspersed gland dots; main vein one and lateral veins 14 to 20 pairs; odour, characteristically aromatic; taste, acrid.

b) Microscopic:

Rachis **–**TS through rachis shows epidermis a single layer of isodiametric cells covered by thick cuticle; unicellular, non-glandular, curved, gradually tapering trichomes measuring 37 to 45 µ long and 2 to 5 µ broad, present; base of trichome swollen and embedded in epidermis, cortex many layered, parenchymatous, hypodermal cortical cells are smaller, isodiametric, compactly arranged, inner cortical cells are larger, elongated tangentially, loosely arranged with intercellular spaces; abundant pyramidal calcium oxalate crystals measuring 12 to 25 µ in length and 5 to 15 µ in breadth, several showing twinning, present in cortical cells; cortex in the hypodermal region is traversed by lysigenous cavities; vascular bundle is encircled by a ring of 2 or 3 layered sclerenchymatous pericycle and consists of vessels with annular and spiral thickenings, arranged in radiating rows, xylem parenchyma and xylem fibres with thick walls; phloem is situated towards the periphery of xylem ring and contains sieve tubes, companion cells, phloem parenchyma and phloem fibres; medullary rays uniseriate, numerous, with

cells containing calcium oxalate crystals; pith large, made up of thin walled parenchymatous cells, several of which are pitted.

Leaf -

Midrib –TS of leaf through midrib region flat towards adaxial surface and ridged towards abaxial surface; unicellular, non glandular trichomes arise from the abaxial epidermis; adaxial and abaxial hypodermis bi or tri seriate, composed of isodiametric collenchymatous cells; collenchymatous cells of both the surfaces possess single and twinned rhomboid calcium oxalate crystals, ground tissue composed of loosely arranged, thick-walled isodiametric parenchymatous cells; vascular bundle forms an arc with adaxial xylem and abaxial phloem; xylem comprises of vessels with annular and spiral thickenings, xylem parenchyma and fibres; phloem contains sieve tubes, phloem parenchyma and phloem fibres.

Lamina -TS shows both the adaxial and abaxial epidermis covered by a cuticle; abaxial epidermal cells narrow and laterally elongated while those on adaxial surface slightly radially elongated; palisade biseriate, concentric starch grains of 3 to 5 μ diameter are found in spongy cells, spongy parenchyma made up of loosely arranged chlorenchyma; lysigenous cavities present; epidermal cells of lamina in surface view are elongated, straight walled and polygonal; in costal region they are elongated and thin walled; stomata more on abaxial surface than on adaxial; paracytic; stomatal index of abaxial epidermis 16 to18 and of adaxial epidermis 13 to 15; unicellular, non glandular, gradually tapering, curved trichomes measuring 80 to 160 μ long and 6 to 15 μ broad are distributed on the abaxial epidermal layers; trichomes numerous on costal region and fewer on intercostal regions, leaving cicatrices after detachment.

Powder -Slightly oily, characteristically aromatic, acrid, light greenish; epidermal cells, unicellular thick walled, long trichomes gradually tapering towards the tip from rachis and lamina; stomata, palisade cells, collenchyma, vessels with annular and spiral thickenings and pyramidal crystals of calcium oxalate, several showing twinning also present.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	:	Not more than	2	per cent,	Appendix	2.2.2
Total ash	:	Not more than	12	per cent,	Appendix	2.2.3
Acid-insoluble ash	:	Not more than	2	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	:	Not less than	20	per cent,	Appendix	2.2.6
Water-soluble extractive	:	Not less than	34	per cent,	Appendix	2.2.7

T.L.C. -

T.L.C. of alcoholic extract on precoated silicagel 'G' plate using *n-hexane: ethyl acetate* (9:1) under UV 366 nm shows spots at R_f. 0.17. 0.27, 0.55, 0.64, 0.82, 0.90; on spraying the plate with modified Dragendorff's reagent, spots appear at R_f. 0.15, 0.17 and 0.27. On spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes 105°, spots at R_f. 0.10, 0.15, 0.17, 0.27, 0.55 and 0.64 .

CONSTITUENTS -Alkaloids like koenidine, koenigine, koenimbine, mahanimbine, muconine murrayacine and volatile oils.

PROPERTIES AND ACTION -	
Rasa	: Kaṣāya, Tikta, Madhura
Guṇa	: Laghu, Snigdha
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Kaphapittahara, Rucya, Dīpana, Pācana, Viṣaghna, Varṇya
IMPORTANT FORMULATIONS – Dodi Guna	
THERAPEUTIC USES- Arśa (Piles), Atisāra (Diarrhoea), Chardi (Emesis), Dāha (Burning sensation), Duṣṭa vraṇa (Non-healing ulcer), Jvara (Fever), Kaṇḍu (Itching), Kṛmi (Helminthiasis), Kuṣṭha (Leprosy / diseases of skin), Prameha (Metabolic disorder), Pravāhikā (Dysentery), Śūla (Pain / Colic), Śoṣa (Emaciation), Śopha (Oedema), Śvitra (Leucoderma / Vitiligo)	
DOSE – Cūrṇa (Powder): 3 to 6 g. Svarasa (Juice): 10 to 20 ml.	

ŚITIVĀRAKA (Seed)

Śitivāraka consists of seeds of *Celosia argentea* L. (Fam. Amaranthaceae), an erect glabrous annual herb, 30 to 90 cm high, with conical to oblong feathery flowering spikes found commonly growing as a weed in cultivated fields throughout India upto an altitude of 1500 m.

SYNONYMS- Sirivālikā, Kuraṇḍa, Kuraṇṭikā, Śitavāra, Śrīvāraka, Sitivāra

REGIONAL LANGUAGE NAMES-

Ben. : Sushunimaak, Shushunishaak
Eng. : Silver spiked cock's comb
Guj. : Laanpadi, Lonpadi
Hin. : Siriyaari, Suravaali, Siravaari
Mar. : Kuradu, Karadu, Surali
Pun. : Suravaali
Tam. : Pannaikkeerai
Urd. : Suravaali

DESCRIPTION-

a) Macroscopic:

Seeds lenticular, smooth, shining black or brown, 0.9 to 1.8 mm in diameter, hilum prominent, present in a pit; embryo curved; no odour; taste, bland.

b) Microscopic:

TS of seed shows testa, composed of a thin epidermis and groups of reddish columnar cells arranged in pyramid structures on an inner horizontal layer of thick walled elongated cells; yellow collapsed integument lined internally by cuticle; a layer of lignified squarish cells; endosperm of polygonal parenchymatous cells containing numerous alerurone grains and fixed oil.

Powder – Light grey, shows fragments of deep brown to reddish testa of polygonal cells bearing reticulate network of pits; lignified cells showing striation in surface view; parenchymatouous cells of endosperm containing numerous aleurone grains and fixed oil; and parenchymatous cells of embryo.

IDENTITY, PURITY AND STRENGTH-

Foreign matter - Not more than 2 per cent, Appendix 2.2.2
Total ash - Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash - Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractvie - Not less than 3 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 7 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract of the drug on precoated silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene:ethyl acetate* (95:7) shows spots at R_f. 0.12 (violet), 0.20 (greenish-grey), 0.31 (yellow), 0.36 (violet), 0.59 (violet) and 0.78 (purple), on spraying at *anisaldehyde-sulphuric acid reagen*t followed by heating at 105° for 10 minutes.

CONSTITUENTS – Nonapeptide, celogenamide, celosian, an acidic polysaccharide**.**

PROPERTIES AND ACTION-

Rasa	**:**	Kaṣāya, Madhura, Kaṭu
Guṇa	**:**	Rūkṣa, Guru, Sara
Vīrya	**:**	Śīta
Vipāka	**:**	Madhura
Karma	**:**	Tridoṣahara, Bastiśodhaka, Saṁgrāhī, Mūtrala, Vṛṣya, Snehana, Medhya, Rsāyana

IMPORTANT FORMULATIONS- Kaphaja mutra krchranasaka sitivarak, Sitivaraka bija Curna, Sitivara Guna

THERAPEUTIC USES- Aśmarī (Calculus), Arśa (Piles), Atisāra (Diarrhoea), Gulma (Abdominal lump), Hṛdroga (Heart disease), Jvara (Fever); Mūtrāghāta (Urinary obstruction), Mūtrakṛcchra (Dysuria), Plīhāroga (Splenic disease), Raktavīkāra (Disorders of blood), Śopha (Oedema)

DOSE- Cūrṇa (Powder): 3 to 6 g.

ŚIVA-NĪLĪ (Root and Stem)

Śiva-nīlī consists of the dried roots and stems of *Indigofera aspalathoides* Vahl ex DC. (Fam. Fabaceae), a stiff silvery, hoary under shrub with trifoliate leaves, found in the plains of South India.

SYNONYMS – Bhū- nīlī

REGIONAL LANGUAGE NAMES-

Eng.	: Wiry indigo
Kan.	: Shiva-malli, Nila
Mal.	: Sivanar vayambu, Manneli
Mar.	: Shiva-nimba
Tam.	: Sivanarvembu
Tel.	: Nela vempali

DESCRIPTION -

a) Macroscopic:

Root **-**Roots 8 to 10 cm long 2 to 5 mm thick, cylindrical , bearing lateral roots, light brown, surface smooth with transverse lenticels; fracture entire, fractured surface shows a thin bark and a compact light coloured central cylinder of wood; odour and taste indistinct.

Stem **-**Stem pieces 2 to 5 mm in thickness and of various lengths; surface smooth, dark brown, with vertical series of lenticels, fracture short, fractured surface fibrous, with a thin bark, thick pale coloured wood and a central narrow pith; odour and taste indistinct.

b) Microscopic:

Root **–**TS circular, shows cork composed of tangentially elongated, rectangular, compactly arranged, stratified, thick walled, suberised cells some filled with tannins; secondary cortex multiseriate, composed of loosely arranged, isodiametric, parenchymatous cells; and some cells filled with numerous rhomboidal calcium oxalate crystals of about 6 to 12 µ size; phloem consists of fibres along with other phloem elements; wood wide with numerous xylem elements and fibres; vessels aggregated in groups of 2 to 4; wall thickenings scalariform and reticulate, xylem fibres numerous, polygonal, 10 to 15 µ in diameter, very much thickened with lignin and with a narrow lumen; xylem rays 3 to 5 seriate, short, fusiform, walls pitted.

Stem **-**TS circular, cork interrupted by lenticels; cork cambium present; secondary cortex 6 to 8 seriate, peripheral 2 to 3 layers composed of isodiametric cells; inner layers with tangentially much elongated, thin walled, parenchymatous cells containing abundant prismatic calcium oxalate crystals, phloem contains sieve tubes, companion cells, fibres and parenchyma; phloem parenchyma contains prismatic calcium oxalate crystals, fibres in groups of 3 or 4, scattered; xylem contains vessels, fibres and parenchyma; vessels arranged in 40 to 60 radiating rows, each row containing 2 to 10 pitted vessel elements of different sizes; cross wall oblique; fibres numerous, polygonal, 10 to 15 µ in diameter and 225 to 280 µ in length with tapering ends, walls much thickened with lignin; simple pits present, and lumen very narrow; rays mostly uniseriate; rarely biseriate; pith composed of thin walled, loosely arranged, parenchymatous cells.

Powder –Brown, shows the presence of tangentially elongated, stratified cork cells, prismatic calcium oxalate crystals, vessels with scalariform thickenings and bordered pits arranged in vertical rows, fibres measuring 225 to 280 μ long, occasionally with simple pits.

IDENTITY, PURITY AND STRENGTH -

Foreign matter - Not more than 2 per cent, Appendix 2.2.2
Total ash - Not more than 8 per cent, Appendix 2.2.3
Acid-insoluble ash - Not more than 3 per cent, Appendix 2.2.4
Alcohol-soluble extractive - Not less than 8 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 13 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of alcoholic extract on silica gel 'G' plate using *n-hexane:ethyl acetate* (9:1) under UV 366 nm shows spots at R_f. 0.12, 0.35 and 0.59 (all blue); on exposure to *iodine vapour* spots appear at R_f.0.12, 0.29, 0.35 and 0.59 (yellow), on spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° spots appear at R_f. 0.12, 0.29, 0.35, and 0.59(brown).

CONSTITUENTS - Fixed oil.

PROPERTIES AND ACTION –

Rasa	: Tikta, Kaṣāya
Guṇa	: Laghu, Rūksa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kapha Vātahara, Keśya, Kuṣṭhaghna

IMPORTANT FORMULATIONS – Used as simgle drug

THERAPEUTIC USES- Amavata (Rheumatism), Aruṁṣika (Dandruff), Dantaśūla (Tooth ache), Gulma (Abdominal lump), Kuṣṭha (Leprosy / diseases of skin), Plīha-roga (Splenic disease), Udararoga (Diseases of abdomen), Vatarakta (Gout), Vidradhi (Abscess), Visarpa (Erysepales)

DOSE – Cūrṇa (Powder): 3 to 6 g.

ŚLEṢMĀTAKA (Fruit)

Śleṣmātaka consists of dried, ripe fruits of *Cordia dichotoma* Forst. f. Syn.*C. obliqua* Willd., *C. myxa* Roxb. (Fam. Boraginaceae), a medium sized tree with short crooked trunk with drooping branches, distributed throughout warmer parts of India.

SYNONYMS- Bahuvāraḥ, Śelu

REGIONAL LANGUAGE NAMES-

Ass.	:	Dilk
Ben.	:	Bahnaree, Bahuvar
Eng.	:	Sebesten
Guj.	:	Gundaavada, Gundaa
Hin.	:	Lasora, Lisodaa
Kan.	:	Challe kaayi
Mal.	:	Naruvari, Naruviri
Mar.	:	Bhonkar
Pun.	:	Lasuda
Tam.	:	Naruvili, Narivilee
Tel.	:	Nakkera

DESCRIPTION -

a) Macroscopic:

Fruits conical with acute apex, upto 2 cm in length and 1.5 cm in diameter, occasionally with attached calyx and pedicel, greyish brown to dark brown, surface shrunken, hard to break; odour, specific; taste, indistinct.

b) Microscopic:

Epicarp shows single layer of thick walled and tangentially elongated cells covered externally with thick cuticle; most of the area just below the epicarp occupied by large patches of stone cells; mesocarp consists of thin walled and collapsed parenchyma cells, patches of fibres with a few stone cells, numerous secretory canals lined by 5 to 7 epithelial cells as well as small vascular bundles distributed in the central and lower region of mesocarp; small circular to oval starch grain and rosette of calcium oxalate crystals present in a few parenchyma cells; endocarp represented by 4 to 6 layers of thick walled polygonal stone cells with narrow lumen; testa thin walled and single layered; cotyledon consists of thick walled parenchyma cells containing simple, small, circular to oval starch grains, measuring 5 to 10 μ in diameter with hilum as a point in the centre.

Powder- Powder shows fragments of fibres with tapering or pointed ends, parenchyma cells with rosette of calcium oxalate crystals and starch grains, polygonal stone cells with wide lumen and pitted walls, stone cells with highly thickened walls and narrow lumen, scalariform vessels, fragments of secretory canals and thick walled cells of epicarp, thick walled parenchyma cells of cotyledon with starch grains.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	-	Not more than 2 per cent,	Appendix 2.2.2
Total ash	-	Not more than 9 per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than 1 per cent,	Appendix 2.2.4

Alcohol-soluble extractive - Not less than 7 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 30 per cent, Appendix 2.2.7

T.L.C.-

T.L.C. of alcoholic extract on precoated silica gel 'G' plate using *toluene: ethyl acetate: acetic acid: methanol* (6:4:2:2) under UV 254 nm shows spots at R_f. 0.20, 0.26,0.33, 0.35, 0.52 (all blue), 0.58, 0.67, 0.83, 0.86, 0.39, 0.79 and 0.92 (all pink).

CONSTITUENTS- β-sitosterol, palmitic, stearic and oleic acids.

PROPERTIES AND ACTION -

		Āma Phala	Pakva-phala
Rasa	:	Madhura, Tikta, Kaṣāya	Madhura
Guṇa	:	Laghu, Rūkṣa	Snigdha, Guru
Vīrya	:	Śīta	Śīta
Vipaka	:	Kaṭu	Madhura
Karma	:	Pittahara, Kaphahar, Gr¢h¤	Pittahara, Bṛṁhana, Vṛṣya Rūcya, Cakṣuṣya, Keśa-Kṛṣṇīkaraṇa

IMPORTANT FORMULATIONS- Gojihvādi Kvātha Cūrṇa

THERAPEUTIC USES- Jvara (Fever), Kāsa (Ccough), Kṛmi (Worm infestation), Pratisyaya (Coryza), Raktadoṣa (Disorders of blood), Raktapitta (Bleeding disorder), Sukradaurbalya (Seminal stress), Śvāsa (Asthma), Tṛṣṇā (Thirst), Upadaṁśa (Syphilis / Soft chancre), Vatapittajanya (Due to Vata and Pitta dosa), Vikāra (Abnormality)

DOSE- Pakva phala pānaka (Syrup of ripened fruit): 10 to 20 ml.

ŚLEṢMĀTAKA (Stem Bark)

Śleṣmātaka consists of dried stem bark of *Cordia dichotoma* Forst. f. *C. obliqua* Willd., *C. myxa* Roxb. (Fam. Boraginaceae), a medium sized tree with short crooked trunk with drooping branches, distributed throughout warmer parts of India.

SYNONYMS- Bahuvārah, Śelu

REGIONAL LANGUAGE NAMES-

Ass. : Dilk
Ben. : Bahnaree, Bahuvar
Eng. : Sebesten
Guj. : Vadagunda
Hin. : Lasora, Lisodaa
Kan. : Chikkachalli, Doduchallu
Mal. : Naruvari, Naruviri
Mar. : Bhonkar
Pun. : Lasuda
Tam. : Naruvili, Narivilee
Tel. : Nakkera

DESCRIPTION-

a) Macroscopic:

Bark in pieces of 5 to 10 cm long and 6 to 12 mm thick; dark greyish brown, surface rough with transverse and longitudinal cracks and fissures, inner surface deep greyish; fracture tough, fractured surface horny; taste and odour indistinct.

b) Microscopic:

Bark shows wide cork consisting of rectangular and tangentially elongated cells, rhytidoma present; phellogen indistinct; phelloderm composed of thin walled tangentially elongated cells; phloem wide consisting of sieve tubes, companion cells, phloem parenchyma and fibres, traversed by uni to biseriate medullary rays, fibres present in tangential bands alternating with bands of ceratenchyma extending from one medullary ray to another; fibres very long with narrow lumen and tapering, pointed or blunt ends.

Powder- Shows fragments of thin walled parenchyma cells, long thick walled fibres, groups of elongated cells of ceratenchyma and cork cells.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	-	Not more than 2	per cent,	Appendix 2.2.2
Total ash	-	Not more than 17	per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than 0.6	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 9	per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than 4	per cent,	Appendix 2.2.7

T.L.C.-

T.L.C. of alcoholic extract on precoated silica gel 'G' plate using *chloroform: ethyl acetate: formic acid* (3:6:1) under UV 254 nm shows spots at R_f. 0.16,0.28, 0.48, 0.59, 0.80 (all brown).

CONSTITUENTS- Gallic acid and β-sitosterol.

PROPERTIES AND ACTION -

Rasa	**:**	Madhura, Tikta, Kaṣāya, Katu
Guṇa	**:**	Rūkṣa, Picchila
Vīrya	**:**	Śīta
Vipāka :	Kaṭu	
Karma :	Pittahara, Kaphahara, Keśya, Viṣtambhi, Grāhī, Kṛmighna, Pācana, Viṣaghna	

IMPORTANT FORMULATIONS- Used as single drug

THERAPEUTIC USES- Amados (Semi-disgested food metabolites), Bahuvrana (Multiple injuries / Ulcers), Drkjata-masurika (Occular manifestation of small pox), Kṛmi-śula (Colic due to worm infestation), Kuṣṭha (Leprosy / diseases of skin), Lūtāviṣa (Spider bite), Masurika (Small pox), Raktadoṣa (Disorders of blood), Tvak-roga (Skin diseases), Visarpa (Erysepales), Visphota (Blister), Vraṇa (Ulcer)

DOSE- Kvātha (Decoction): 50 to 100 ml.

ŚLĪPADĀRIKANDA (Tuber)

Ślīpadārikanda consists of fresh or dry tuber of *Typhonium trilobatum* Schott. (Fam. Araceae), a perennial herb with a broadly ovate, open spathe and hastate leaves found in parts of peninsular India, and from Yamuna eastwards to north - eastern states.

REGIONAL LANGUAGE NAMES-

Ben.	: Ghetkochu
Mal.	: Chenna
Tam.	: Pitikarunai

DESCRIPTION –

a) Macroscopic:

Rhizome fusiform, light brown outside, creamish inside, flaky and peeling off on the outer surface, bearing bud primordia and wiry, unbranched, thin adventitious rootlets; rhizomes or tubers usually available in transversely cut pieces 4 cm long and 2.5 to 6.5 cm in diameter; fracture, short; starchy; taste, slightly acrid.

b) Microscopic:

A few layers of thin walled corky cells form the outermost tegumentary tissue; cambium lying below the bark irregular, discontinuous and usually 2 to 5 layered; below the cambium a few layers made of parenchymatous cells free from starch grains; cortex or ground tissue consisting of thin walled, parenchymatous, angular or polygonal cells rich in simple and aggregate starch grains; grains clear, without striations, hilum 2 to 3 stellate; simple grains mostly ovoid or sub-spherical, compound grains polyhedral or sub-spherical with 2 to 6 units; idioblasts containing raphide bundles and some cells with dark contents scattered in the cortex; a distinct endodermis not seen; vascular bundles scattered, running obliquely in the ground tissue and consisting of xylem comprising a few vessels with spiral and annular thickening, and parenchyma; phloem comprises of sieve tubes and companion cells; some of the vascular bundles may be surrounded by rings of cork cells.

Powder – Creamish, fine in texture, tasteless and starchy; microscopy shows abundant single and 2 to 6 membered compound starch grains, usually up to 45 µ in size and raphides up to 50 µ in length, loose or in bundles of up to 100 µ in length, and vessel fragments with spiral thickenings.

IDENTITY, PURITY AND STRENGTH –

Foreign matter - Not more than 1 per cent, Appendix 2.2.2
Total ash - Not more than 3 per cent, Appendix 2.2.3
Acid-insoluble ash - Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive - Not less than 9 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 21 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of alcoholic extract of the drug on silica gel 'G' F_{254} using *toluene: ethyl acetate: acetic acid* (6.5:3.1:0.4), on spraying the plate with *anisaldehyde-sulphuric acid reagent* and heating the plate for 5 minutes at 105^{o} shows spots at R_f. 0.10, 0.19 (light violet), 0.53 (violet), 0.57 (violet) and 0.68 (dark violet).

CONSTITUENTS – β –sitosterol and unidentified sterols.

PROPERTIES AND ACTION-	
Rasa	: Kaṭu, Kaṣāya
Guṇa	: Tīkṣṇa, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Arṣoghna, Śothahara, Lekhana, Viṣaghna, Dīpana, Pācana, Śūlapraśamana
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES- Agnimāndya (Digestive impairment), Arbuda (Tumor), Arśa (Piles), Raktārśa (Bleeding piles), Śotha (Oedema), Sarpadamśa (Snake bite), Slipada (Fliariasis), Udarroga (Diseases of abdomen)	
DOSE - Cūrṇa (Powder) : 5 to 10 g daily dose after Sodhana.	

SPHĪTAKĪṬĀRĪ (Rhizome)

Sphītakīṭārī consists of the dried rhizome with frond bases of *Dryopteris filix – mas* (L.) Schott. Syn. *Aspidium filix-mas* L. (Fam. Dryopteridaceae), a fern distributed practically all over temperate regions; the drug is imported into India. Indian species are *D. schimperiane, D. marginata, D. odontoloma, D. barbiflora, D. blandtorchi* occurring in the Himalayas.

SYNONYMS - Salka parṇāṅga, Granthi-pādikā

REGIONAL LANGUAGE NAMES-

Ben.	: Pankharaaj
Eng.	: Male fern
Hin.	: Keeldaaru, Bisauraa
Tam. *Urd.*	: Iruvi : Sarakhsa

DESCRIPTION -

a) Macroscopic:

Rhizome thick, cylindrical, dark brown to black in colour, 6 to 25 cm long and 2 to 4 cm in diameter and covered by the base of petioles; frond bases are hard, persistent, dark brown and curved; the petiole bases and the younger parts of the rhizome are completely covered by the brown, dense silky and shining, chaffy scales termed ramentae; odourless, taste at first sweetish, becoming bitter and extremely nauseous.

b) Microscopic:

Rhizome -Epidermis single layered, unicellular and covered by thick cuticle, followed by hypodermis composed of sclerenchymatous cells with dark resinous contents; the ground tissue is made up of thick walled parenchyma cells packed with starch grains; about 6 to 9 meristeles embedded in the ground tissue in a circle; each meristele enclosed by a layer of pericycle and endodermis, this is followed by moderately thick walled phloem; xylem occupies the centre of the meristele and consists of tracheids; intercellular spaces in the rhizome of Male fern shows the secreting glands; the marginal cells of the ramenta is prolonged at intervals into hair like processes, that are formed by two contiguous cells parallel to each other; glandular process absent; the cells of the ramentum are slightly thick walled, narrow and elongated longitudinally.

Powder -Brown, isolated tracheids with scalariform thickenings, oblique walls, parenchyma cells with starch grains measuring about 15 to 20 μ in size present; stalked glands, ramental hairs, sclerenchymatous and marginal cells also seen.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	**-**	Not more than 2	per cent,	Appendix 2.2.2
Total ash	**-**	Not more than 5	per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than 0.1	per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than 12	per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than 13	per cent,	Appendix 2.2.7
Fixed oil	-	Not less than 3	per cent,	Appendix 2.2.8

T.L.C. –

T.L.C. of dichloromethane extract on aluminium plate precoated with silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene : ethyl acetate* (9:1) shows spots at R_f 0.2 (dark grey), 0.36 (violet), 0.4 (dark grey), 0.42 (violet), 0.5 (orange), 0.68 (yellow), 0.82 (yellow) on dipping the plate in *vanillin - sulphuric acid reagent* and heating at 105°for 5 minutes.

CONSTITUENTS- Filicin; α-flavaspidic acid; albaspidin; filixic acid; hexadeca aspidinol; dropterin; filmarone; β-aspidin; 9-aliphatic alcohols and 3 sterols.

PROPERTIES AND ACTION -	
Rasa	: Kaṭu
Guṇa	: Laghu, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Lekhana, Virecana **IMPORTANT FORMULATIONS –**Used as single drug
THERAOEUTIC USES- Jvara (Fever), Sphita Kṛmi (Tape worm), Vātarakta (Gout)	
DOSE -Cūrṇa (Powder): 1 to 3 g.	

SPṚKKĀ (Whole Plant)

Spṛkkā consists of the dried entire plant of *Anisomeles malabarica* (L.) R. Br. ex Sims (Fam. Lamiaceae), a densely pubescent, aromatic, 1.2 to 2 m high perennial herb, commonly found in the Western Ghats from Maharashtra to Karnataka, Andhra Pradesh, Kerala and Tamil Nadu.

SYNONYMS – Sprk, Devī, Vadhū, Sugandhā

REGIONAL LANGUAGE NAMES-

Ben. : Sprk, Devī, Vadhū, Sugandhā
Guj. : Karpooree, Madhuree
Hin. : Asabarag, Asarak
Kan. : Nalehullu, Hikke
Mar. : Karpoorvallee
Tam. : Irattai Peymarutti, Perundumbai

DESCRIPTION –

a) Macroscopic:

Root - Tap root, branched, woody, hard. stout, cylindrical, somewhat twisted, laterally flattened, measuring 7 to 14 cm in diameter, variable in length, arising from the basal portion of the highly knotty crown, 8 to 20 cm in diameter; lateral braches about 10 to 12 cm in diameter; surface very rough, longitudinally wrinkled, fissured, bears long wiry, twisted lateral roots or scars left by them; at places exhibits 10 to 12 cm wide circular to oval, tumor like protuberances; taste bitter, odour faint and not characteristic.

Stem - The older stems arising from the upper surface of the cylindrical, crown stout, 3 to 4 cm in diameter, densely tomentose, exposing at places the inner hard whitish, longitudinally striated wood; young stems cylindrical, faintly ridged and furrowed, densely tomentose, soft, axillary and oppositely branched, internodes 3 to 5 cm long and 0.8 to 1.5 cm in diameter, fracture outer fibrous, inner short, fractured surface exhibits central wide whitisth porous wood occupying the major portion of the stem and outer ridged tomentose margin; odour, very faint; taste, slightly bitter and astringent.

Leaf - Simple, opposite, oblong to lanceolate, 7 to 8 cm in length, 2 to 2.5 cm in breadth, serrate to crenate, acute, reticulate, veins more prominent at lower side, arising from the base, both the surfaces are densely tomentose, base symmetrical; petiole densely pubescent, 1.5 to 4 cm in length and 2 to 4 mm in diameter, cylindrical and channelled on the upper side.

b) Microsopic:

Root - TS circular, cork composed of 10 to 15 rows of tangentially elongated suberized cells, the outermost few layers being very deep brown in colour and at places not continous or often getting disintegrated; cortex narrow consisting of 4 to 5 rows of parenchymatous cells, traversed by isolated or small groups of spherical lignified thick walled stone cells; phloem comparatively wider, about 15 to 20 in rows, composed of phloem parenchyma, sieve tubes and companion cells; groups of stone cells of various sizes, shapes and thickness and oil canals often arranged in rows, especially in the inner region of the phloem; medullary rays multiseriate, brownish, funnel shaped, in continuation with that of xylem, cells somewhat tangentially elongated; xylem exhibits distinct growth rings and composed of vessels frequently containing yellowish brown tylosis, thin walled tracheids, fibres and

pitted parenchyma often encircling vessels; starch grains simple, rarely compound, oval to spherical, with distinct hilum, present throughout the parenchymatous cells of the xylem.

***Stem* -** TS of the stem somewhat quadrangular, epidermis single layer, covered with thick cuticle, cells rectangular to squarish in shape, filled with some yellowish brown contents; simple, covering, 2 to 3 celled, uniseriate trichomes of adjacent cells, characteristically thickened spirally, rarely branched, the basal cell often embedded with a few microsphenoidal crystals of calcium oxalate; glandular trichomes, short, bearing uni to bi cellular stalk and circular bulging oval, cup shaped or mushroom shaped head; cortex collenchymatous,2 to 4 in rows and 5 to 15 under the ridge; endodermis distinct; pericycle exhibits discontinuous ring of thin walled groups of lignifed fibres; phloem very narrow, often getting obliterated; xylem consisting of radially arranged oval to spherical vessels, pitted parenchyma, thin walled fibres and uni to biseriate medullary rays containing acicular crystals of calcium oxalate; pith parenchymatous and contains acicular crystals of calcium oxalate.

Lea f-
***Petiole* –** TS dorsiventrally flattened, with two prominent wing like projections on the lateral sides; shows epidermis consisting of tangentially elongated cells filled with brownish content and covered with thick cuticle; trichomes similar to that of leaf and stem; underneath the epidermis lies a band of collenchyma forming 3 to 10 rows; a boat shaped meristele shows radially arranged xylem vessels and narrow phloem almost encircling the xylem, the upper phloem tissue often exhibiting a few tangentially running cavities; meristele lying under the wing is very small, hardly consisting of 2 or 3 rows of narrow xylem vessels encircled by narrow phloem; pericyclic region traversed with a few fibres; on the adaxial sides lies 2 to 4 rows of thick walled irregular parenchymatous cells; acicular crystals of calcium oxalate present throughout parenchymatous tissue.

***Midrib* –** TS passing through the midrib region shows highly pubescent upper and lower epidermis; cells filled with dark brownish contents, 12 to 15 rows of collenchymatous tissue beneath the upper epidermis and 2 to 6 rows above the lower epidermis; a discontinuous, radially arranged, deep arc of centrally located meristele consisting of xylem, narrow phloem, uni- to bi-seriate medullary rays and a band of pericycle, occasionally traversed with isolated or groups of lignified fibres.

Lamina - TS shows epidermal cells, tubular to rectangular in shape, with thick striated cuticle, occasionally papillose; trichomes many, identical with that of stem but glandular trichomes are more in number; palisade tissues in a single row, discontinuous over the midrib, remaining mesophyll tissues consisting of 4 to 6 rows of spongy parenchyma containing acicular crystals of calcium oxalate; small vascular bundles encircled by parenchymatous sheath traversed throughout the mesophyll tissue; upper and lower epidermis in surface view shows stomata, diacytic and anisocytic, more on lower side; stomatal index 8 to 10 on upper side and 22 to 25 on lower side, palisade ratio 4 to 6 and veinislet number 4 to 7.

Powder - Greenish brown, showing abundant trichomes of various sizes and shapes, thick walled, coiled, multicellular; glandular trichomes with uni to bi- cellular stalk and spherical glistening head; fragments of long, unicellular, simple trichomes; isolated or groups of fibrous sclereids and stone cells varying in size, thickness and shapes, often exhibiting radiating, distinct connecting pits; starch grains simple and compound throughout and embedded in the parenchymatous cells; pitted, spiral and reticulate vessels of the vascular strands; epidermal cells of lamina in surface view with slightly sinous walls, containing diacytic and anisocytic stomata and sessile glandular trichomes of 4 to 8 celled head.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	-	Not more than 2 per cent,	Appendix 2.2.2
Total ash	-	Not more than 7 per cent,	Appendix 2.2.3
Acid-insoluble ash	-	Not more than 2 per cent,	Appendix 2.2.4
Alcohol-soluble extractvie	-	Not less than 6 per cent,	Appendix 2.2.6
Water-soluble extractive	-	Not less than 11 per cent,	Appendix 2.2.7

T.L.C. –

T.L.C. of the alcoholic extract on silica gel 'G' plate (0.2 mm thickness) using *toluene: ethyl acetate* (6:4) shows spots at R_f. 0.14, 0.43, 0.71 and 0.82 on spraying with *vanillin sulphuric acid reagent* and heating the plate for about 10 minutes at 105°.

T.L.C. of the volatile oil on silica gel 'G' plate (0.2 mm thick) using *toluene:ethyl acetate* (93:7) shows spots at R_f. 0.18, 0.25, 0.38, 0.62, 0.74 and 0.87 on spraying with *vanillin sulphuric acid reagent* and heating the plate for about 10 minutes at 105°.

CONSTITUENTS – Triterpenic acid, betulinic acid, two diterpenoids viz., ovatodiolide and anisomelic acid, aerial parts contain five 14 membered macrocylic diterpenes namely anisomelode, β-sitosterol, malabaric acid, 2-acetoxymalabaric acid, anisomelyl acetate and anisoelol; a terpenoid, anisomelin and a flavone 4, 5-dihydroxy-3,6,7-trimethoxyflavone.

PROPERTIES AND ACTION -

Rasa : Tikta, Kaṭu, Kaṣāya
Guṇa : Rūkṣa, Laghu, Tīkṣṇa
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Vātahara, Kaphahara, Varṇaprasādana, Anulomana, Lekhana, Viṣaghnī

IMPORTANT FORMULATIONS - Sahacarādi Taila, Balā Taila, Balādhātryādi Taila

THERAPEUTIC USES - Aśmarī (Calculus), Kaṇḍu (Itching), Kaphavikāra (Disorders due to vitiation of Kapha dosa), Kāsa (Cough), Koṭha (Ringworm / Impetigo / Erythema), Mūtrakṛcchra (Dysuria), Piḍakā (Carbuncle), Prameha (Metabolic disorder), Śvāsa (Asthma), Vraṇa (Ulcer)

DOSE- Cūrṇa (Powder): 3 to 5 g.

SRUVAVṚKṢA (Fruit)

Sruvavṛkṣa consists of fruits of *Flacourtia indica* (Burm.f.) Merr. Syn. *F. ramontchii* Herit. (Fam. Flacourtiaceae), a thorny small tree up to 8 m high bearing small, greenish – yellow flowers and small, red or dark brown, globose fruits. It is found in sub-montane areas of Punjab and Himachal Pradesh, Bihar, Maharashtra, and southern peninsula.

SYNONYMS – Vikaṅkata, Gopakaṇṭaḥ

REGIONAL LANGUAGE NAMES-

Ben.	: Bincha, Bainchi-kul, Bainchaa
Eng.	: Governors plum, Madagaskara plum, Mauritius plum
Guj.	: Kankata, Kaankod
Hin.	: Bilangra, Kakaiyaa, Kataai
Kan.	: Lumanika, Dodda gejjalakai, Hunmunaki, Panumbus
Mal.	: Vavankataku, Vikamkath, Yaliya nzerinigal
Mar.	: Kaker, Bhekal
Ori.	: Kantheikoli, Vaincha, Unicha
Pun.	: Kanghu
Tam.	: Sottaikala, Kat-ukala, Panampuvatti
Tel.	: Putikatada, Putregu, Kanaveguchettu, Vikankata, Kandregu

DESCRIPTION-

a) Macroscopic:

Fruit greyish green to reddish brown, rounded, lobed, 5 to 12 mm in diameter; containing up to 16 seeds in 2 rows; seeds small, creamish, sometimes a few aborted; taste sharp and sweet, flavour agreeable.

b) Microscopic:

Fruit- A transverse section of fruit shows an outermost epidermal layer of epicarp comprising small, thin walled, rounded cells occasionally bearing smooth, small, almost straight, tapering, unicellular trichomes; bulk of the fruit tissue comprises of the many layered, mesocarp made up of thin walled parenchymatous cells interspersed abundantly with cavities filled with brown colouring matter or substance; endocarp lines the individual ovular loculi and comprises some layers of stone cells interspersed with long cells placed tangentially or obliquely to the cavity; cells of endocarp layer are relatively clear and transparent, some cells of this layer also contain prismatic crystals of calcium oxalate 15 to 25 µ in size.
Seed- The outer seed coat consists of a few layers of rounded cells; inner integument consists of a single layer of squarish cells containing brown pigment; endosperm comprises of thin walled, compactly arranged, rectangular, parenchymatous cells rich in starch.

Powder –Dark brown, texture fine, taste slightly sour and odour flour like; microscopy shows unicellular trichomes upto 350 µ long, and stone cells upto 120 µ in size.

IDENTITY, PURITY AND STRENGTH –

Foreign matter - Not more than 1 per cent, Appendix 2.2.2
Total ash - Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash - Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive - Not more than 20 per cent, Appendix 2.2.6
Water-soluble extractive - Not more than 21 per cent, Appendix 2.2.7

T.L.C.-

T.L.C. of alcoholic extract of the drug on silica gel 'G' F_{254} plate using *butanone: ethyl acetate: acetic acid: water* (3:5:1:1). On spraying the plate with NP/PEG reagent, under 366 nm shows spots at R_f. 0.28 (light yellow), 0.33 (white fluorescent), 0.57 (orange red) and 0.74 (green).

CONSTITUENTS- Flacourside, methyl 6-*O-(E)-p*-coumaroyl glucopyranoside and 6-*O-(E)-p*-coumaroyl glucopyranose

PROPERTIES AND ACTION -	
Rasa	: Madhura, Tikta
Guṇa	: Tīkṣṇa, Laghu, Rūkṣa
Vīrya	:Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphahara, Mūtrala, Pācana, Pittahara, Rūcya, Viṣaghna
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES- Agnimāndya (Digestive impairment), Kāmalā (Jaundice), Plīhāvṛddhi (Splenomegaly), Prameha (Metabolic disorder), Raktavikāra (Disorders of blood), Śotha (Inflammation), Yakṛdroga (Diseases of liver)	
DOSE - Cūrṇa (Powder): 5 to 10 g.	

STHŪLAILĀ (Fruit)

Sthūlailā is the dried fruits of *Amomum subulatum* Roxb. (Fam. Zingiberaceae), a perennial rhizomatous herb upto a height of 1.5 to 2 m growing in West Bengal, Sikkim and Assam Hills.

SYNONMYS – Bṛhadelā, Bṛhat elā, Bhadrailā

REGIONAL LANGUAGE NAMES-

Ben.	: Bara elachi, Baara aliachi, Bad elaach
Eng.	: The Greater Cardamom
Guj.	: Mothi elichi, Moto-elachi
Hin.	: Baraa-elaachi, Badi ilaayachi
Kan.	: Dodda yalakki
Mal.	: Valiya elam, Perelam, Peri-elav
Mar.	: Mothe elaayachi, Moteveldode
Ori.	: Badaa alaicha, Alaicha
Pun.	: Budi eleichi
Tam.	: Periya elam
Tel.	: Peddayelaki, Pedda elakulu
Urd.	: Ilaayachi badi, Heel kalan

DESCRIPTION –

a) Macroscopic:

Fruits are indehiscent capsules, dark brown with occasional pink tinge; ovate - elliptic, 1 to 3 cm long and 1 to 2 cm broad, slightly three angular and three loculed; each locule with a ragged membraneous septum; fruit rind coarsely striated; each fruit bears 20 to 70 seeds held in a viscid pulpy mass; seeds ovate - elliptic and angular, brownish black, 2 to 4 mm long and 2 to 3 mm broad in size; membraneous aril present; aromatic and strongly pungent with a camphoraceous taste.

b) Microscopic:

Fruit- Pericarp consists of a single layer of epidermis formed by tangentially elongated cells with brownish oil droplets; mesocarpic tissue consists of thin walled parenchymatous cells, both isodiametric and tangentially elongated, more compact towards the endocarpic region; many fibro-vascular bundles present in a row in the mesocarp.

Seed- Shows a somewhat triangular outline; outer layer of the testa is with a single row of thick walled, compact and radially elongated cells followed by perisperm tissue composed of 10 to 15 layers of radially elongated parenchyma cells packed with many simple, small, mostly globular starch grains and tiny rosettes of calcium oxalate crystals; endosperm cells parenchymatous, usually 8 to 10 layered.

Powder- Dark brown, microscopic observation shows a patch of elongated rectangular parenchyma; perisperm cells packed with starch grains; polyhedral starch grains and rosettes of calcium oxalate crystals of about 5 µ

across; irregular, thick walled stone cells with very narrow lumen, size 20 to 105 μ; brownish resin masses; narrow elongated fibres; spiral, reticulate and pitted vessels.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 7 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 18 per cent, Appendix 2.2.7
Volatile oil	-	Not less than 1 per cent, Appendix 2.2.10

T.L.C.-

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thickness) using *hexane:ethyl acetate* (8:2) after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105° for 5 minutes shows spots at R_f. 0.44 (pink), 0.52 (pink), 0.6 (light pink), 0.67 (brown), 0.72 (pink) and 0.78 (light brown).

CONSTITUENTS- Volatile oil predominantly containing cineol with other constituents such as α-pinene, β-pinene, sabinene, myrcene, α-terpinene, β-terpinene, limonene, *p*-cymene, terpinenol, α-terpineol, δ-terpineol and nerolidol.

PROPERTIES AND ACTION-	
Rasa	: Tikta, Kaṭu
Guṇa	: Laghu, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Anulomana, Dīpana, Hṛdya, Kaphahara, Mūtrala, Pittasāraka, Śiraḥśodhaka, Vātahara
IMPORTANT FORMULATIONS- Ela Arka Gunah, Bhadra Arka Gunah, Sthula Ela Guna, Sthulela Guna	
THERAPEUTIC USES- Aruci (Tastelessness), Bastivikāra, Chardi (Emesis), Dantaroga (Disease of tooth), Hṛllāsa (Nausea), Kaṇḍu (Itching), Kaṇṭharoga (Disease of throat), Kāsa (Cough), Mukharoga (Disease of mouth), Raktapitta (Bleeding disorder), Raktavikāra (Disorders of blood), Śiroroga (Disease of head), Śūla (Pain / colic), Śvāsa (Asthma), Tṛṣā (Thirst), Tvakroga (Skin diseases, Viṣavikāra (Disorders due to poison), Vraṇa (Ulcer)	
DOSE - Cūrṇa (Powder): 1 to 3 g.	

ŚUKANĀSĀ (Rhizome)

Śukanāsā consists of the rhizomes of *Corallocarpus epigaeus* Benth. ex Hook. f. Syn. *Bryonia epigaea* Rottler; *Rhyncocarpa epigaea* Naud and *Aechmandra epigaea* Arn. (Fam. Cucurbitaceae), a monoecious tendril climber, found in the scrub jungles of South India along hilly tracts.

SYNONYMS - Nāhikanda, Kaṭunāhī, Nāhikā, Ākāśagaruḍa

REGIONAL LANGUAGE NAMES-

Guj.	: Kadvinai, Naahikand
Hin.	: Mirchiakand, Kirakanda, Kadvi naahi, Naahi Kand
Kan.	: Akasha garudagadde
Mal.	: Kollamkova kizhang
Mar.	: Karunai, Kadavinai, Akashagarudi
Tam.	: Karutankilanku
Tel.	: Murudonda, Nagadonda

DESCRIPTION -

a) Macroscopic:

Whole tubers napiform, upto 5 cm in diameter, cut pieces 1 to 2 cm in length and 1.5 to 3.5 cm in diameter, brownish yellow; skin very thin and closely intact; cut surface yellowish white; fracture, short, starchy; taste, bitter.

b) Microscopic:

Rhizome - Cork made up of 8 to 10 rows of cells, of which the outermost 3 or 4 layers are tangentially elongated, thick walled cells and inner few layers radially arranged and thin walled; rest of the ground tissue of parenchyma cells contain simple starch grains measuring about 10 to 20 µ in diameter and compound starch grains with 2 to 4 components; xylem composed of isolated strands embedded in the ground tissue, including a large solitary and wide vessels present in radial multiples of two or three, phloem scattered in the ground tissue particularly towards inside of the xylem strands.

Powder - Yellowish white, taste very bitter; tissue debris with thick walled cork cells in surface view, compound starch grains, simple starch grains, fibres and vessels observed.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	- Not more than 2 per cent,	Appendix 2.2.2
Total ash	- Not more than 4.5 per cent,	Appendix 2.2.3
Acid-insoluble ash	- Note more than 1.0 per cent,	Appendix 2.2.4
Alcohol-soluble extractive	- Not less than 5 per cent,	Appendix 2.2.6
Water-soluble extractive	- Not less than 14 per cent,	Appendix 2.2.7
Fixed oil	- Not less than 1 per cent,	Appendix 2.2.8

T.L.C. –

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene: methanol* (7:1) under UV 366 nm shows fluorescent spots at R_f. 0.14, 0.19 and 0.46 (all blue), 0.69 (fluorescent blue), 0.74, 0.80, 0.89 (all blue). Under UV 254 nm spots appear at R_f. 0.11, 0.24, 0.31, 0.37 and 0.63 (all green), 0.69 (pale blue), 0.80 (green), on dipping the plate in *vanillin-sulphuric acid* and heating at 105° for 5 minutes spots appear at R_f. 0.14, 0.2, 0.26 and 0.34 (all pale brown) 0.63 and 0.74 (both grey).

CONSTITUENTS- Bryonin; epigaeusyl ester; corallocarpuscalarolide; corallocarpenoyl ester; dotriacont-22,25-diol-10-one.

PROPERTIES AND ACTION-	
Rasa	: Kaṭu, Tikta
Guṇa	: Laghu, Rūkṣa, Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Śothahara, Vamana, Virecana, Viṣaghna
IMPORTANT FORMULATIONS- Kāśmaryādi ghṛta	
THERAPEUTIC USES- Āmavata (Rheumatism), Aruci (Tastelessness), Atisāra (Diarrhoea), Dāha (Burning sensation), Hikkā (Hiccup), Jīrṇa Āntraśotha(Chronic intestinal pain), Jīrṇajvara (Chronic fever), Jvara (Fever); Kāsa (Cough), Kṛmi roga (Worm infestation), Pravāhikā (Dysentery), Sarpa viṣa (Snake poison), Śotha (Inflammation), Śvāsa (Asthma), Vātakapha Jvara (Fever due to Vata Kapha); Visphoṭaka (Blisterous eruption), Vraṇa (Ulcer), Yoni roga (Disease of female genital tract)	
DOSE - Cūrṇa (Powder): 3 to 5 g	

AVETASA (Leaf)

Śveta vetasa consists of dried leaves of *Salix alba* L (Fam. Salicaceae), a large tree with olive green, purple or yellow branches cultivated in Western Himalayas. The plant is not found to grow wildly in India.

SYNONYMS -Śveta veda muśka

REGIONAL LANGUAGE NAMES-

Eng.	: European willow, White willow
Hin.	: Sveta veda muska
Kan.	: Neerganjimara
Mar.	: Pandra veda muska
Pun.	: Bis, Malchang, Bhushan, Madnu
Urd.	: Bed Sada

DESCRIPTION –

a) Macroscopic:

Leaves 6.3 to 10 cm long, lanceolate, broadest at a little above the middle, pinnately veined, apex acute and margin minutely serrated, silvery when young, glaucous beneath; petiole 7.5 to 12.5 mm long; odour and taste nil.

b) Microscopic:

Petiole **-**TS of the petiole irregular in outline with 'V' shaped groove on the upper side; stele centrally located and bicollateral; epidermis single layered covered by a thick cuticle and a few trichomes upto 108 µ long, followed by 10 to 15 rows of collenchyma; collenchyma on the adaxial side of the petiole followed by 10 to 12 rows of parenchyma, parenchyma tissue absent on the abaxial side of the petiole; vascular bundle consisting of xylem and phloem; idioblasts present throughout the ground tissue, filled with rosette crystals and a few prismatic crystals of calcium oxalate.

Midrib **-**TS of leaf passing through the midrib more convex on the abaxial side and almost flat on the adaxial side; upper epidermis single layered, lower epidermis two layered; a cuticle is present; a few epidermal cells filled with light pink pigment; a few unicellular long trichomes present; epidermis followed by 5 or 6 rows of collenchyma, 5 or 6 rows of parenchyma with a few cells filled with rosette crystals of calcium oxalate; midrib shows a centrally located bicollateral stele, surrounded by patches of pericyclic fibres; vascular bundle consists of a xylem and phloem; pericycle made up of fibres.

Lamina **-**Lamina isobilateral; trichomes 45 to 108 µ long; upper epidermis single layered whereas lower two layered, made up of barrel shaped cells; two layers of palisade cells present adjacent to both upper and lower epidermis; 2 or 3 layers of spongy cells in the central region; a few cells of the mesophyll are filled with rosette and prismatic crystals of calcium oxalate; vascular bundles of the veins are seen; average stomatal index 5 to 7 and 8 to 11 on upper and lower surface respectively; palisade ratio 6 to 11 on both surfaces.

Powder -Greyish green, taste and odour nil; exhibits upper epidermis made up of straight anticlinal walls and devoid of stomata; lower epidermis made up of straight anticlinal walls covered by paracytic stomata, cicatrices and trichomes, fragments of lamina in sectional view, trichomes two celled long with a small basal cell and a long apical cell with smooth walls; rosette and prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than	2	per cent,	Appendix	2.2.2
Total ash	-	Not more than	10.5	per cent,	Appendix	2.2.3
Acid-insoluble ash	-	Not more than	0.6	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	-	Not less than	11	per cent,	Appendix	2.2.6
Water-soluble extractive	-	Not less than	66	per cent,	Appendix	2.2.7

T.L.C. –

Take 2 g of the powdered drug and extract with methanol (2 x 25 ml), by refluxing on a water bath. Filter and concentrate the pooled extract. Adjust the volume to 10 ml with ethanol and apply about 20 µl on precoated silica gel 60 F_{254} plate.

T.L.C. of alcoholic extract on aluminium plate precoated with silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene:ethyl acetate:formic acid: methanol* (3:3:0.8:0.2), with *anisaldehyde sulphuric acid reagent* followed by heating at 105^{o} for 5 min shows spots at R_f. 0.13 (yellow), 0.36 (light violet), 0.47 (light brown), 0.52 (light yellow), 0.65 (greenish grey), 0.76 (blue) and 0.86 (purple).

CONSTITUENTS –Amentoflavone, apigenin, (+)-catechin, (+)-gallocatechin, isoquercetrin, rutin, narcissin, isorhamnetin-3-*O*-*β*-D-glucoside, salicin, fragilin, salicortin.

PROPERTIES AND ACTION –

Rasa : Tikta, Kaṣāya
Guṇa : Laghu, Rūkṣa
Vīrya : Śīta
Vipāka : Kaṭu
Karma : Grāhī, Jvaraghna, Kaphahara, Mūtrala, Rakṣoghna, Vedanāsthāpana, Vraṇa Śodhana

IMPORTANT FORMULATIONS –Used as single drug

THERAPEUTIC USES- Amavāta (Rheumatism), Śvitra (Leucoderma / Vitiligo), Atisāra (Diarrhoea), Kāmalā (Jaundice), Karṇaroga (Disease of ear), Pravāhikā (Dysentery), Raktaṣṭhivana (Haemoptysis), Raktapitta (Bleeding disorder), Vātarakta (Gout)

DOSE- Cūrṇa (Powder): 3 to 6 g
Kaṣāya (Decoction): 50 to 100 ml

TAKKOLA (Fruit)

Takkola consists of fruits of *Illicium verum* Hook. f. (Fam. Magnoliaceae), an evergreen shrub or tree attaining a height of 8 to 15 m and diameter of 25 cm. The plant is a native of China and is sometimes cultivated in India. Most of the drug available in the market is imported.

REGIONAL LANGUAGE NAMES-

Ass.	:	Baadiyaane khataai
Eng.	:	Star Anise of China
Hin.	:	Ansafal
Mal.	:	Takkolpputtil
Mar.	:	Baadiyaan
Tam.	:	Anushappu, Anushuppu, Annashuppu
Tel.	:	Anasapuveru
Urd.	:	Baadiyaan khataai

DESCRIPTION –

a) Macroscopic:

Fruits star shaped, consisting of 8 carpels (follicles) arranged in a whorl around a short central column attached to a pedicel; each follicle 12 to 17 mm long, up to 14 mm deep, up to 5 mm broad, boat shaped, bluntly beaked at the apex, woody and wrinkled, reddish brown outside, smooth glossy inside, opening by ventral suture at the upper margin, containing one seed. Pedicel up to 5 cm long, strongly curved at the distal end; seeds reddish brown, compressed-ovoid, smooth, shiny with brittle seed coat enclosing a soft, oily kernel; odour, pleasant, resembling that of anise; taste, agreeable, aromatic, sweet.

b) Microscopic:

TS of the follicle shows an outer most single layered epicarp of flattened, nearly rectangular cells; mesocarp consists of parenchymatous, many layered, spongy tissue composed of irregular cells with brownish walls and containing frequent cavities, patches of sclerenchyma, occasional vascular strands surrounded by sclerenchyma and prismatic crystals; endocarp composed of a layer of columnar, transluscent or clear cells containing scattered, occasional prismatic crystals; seed shows testa with an outer epidermal layer made up of sclereids; inner layer of seed coat consists of thick walled, brown-pigmented cells; endosperm composed of thin walled parenchyma cells contain food reserves.

Powder– Dark brown, coarse, odour anise like; taste slightly tingling, powder microscopy shows groups of clear, thin walled, columnar cells 200 to 220 µ long from endocarp, and fragments of seed coat comprising sclereids of 100 to 130 µ in size in surface and side views; compiles with the following colour tests:-

IDENTITY, PURITY AND STRENGTH –

Identification :-

1) Take a few mg of powder, add about 5ml of 5% KOH and boil for 2 minutes, cool and dilute to 10 ml with water: a blood red colour is produced.

2) Take powder of fruits without seeds, add a few ml of ethanol and boil for 2 minutes; cool, filter and add 25 ml water to filterate; extract with 10 ml petroleum ether; evaporate the petroleum ether layer to dryness; dissolve the residue in 2 ml acetic acid, add small quantity of ferric chloride and shake well, add sulphuric acid slowly along the tube wall: brown colour is produced at the junction of the two liquids.

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 13 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 21 per cent, Appendix 2.2.7
Essential oil contents	-	Not less than 3 per cent, Appendix 2.2.8

T.L.C-

T.L.C. of alcoholic extract of the drug is developed on silica gel 'G' 60 F_{254} plate using *chloroform: methanol:acetic acid* (8:2:0.25) shows spots at R_f. 0.12 (dark green), 0.27 (green), 0.33 (bluish grey), 0.40 (grey) and 0.50 (grey) on spraying the plate with *anisaldehyde-sulphuric acid reagent* and heating the plate for 15 minutes at 105^o.

CONSTITUENTS - Essential oils, flavonol glycosides, and veranisatins A, B & C.

PROPERTIES AND ACTION -

Rasa	**:**	Madhura, Kaṭu
Guṇa	**:**	Laghu, Snigdha, Tīkṣṇa
Vīrya	**:**	Uṣṇa
Vipāka	**:**	Madhura
Karma	**:**	Kaphahara, Dīpana, Pācana, Vātānulomana, Mūtrala, Vātaghna, Koṣṭhavāta - śamana, Vedanāhara

IMPORTANT FORMULATIONS- Karpurādi Cūrṇa

THERAPEUTIC USES- Ādhmāna (Flatulance with gurgling sound), Aruci (Tastelessness), Gulma (Abdominal lump), Mukhadurgandha (Halitosis), Sandhivata (Arthritis), Śūla (Pain / Colic)

DOSE- Cūrṇa (Powder): 250 to 625 mg.

TINDUKA (Fruit)

Tinduka consists of unripe and ripe fruits of *Diospyros peregrina* Gurke Syn. *Diospyros embryopteris* L. (Fam. Ebenaceae), a medium sized tree having alternate leaves and ellipsoid or sub-globose, green or light brown fruits possessing prominent, persistent, woody calyx. The tree is distributed throughout India.

SYNONYMS -Viralā, Asitakāraskara, Kālaskandha, Sphūrjaka

REGIONAL LANGUAGE NAMES-

Ass.	: Kendu
Ben.	: Gab
Eng.	: Indian Gaub, Persimon
Guj.	: Timbaravo, Temru
Hin.	: Tendu, Gaabh, Maakaatendu
Kan.	: Holetupare, Kusharta
Mal.	: Panachi, Panachchi, Pananchi
Mar.	: Temburni
Ori.	: Kendu
Tam.	: Kattatti, Kavikattai, Tumbi, Paanicikaa, Tumbika
Tel.	: Tumiki, Gaara
Urd.	: Tendu

DESCRIPTION -

a) Macroscopic:

Fruit globose, ovoid or ellipsoid berry, 3.5 to 5 cm in width, with a much large and thickened, often woody calyx; cuticle thick and shiny; green when unripe, yellowish orange when ripe; nearly smooth or covered with a rusty mealiness; fleshy and possessing a viscid, glutinous pulp when fresh, hard when dried, 6 to 10 celled; both unripe and ripe fruits cut longitudinally in to 3 to 4 pieces along with persistent calyx and dried for use; seed solitary in each cell, thin, flat, and oblong; testa hard, separable; endosperm prominent.

b) Microscopic:

Fruit **-**TS through the fruit shows a thick, stratified cuticle supported on a many-layered exocarp; outermost layer of small, rectangular or rounded cells forms the epidermis; hypodermal region of exocarp possesses abundant groups of stone cells mixed with parenchymatous patches; mesocarp constitutes many layers of parenchymatous cells possessing abundant, large cavities having reddish brown colouring matter; innermost layer of pericarp lined with the cuticle and constituting the endocarp.

Seed **-**Testa, thick, many layered and lined externally by cuticle; outermost layer of squarish or angular, thick cells forms the outer epidermis of testa; many layers of parenchymatous, sub epidermal zone contain abundant brown colouring matter; innermost layer of testa consists of thin walled, parenchymatous cells; endosperm prominent and cartilaginous with cells having very thick, wavy or straight walls.

Powder -Dull brick red, coarse and granular; taste and odour not distinct; microscopy shows abundant stone cells 60 to 120 µ in size and cells of cartilaginous endosperm.

IDENTITY, PURITY AND STRENGTH –

Foreign matter - Not more than 2 per cent, Appendix 2.2.2
Total ash - Not more than 6 per cent, Appendix 2.2.3
Acid-insoluble ash - Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive - Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 16 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of alcoholic extract of the drug on silica gel 'G' F_{254} plate using *ethyl acetate: n-hexane* (7:3).On spraying the plate with *anisaldehyde-sulphuric acid reagent* and heating the plate for 10 minutes at 105º, spots appear at R_f. 0.41 (light blue) 0.49 (brownish zone) 0.61 (bluish) and 0.83 (dark blue).

CONSTITUENTS- Alkanes and triterpenoids. Seed contains hexacosane and β-sitosterol, β-sitosterol glucoside, gallic acid and betulinic acid. Fatty oil (32%), unsaponified matter and β-amyrin.

PROPERTIES AND ACTION -		
	Pakva phala	Apakva phala
Rasa	: Madhura	Kaṣāya
Guṇa	: Guru, Snigdha	Laghu, Rūkṣa
Vīrya	: Sīta	Sīta
Vipāka	: Madhura	Kaṭu
Karma	: Pittahara, Kaphahara Durjara, Puṣṭikara	Vātaprakopaka, Grāhī, Lekhana
IMPORTANT FORMULATIONS – Used as single drug		
THERAPEUTIC USES -	Pakva phala- Āsmarī (Calculus), Aruci (Tastelessness), Kapharoga (Disease due to Kapha dosa), Prameha (Metabolic disorder), Raktadoṣa (Disorders of blood)	
	Apakva phala- Atisāra (Diarrhoea), Bhagna (Fractures), Dāha (Burning sensation), Kuṣṭha (Leprosy / diseases of skin), Śotha (Oedema), Medoroga (Obesity), Pravāhikā (Dysentery), Raktapitta (Bleeding disorder), Udarda (Urticaria), Vraṇa (Ulcer)	

DOSE - Pakva phala (Ripe)- Cūrṇa (Powder): 5 to 10 g.

Apal

TRĀ

YAMĀṆĀ (Rhizome)

Trāyamāṇā consists of dried rhizomes of *Gentiana kurroo* Royle (Fam. Gentianaceae), a perennial herb with tufted and decumbent stem distributed sporadically in sub-alpine to alpine meadows between altitudes of 1500 to 3000 m.

SYNONYMS- Trāyanti, Girijā, Adrisānuj, Balabhadrā, Pālanikā, Trāyantikā

REGIONAL LANGUAGE NAMES-

Eng. : Indian gentian
Guj. : Traymana
Hin. : Trayman, Kadu
Kan. : Karadihanni
Mal. : Trayamana
Pun. : Kadu
Tam. : Kampanitirai
Tel. : Trayama

DESCRIPTION-

a) Macroscopic:

Dried rhizome pieces cylindrical to quadrangular, upto 12 cm long, 0.8 cm thick, dark brown with yellowish-white patches of exfoliated bark and marked by closely arranged transverse annulations and a few scars of rootlets; fracture, short and brittle; odour, characteristically aromatic; taste, bitter.

b) Microscopic:

TS of rhizome shows thin cork of tangentially elongated cells, 2 or 3 layered cork cambium of polygonal cells; multilayered cortex of oval to round cells; phloem 2 to 3 layered; cambium present and xylem largely composed of vessels arranged in radial rows or single; broad squarish pith region of large circular cells extend from corners into intervascular regions; cells of cortex and pith filled with resinous mass and broad acicular crystals of calcium oxalate.

Powder- Light brown, shows fragments of round to elongated polygonal or oval parenchymatous cells of cortex and pith containing globules of resinous mass and broad acicular crystals of calcium oxalate; reticulately thickened vessels; yellowish-brown cork cells filled with brown granular material; abundant brownish coloured mycorrhizal hyphae may occur in association with cortex cells.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	**-**	Not more than 2 per cent,	Appendix 2.2.2
Total ash	**-**	Not more than 7 per cent,	Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than 2 per cent,	Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than 28 per cent,	Appendix 2.2.6
Water-soluble extractive	**-**	Not less than 13 per cent,	Appendix 2.2.7

T.L.C.-

T.L.C. of alcoholic extract of the drug on precoated silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene :ethyl acetate* (90:10) shows spots at R_f.0.13 (light violet), 0.20 (violet), 0.28 (light violet), 0.34 (brick red), 0.40 (violet), 0.50 (magenta), 0.55 (pink), 0.63 (violet), 0.78 (dark pink) and 0.96 (dark pink) on spraying with *anisaldehyde-sulphuric acid reagent* followed by heating at 105º for 10 minutes.

CONSTITUENTS- Gentianic acid.

PROPERTIES AND ACTION -

Rasa **:** Tikta, Kaṣāya
Guṇa : Sara
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Pittahara, Kaphahara, Viṣaghna

IMPORTANT FORMULATIONS- Trāyamāṇādya Ghṛta, Ca Ci. 5, Trayamana Guna, Trayanti Guna, Trayamana Kvatha, Mahāpaiśācika Ghṛta, Ca Ci. 9

THERAPEUTIC USES- Atisāra (Diarrhoea), Bhrama (Vertigo), Gulma (Abdominal lump), Hṛdroga (Heart disease), Jvara (Fever), Raktapitta (Bleeding disorder), Raktavīkāra (Disorders of blood), Śūla (Pain / Colic), Sutikaśūla (Postpartum abdominal pain), Tṛṣṇā (Thirst), Visama & Paittika, Visarpa (Erysepales)

DOSE- Cūrṇa (Powder): 1 to 3 g.

TRIPAKṢĪ (Whole Plant)

Tripakṣī consists of the whole plant of *Coldenia procumbens* L. (Fam. Boraginaceae), a procumbent herb with trailing stems appressed to the ground and rooting all along; found wild in fallow fields, dried up lakes and roadsides in warmer parts of India.

SYNONYMS - Tripuṁkhī

REGIONAL LANGUAGE NAMES-

Eng.	: Trailing coldenia
Guj.	: Basriookharad
Hin.	: Tripunkhi
Kan.	: Tripakshi
Mal.	: Cherupadi
Mar.	: Tripakshi, Tripunkhi
Ori.	: Gondri lota
Tam.	: Ceruppatai
Tel.	: Hamsapadu, Chepputhatteku

DESCRIPTION –

a) Macroscopic:

Root -Taproot well developed, creamy white, length variable, thickness upto 1.5 cm, rootlets present, no characteristic odour and taste.

Stem -Stem procumbent, numerous branches radiating from the root reaching upto 40 cm long, shaggy, with appressed silky white hairs, especially on younger branches, bitter, no odour.

Leaf -Leaves ashy green on upper surface, lower surface greenish, crisped, shortly petiolate, obovate to oblong, crenate, pubescent, no odour and taste.

b) Microscopic:

Root -Cork and outer cortex crushed, scattered sclerenchymatous patches present in the inner cortex; phloem present; cambium distinct; xylem consists of scattered, solitary circular vessels; xylem parenchyma lignified; uniseriate ray radiating from the centre.

Stem -Epidermis single layer of tabular cells, with an occasional much larger cell; thick walled unicellular trichomes, 200 to 400 µ in length present; cortex consists of about two layers of hypodermal chlorenchyma followed by about four layers of collenchyma and inner layers of circular parenchyma; pericycle present with small patches of lignified fibres; stele consists of scattered xylem vessels, with layers of phloem cells at the periphery; occassional phloem fibres seen; medullary rays uniseriate; pith large and parenchymatous with intercellular spaces and shows starch grains and druses.

Leaf -

Petiole -Almost circular in outline; epidermal cells single layered with trichomes and a few empty idioblasts; one or 2 rows of chlorenchyma follows epidermis; ground tissue parenchymatous.

Midrib -Shows a slight convex curvature on the adaxial face and a deeper curvature on the abaxial face; epidermis single layered with unicellular trichomes upto 400 µ in length; the sub epidermal layers composed of 1 or 2 rows of collenchyma; collateral crescent shaped median vascular strands with two smaller bundles present on the adaxial side; ground tissue parenchymatous; druses present.

Lamina -Dorsiventral; epidermis single layer with a few empty idioblasts; stomata anomocytic; adaxial and abaxial epidermal cells polygonal with straight walls in surface view; palisade two layered, second layer with shorter cells; stomatal number 48 to 52 / mm^2 for abaxial surface; 40 to 46 / mm^2 on adaxial surface; stomatal index 2 or 3 on both adaxial and abaxial epidermis; palisade ratio 9 to 11; vein islet number 10 to 12; veinlet termination number 15 to 18.

Powder -Ashy green, numerous thick walled unicellular trichomes, fragments of leaf with anomocytic stomata, fibres, occasional druses observed vessels scalariform.

IDENTITY, PURITY AND STRENGTH -

Foreign matter - Not more than 1 percent, Appendix 2.2.2
Total ash - Not more than 13 percent, Appendix 2.2.3
Acid-insoluble ash - Not more than 2 percent, Appendix 2.2.4
Alcohol-soluble extractive - Not less than 10 percent, Appendix 2.2.6
Water-soluble extractive - Not less than 17 percent, Appendix 2.2.7
Fixed oil - Not less than 3 percent, Appendix 2.2.8

T.L.C. -

T.L.C of chroloform extract on aluminium plate precoated with silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene: ethyl acetate (6:1*) and 6 drops of formic acid, under UV 366 nm shows fluorescent zones at R_f 0.10, 0.16, (both white), 0.38 (pink), 0.50 (magenta), 0.56 (white), 0.60 (pink), 0.67 (magenta) 0.73, (deep violet) and 0.83 (white). On exposure to *iodine vapours* spots appear at R_f. 0.16, 0.31 (both yellowish brown), 0.38 (greenish yellow), 0.50, 0.56 (both yellowish brown), 0.60 (greenish yellow) 0.67 and 0.70 (both yellowish brown. On dipping the plate in *vanillin-sulphuric acid reagent* and heating at 105° for 5 minutes, spots appear at R_f 0.13 (violet), 0.20 (yellow), 0.25 (violet), 0.27, 0.40 (both yellow), 0.44 (green), 0.50, 0.53 (both violet), 0.63 (yellow), 0.67 (green) and 0.70 (violet).

CONSTITUENTS - Steroid glycosides.

PROPERTIES AND ACTION -	
Rasa	: Tikta, Kaṣāya
Guṇa	: Laghu, Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphaghna, Pācana, Śothaghna, Vātahara
IMPORTANT FORMULATIONS –Used as single drug	

THERAPEUTIC USES- Āmavāta (Rheumatism), Vidradhi (Abscess)
DOSE – Cūrṇa (Powder) : 3 to 6 g

TUVARAKA (Seed)

Tuvaraka consists of the dried seeds of *Hydnocarpus pentandra* (Buch.-Ham.) Oken Syn. *H. laurifolia* (Dennst.) Sleummer., *H. wightiana* Blume (Fam. Flacourtiaceae), a deciduous evergreen tree upto 15 m or more, endemic to tropical forests of Western Ghats, upto 600 m.

SYNONYMS - Kaṭukapittha

REGIONAL LANGUAGE NAMES-

Ben.	:	Chaulmugraa
Eng.	:	Chaulmugra
Hin.	:	Chaalmograa
Kan.	:	Garudphala, Toratti, Suranti
Mal.	:	Kodi, Vrikshamroti, Marotti
Mar.	:	Kadukavatha
Tam.	:	Nirati Muthu
Tel.	:	Nirudu, Niridi
Urd.	:	Chaalmagraa

DESCRIPTION-

a) Macroscopic:

Seeds obtusely angular, elongate - obovate, dark brown, 8 to15 mm in width and 12 to 28 mm in length; testa longitudinally ridged and stony; cotyledons two, thin, papery; endosperm, abundant and oily; odour, indistinct; taste, acidic.

b) Microscopic:

TS through micropylar region of the seed shows seed coat, endosperm and embryo; the seed coat has outer testa made up of three types of cells: (i) an outer parenchymatous epidermis with vascular supply, with a few sclereids present around xylem; ii) a middle sclerotic tissue of cells with four distinct zones , a few outer layers of isodiametric sclerotic cells upto 30 µ diameter, with thick walls and simple pits, followed by radially elongated thick walled cell; a middle uniseriate, ribbon shaped thick walled sclereids elongated up to 900 µ; a few layers of tangentially elongated sclereids; (iii) an inner multiseriate epidermal layer with thin walled isodiametric,compactly arranged cells; tegmen is undifferentiated and is almost crushed by the endosperm; endosperm consists of compactly arranged isodiametric thinwalled parenchymatous cells, filled with oil globules and abundant rosettes of calcium oxalate prisms of 15 to 20 µ; cotyledons two, possess single layer of epidermal cells with brick shaped cells; mesophyll undifferentiated.

Powder- Coarse, oily, brownish; shows thin walled polygonal cells of epidermis, polygonal thin walled cells of endosperm with rosettes of calcium oxalate crystals of 25 to 30 µ; isodiametric sclereids with simple pits forming unbranched radiating canals measuring from 20 to 28 µ in diameter, laterally compressed sclereids measuring 300 to 900 µ long and 20 to 30 µ wide, fibrous tissue and xylem elements with annular and spiral thickenings.

IDENTITY, PURITY AND STRENGTH-

Foreign matter - Not more than 2 per cent, Appendix 2.2.2
Total ash - Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash - Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive - Not less than 35 per cent, Appendix 2.2.6
Water-soluble extractive - Not less than 12 per cent, Appendix 2.2.7

T.L.C -

T.L.C. of alcoholic extract on silica gel 'G' plate using *n-hexane:ethyl acetate* (9:1) under UV 366 nm shows fluorescent spots at R_f. 0.15 (blue), 0.48 (green) and 0.83 (blue), on exposure to iodine vapour spots appear at R_f. values, 0.15, 0.25, 0.36, 0.48, 0.83 and 0.92(all yellow), and on spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° spots appear at R_f. 0.15, 0.25, 0.48 and 0.83.

CONSTITUENTS- Epegenin, hydnocarpin, isohydnocarpine methoxyhydnocarpin and fixed oils.

PROPERTIES AND ACTION -

Rasa	: Tikta, Madhura, Kaṣāya
Guṇa	: Snigdha, Tīkṣṇa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Rasāyana, Ubhayatobhāgahara

IMPORTANT FORMULATIONS- Tuvaraka Taila, Tuvarak Guna, Tuvaraka Taila Rasayana, Tuvaraka Tailah

THERAPEUTIC USES- Ānāha (Distension of abdomen due to obstruction to passage of urine and stools), Arśa (Piles), Gṛdhrasī (Sciatica), Gaṇḍamālā (Cervical lymphadenitis), Gulma (Abdominal lump), Jvara (Fever), Kaṇḍu (Itching), Kaphavataja roga (Disorders due to Kapha & Vata dosa) , Kṛmi (Helminthiasis), Kuṣṭha (Leprosy / diseases of skin), Śotha (Oedema), Prameha (Metabolic disorder), Raktavīkāra (Disorders of blood), Tvak roga (Skin diseases), Udara (Urticaria), Udavarta (A condition like partial intestinal obstraction), Vraṇa (Ulcer)

DOSE- Cūrṇa (Powder): 1 to 3 g.

ŪṢANDĪ (Whole Plant)

Ūṣandī consists of the whole plant of *Glinus lotoides* L. Syn. *Mollugo hirta* Thub, *M. lotoides* Kuntz. (Fam. Aizoaceae), a spreading annual herb with white hairy aerial parts, distributed in warmer parts of India in plains and also on hills upto 800 m.

SYNONYMS - Bhissata, Okharadi

REGIONAL LANGUAGE NAMES-

Ben.	: Duserasag
Guj.	: Aakaraadya
Hin.	: Gandibudi
Kan.	: Chandra kaasi soppa
Mar.	: Kothuk, Bhisata
Ori.	: Gandhibuti
Pun.	: Gandibuti
Tam.	: Ciruceruppatai
Tel.	: Chandrasi koora

DESCRIPTION -

a) Macroscopic:

Root -Tap roots well developed, stout, fleshy, long, cream in colour, odour and taste not characteristic.

Stem -Spreading, much branched, villous, bearing pinkish white flowers in axillary fascicles, odour nil and taste not characteristic.

Leaf -Leaves opposite, more than two at nodes, one to two cm in width and 0.5 to 1.5 cm in length and densely villous on both sides, broadly obovate or sub orbiculate, very obtuse at the apex, cuneate at the base, petioles 6 to 10 mm long, slender, hairy, vein inconspicuous, odour nil and taste not characteristic.

b) Microscopic:

Root -TS shows circular outline; epidermis single layer of thick walled cells; four to five layers of thin walled parenchymatous cortex; followed by stele showing anomalous secondary growth; consisting of successive rings of alternate xylem and phloem; xylem consists of solitary wide circular thick walled vessels, in between the successive rings, thin walled parenchyma present; starch grains present; pith absent.

Stem -Cuticle present, epidermis single layered barrel shaped cells; a few cells shows papillary growth, cortex consists of 4 to 5 layers of loosely packed parenchyma, some cells contain druses; two to three layers of stone cells alternating with sclerenchymatous fibers forms the pericycle; stele shows phloem and many solitary circular vessels embedded in thick walled xylem parenchyma; pith large, parenchymatous; starch grains present; a few cells contain druses.

Leaf-

***Petiole* -**TS circular in outline; epidermal cells thin walled with cuticle; epidermal outgrowths of stellate hair mostly dichotomously branched, with four celled stalk; cortical region parenchymatous with intercellular spaces, a few cells contain druses; vascular strand single, deeply arc shaped with many radial files of 2 to 5 xylem elements; phloem present on the abaxial side of the xylem strands; a few layer of ground tissue with smaller cells surround the vascular arc.

***Midrib* -**TS of midrib shows abaxial side slightly curved; epidermal cells single layer, barrel shaped; cuticle present; palisade parenchyma continuous with lamina, two layered followed by 3 to 5 layers loosely arranged spongy parenchyma, some cells contain druses; single vascular strand arc shaped; xylem elements in radial groups; phloem present on the abaxial side of the xylem strands.

***Lamina* -**Dorsiventral; epidermis single layered; cuticle present; two layers of palisade parenchyma followed by loosely arranged spongy parenchyma, some cells contain druses; lower epidermis shows stellate hair dichotomously branched with 3 celled stalk; in surface view abaxial epidermal cell walls sinuous and adaxial slightly wavy; stomata anomocytic type; stomatal number 23 to 25 / mm^2 for abaxial epidermis; 18 to 20 / mm^2 for abaxial epidermis; stomatal index 43 to 45 for abaxial epidermis and 25 to 29 for adaxial epidermis; palisade ratio 2 to 4; vein islet number 4 to 5.

Powder -Greyish green, no characteristic odour and taste, stellate hair druses, fibres, vessels, starch grains measuring upto 5 µ in diameter and elongated pitted stone cells length upto 150 µ narrow lumen.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent, Appendix 2.2.2
Total ash	**-**	Not more than	12	per cent, Appendix 2.2.3
Acid-insoluble ash	**-**	Not more than	1	per cent, Appendix 2.2.4
Alcohol-soluble extractive	**-**	Not less than	8	per cent, Appendix 2.2.6
Water-soluble extractive	**-**	Not less than	23	per cent, Appendix 2.2.7
Fixed oil	**-**	Not less than	3	per cent, Appendix 2.2.8

T.L.C. -

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' F_{254} (0.2 mm thickness) using *toluene: ethyl acetate* (9:1) under UV 254 nm shows spots at R_f. 0.10, 0.17, 0.24, 0.29, 0.46, 0.54, 0.61 and 0.71 (all green). Under UV 366 nm fluorescent spots appear at R_f. 20 (pink) 0.32 (blue), 0.37 (pink), 0.41 (dark pink), 0.49 (blue), 0.54 (pink) and 0.59 (dark pink). On exposure to *iodine vapour* spots appear at R_f. 0.24, 0.65, 0.69 and 0.98 (all brown). On dipping the plate in *vanillin-sulphuric acid reagent* and on heating at 105° for 5 minutes spots appear at R_f. 0.11 (grey), 0.18 (green), 0.29, 0.35 (both grey), 0.39 (green), 0.45, 0.53 (both grey), 0.59 (green), 0.74, 0.80 and 0.98 (all grey).

CONSTITUENTS –Mollugogenol A,B,C,D,E,F and G; mollugocin A and B; β-and γ- sitosterol glucosides; oleanolic acid; apigenin-8-C-glucoside; apigenin-7-rhamnoglucoside; pelargonidin-3-sophorsido-7-glucoside; esculin; sulfuretin; vicenin 2; vitexin.

PROPERTIES AND ACTION -	
Rasa	: Kaṣāya, Tikta

Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Jvaraghna, Kapha-pittahara, Pauṣṭika, Śothahara, Stambhana, Udardapraśamana
IMPORTANT FORMULATIONS – Bhissata Gunah	
THERAPEUTIC USES- Atisāra (Diarrhoea), Raktapitta (Bleeding disorder), Udararoga (Diseases of abdomen), Vidradhi (Abscess), Vraṇa (Ulcer)	
DOSE - Cūrṇa (Powder) : 3 to 6 g.	

VAJRĀNNA (Leaf Base)

Vajrānna consists of the dried sheathy leaf bases of *Pennisetum typhoides* (Burm.) Stapf & C.E. Hubb, Syn. *P. typhoideum* Rich., *P. spicatum* Roem and Schult [Fam. Poaceae (Graminae)], cultivated in the arid and semi-arid regions of central and peninsular India for its fruit used as cereal.

REGIONAL LANGUAGE NAMES-

Ben.	: Bajar, Lahra
Eng.	: Spiked millet, Pearl millet, Bullrush millet
Guj.	: Bajni
Hin.	: Bajra
Kan.	: Sajjai
Mal.	: Mattari
Mar.	: Bajri, Bjr
Ori.	: Gantia, Bajri
Pun.	: Bajra
Tam.	: Kambu, Kampu
Tel.	: Gantelu, Sajjalu, Sajja
Urd.	: Bajra

DESCRIPTION -

a) Macroscopic:

Leaf bases sheathy, recurved, bearing ligules, shining, straw coloured, with smooth adaxial surface and finely lined cream coloured abaxial surface; 1.5 to 2 cm in width and 14 to16 cm in length; venation parallel, lamina absent, odour and taste indistinct.

b) Microscopic:

TS of leaf base shows adaxial and abaxial epidermis, mesophyll and vascular bundles; epidermal cells of adaxial surface are rectangular elongated, compactly arranged; epidermal cells of abaxial surface tabular, some of which are differentiated into bulliform cells but ruptured due to drying of the leaf; mesophyll undifferentiated, composed of spongy tissue, cells isodiametric, thin walled, filled with chloroplasts and aggregates of prismatic calcium oxalate crystals; some of the mesophyll cells aggregated around vascular bundles to form a bundle sheath filled with starch grains measuring about 10 µ in diameter; vascular bundles linearly arranged in the mesophyll, collateral, closed, xylem towards adaxial surface, phloem towards abaxial surface; xylem contains 3 to 5 vessels, arranged in 'Y' form, 30 to 40 µ in diameter, with annular and spiral thickenings, along with xylem parenchyma and xylem fibres; phloem patch contains sieve tubes, phloem parenchyma and phloem fibres; every vascular bundle is associated with a sclerenchymatous bundle cap towards abaxial surface; sclereids thick walled, compactly arranged, and polygonal; in surface view the intercostal epidermal cells of adaxial surface are axially elongated, rectangular comparatively thin and nearly straight walled, length 100 to 350 µ and width 30 to 55 µ; costal cells linear, thin and straight walled, 250 to 425 µ long 12 to 22 µ broad; intercostal cells of abaxial surface are of two types; rectangular, elongate 80 to 125 µ long 20 to 30 µ broad and squarish, smaller silica cells, 30 to 40 µ long and 20 to 30 µ broad; walls of both the type of cells are deeply sinuate; stomata in both the epidermal layers are paracytic type, with two dumb-bell shaped guard cells, 14 to 25 µ long 4 to 8 µ broad, inner walls thickened with lignin, subsidiary cells two, bean shaped 21 to 30 µ long and 6.5 to 9.5 µ broad, hyaline, situated parallel to the

long axis of guard cells; stomata in both the epidermal layers are arranged in vertical rows; but scattered over intercostal cells in adaxial surface; characteristically restricted to two vertical rows on either side of every vein region on abaxial surface; stomatal index of adaxial surface is 8 or 9 and that of abaxial surface it is 10 or 11.

Powder -Greyish brown in colour, fine in texture, consisting of epidermal cells of adaxial and abaxial surface; cells of adaxial epidermis elongated, walls straight; cells of abaxial epidermis two types – rectangular, with sinuate walls and smaller silica cells; stomata present; sclereids from bundle caps, which are thick walled, isodiametric, 8 to 18 μ in diameter; vessels with annular and spiral thickenings; fibres, and aggregates of prismatic calcium oxalate crystals upto 15 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	- Not more than	2	per cent,	Appendix	2.2.2
Total ash	- Not more than	15	per cent,	Appendix	2.2.3
Acid-insoluble ash	- Not more than	12	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	- Not less than	6	per cent,	Appendix	2.2.6
Water-soluble extractive	- Not less than	15	per cent,	Appendix	2.2.7

T.L.C. -

T.L.C. of alcoholic extract on precoated silica gel 'G' plate using *n-hexane:ethyl acetate* (8:2) under UV 366 nm shows fluorescent zones at R_f. values 0.10, 0.44, 0.50, 0.61, 0.82 and 0.86; on spraying with 5% *methanolic sulphuric acid reagent* and heating the plate for 10 minutes at 105° spots appear at R_f. 0.10, 0.40, 0.44, 0.50, 0.61, 0.82, 0.86 and 0.93.

CONSTITUENTS – Flavonoid, alkaloids, tannins, phenols and saponin.

PROPERTIES AND ACTION –	
Rasa	: Madhura, Kaṣāya
Guṇa	: Rūkṣa, Guru
Vīrya	: Uṣṇa
Vipāka	: Amla
Karma	: Balya, Durjara, Hṛdya, Kaphavātahara, Pittahara, Puṁstvahara, Vātakara
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES- Prameha (Metabolic disorder), Śaitya (Milk), Santarpaṇajanya roga, Sthaulya (Obesity)	
DOSE – Svarasa (Juice): 10 to 20 ml.	

VĀLUKĀ-ŚĀKA (Leaf)

Vālukā-Śāka is the dried leaves of *Gisekia pharnaceoides* L. Syn. *G. molluginoides* Wt. (Fam. Aizoaceae) which is a spreading herb with diffused branches of about 20 to 35 cm in length, distributed in coastal areas and arid zones of India.

SYNONYMS- Vālukā

REGIONAL LANGUAGE NAMES-

Ben.	:	Valuka
Hin.	:	Balukaasaaga
Mal.	:	Panckirai
Mar.	:	Vaaluchi-bhaaji
Tam.	:	Manalkirai
Tel.	:	Eskadantikura

DESCRIPTION-

a) Macroscopic:

Leaves simple, opposite, fleshy and brittle; bulk colour reddish brown to greenish yellow; petiole 1.5 to 3 mm long, slightly groved above; lamina 7 to 13 mm long and 3 to 7 mm broad, elliptic, oblong to oblanceolate in shape, glabrous; tip obtuse and apiculate, base cuneate, narrow and unequal; margin entire; slightly recurved, veins obscure; slightly bitter and no characteristic odour.

b) Microscopic:

Dorsiventral in nature; TS shows recurved margin with narrow deep furrowed midrib; upper epidermis single layer of large cells with cuticle; followed by one or two layers of palisade; vascular bundle horse shoe shaped, with 12 to 16 xylem vessels in a row in the centre; phloem just below the xylem; parenchymatous cells present above the xylem; and below the vascular bundle there is a patch of polygonal parenchyma cells extending to the lower epidermis; small, oval starch grains present in most of the parenchymatous cells; many acicular calcium oxalate crystals of length 34 to 44 μ scattered throughout and also as raphides in lower spongy parenchyma; stomata anomocytic.

Powder- Powder grey with a brownish tinge, microscopic observation shows compact polygonal epidermal parenchyma with anomocytic stomata; oval or round starch grains, 20 to 25 μ across, with a linear hilum; needle shaped calcium oxalate crystals, 38 to 58 μ long, pitted and spiral vessels.

IDENTITY, PURITY AND STRENGTH-

Foreign matter - Not more than 2 per cent**,** Appendix 2.2.2
Total ash - Not more than 12 per cent, Appendix 2.2.3
Sulphated ash - Not more than 20 per cent, Appendix 2.2.4
Acid-insoluble ash - Not more than 1 per cent, Appendix 2.2.6
Alcohol-soluble extractive - Not less than 7 per cent, Appendix 2.2.7
Water-soluble extractive - Not less than 30 per cent, Appendix 2.2.8
T.L.C. -

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using *n-hexane:chloroform:methanol* (4:5:1) after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105°

for 5 minutes, shows spots at R_f. 0.10 (light pink), 0.20 (light pink), 0.37 (light pink), 0.60 (light pink), 0.68 (light pink),0.77 (light pink), 0.83 (pink) 0.92 (light pink) and 0.98 (dark pink).

CONSTITUENTS- Oxalic, tartaric, citric and succinic acids besides triacontane, myristone, tetracosanol and dotriacontane.

PROPERTIES AND ACTION -

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu, Rūksa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Anulomana, Kṛmighna, Kuṣṭhaghna, Durgandhanāśana

IMPORTANT FORMULATIONS- Lavaṅgādhya - cūrṇa, Baluka Guna

THERAPEUTIC USES- Kaṇḍu (Itching), Kṛmi (Helminthiasis), Kuṣṭha (Leprosy / diseases of skin), Raktapitta (Bleeding disorder)

DOSE- Cūrṇa (Powder)**:** 3 to 6 g.

VANYA-AŚVAGOLA (Fresh Leaf)

Vanya-aśvagola consists of fresh leaves of *Plantago lanceolata* L. (Fam. Plantaginaceae), a small herb found in Western Himalayas. It is also cultivated through out the greater part of India.

SYNONYMS – Vanya-iṣadgola, Meṣa-jihvā

REGIONAL LANGUAGE NAMES-

Ben. : Bartung
Eng. : Ribwort
Hin. : Baltanga, Jangali isabgola
Kan. : Siriportlagida
Mar. : Baltang
Pun. : Kashur-gul
Tel. : Adavi ishapugorulu
Urd. : Bartang

DESCRIPTION -

A perennial plant with a rosette of lanceolate ribbed leaves which grow from the root-stalk, petioles margined; leaves green, 7.5 to 20 by 2 to 2.5 cm, multicostate, convergent venation, 3 to 5 ribbed, margin entire, lamina tapering downwards in a short broad and curved stalk; taste and odour characteristic.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix	2.2.2
Total ash	**-**	Not more than	24.5	per cent,	Appendix	2.2.3
Acid - insoluble ash	**-**	Not more than	1.7	per cent,	Appendix	2.2.4
Alcohol - soluble extractive	**-**	Not less than	12	per cent,	Appendix	2.2.6
Water - soluble extractive	**-**	Not less than	35	per cent,	Appendix	2.2.7

T.L.C. –

Take 2 g of the dried, powdered drug and extract with methanol (2 x 25 ml), by refluxing on a waterbath. Filter and concentrate the pooled extract. Adjust the volume to 10 ml with ethanol and apply about 20 µl on precoated silica gel 'G' 60 F_{254} plate (thickness 0.2 mm).

T.L.C. of the methanolic extract on precoated silica gel 'G' plate using *toluene: ethyl acetate:formic acid: methanol* (3:3:0.8:0.2), after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^{o} for 5 minutes, shows spots R_f. 0.11 (green), 0.17 (orange),0.37 (violet), 0.46 (violet), 0.53 (light purple), 0.59 (purple), 0.69 (pink), 0.78 (violet), 0.91 (light purple) and 0.98 (light purple).

CONSTITUENTS -Chlorogenic acid, chrysophanic acid, emodin, luteolin, plantaginin, scutellarin, aesculetin.

PROPERTIES AND ACTION –

Rasa : Kaṣāya, Madhura
Guṇa : Snigdha, Guru
Vīrya : Śīta
Vipāka : Madhura

Karma : Mūtrala, Rakta-stambhana, Rasāyana, Śothahara, Srṁsana, Vedanāśāmaka

IMPORTANT FORMULATIONS – Used as single drug

THERAPEUTIC USES -Arśa (Piles), Karṇaśūla (Otalgia), Asṛagdara (Menorrhagia or metrorrhagia or both), Dantaśūla (Tooth ache), Kāsa (Cough), Raktasrāva (Haemmorhage), Śotha (Oedema), Śvāsa (Asthma), Vraṇa (Ulcer)

DOSE – Patra Svarasa (Leaf Juice): 5 to 10 ml.

VETRA (Rhizome)

Vetra is the dried rhizomes of *Calamus rotang* L. (Fam. Arecaceae) a thorny climbing shrub occurring in central and southern India. It is restricted to the plains along the backwaters and coasts.

SYNONYMS – Vetraka, Romaśara, Tejana

REGIONAL LANGUAGE NAMES-

Ben.	: Chaachi bet
Eng.	: Cane, Common rattan
Guj.	: Netar
Hin.	: Beta, Vet, Bent
Kan.	: Betasu
Mal.	: Chural
Mar.	: Veta, Thor veta
Ori.	: Beta
Tam.	: Pirampu
Tel.	: Sanna Bettamu, Pemu

DESCRIPTION –

a) Macroscopic:

Rhizome horizontal and branched; woody, stiff and rough in texture; light grey to brown in bulk; individual pieces tortuous in shape, size ranging from 1 to 5 cm long and 1 to 4 cm in cross section; cut surface shows an inner creamy ring and an outer brownish narrow ring; rhizome marked with wavy annulations at the nodes; internodal length ranges from 3 to 12 mm; with roots arising from the internode; fracture, very tough, fibrous; no characteristic odour bitter in taste.

b) Microscopic:

TS of rhizome circular in outline; epidermis single layered; cortical cells thin walled, parenchyma polygonal towards the epidermis and gradually become circular, with intercellular spaces; cortex shows many resin canals which are red in colour; scattered circular patches of sclerenchymatous cells, about 200 µ in dia. present , followed by an endodermis of a single layer of elongated cells; vascular bundles many, scattered, each circular in outline and has a sclerenchymatous cap; phloem consists of phloem parenchyma, sieve tubes and companion cells; xylem with a large vessel of 62 to 88 µ dia. and with 1 to 3 smaller vessels; starch grains oval or circular in shape and present in many cells in cortex and stele.

Powder -Cream to brown, bitter to taste and with no characteristic odour; microscopic observation shows starch grains of about 5 µ across and round to oval in shape; stone cells of about 35 µ width and triangular to oval in shape with a narrow lumen; reddish resinous masses; slender and wiry fibres of approximately 10 µ width; pitted and spiral vessels and wood parenchyma.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 3 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 9 per cent, Appendix 2.2.7

T.L.C. –

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thickness) using *n-hexane: chloroform* (3:7) as after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^{o} for 5 minutes shows spots at 0.28 (yellow), 0.33 (pink), 0.45 (light pink), 0.51 (yellow), 0.67 (light pink), 0.72 (yellow), and 0.88 (pale yellow).

CONSTITUENTS -Saponins, alkaloids and flavonoids.

PROPERTIES AND ACTION -	
Rasa	: Kaṭu, Tikta
Guṇa	: Laghu
Vīrya	: Śita
Vipāka	: Kaṭu
Karma	: Cedana, Dīpana, Kaphahara, Mūtrala, Pittahara, Viṣaghna
IMPORTANT FORMULATIONS –Venta Guṇa	
THERAPEUTIC USES- Arśa (Piles), Aruci (Tastelessness), Aśmarī (Calculus), Dāha (Burning sensation), Jvara (Fever), Kāsa (Cough), Kuṣṭha (Leprosy / diseases of skin), Mūtrakṛcchra (Dysuria), Prameha (Metabolic disorder), Pravāhikā (Dysentery), Raktapitta (Bleeding disorder), Śotha (Inflammation), Tṛṣṇā (Thirst), Tvakroga (Skin diseases), Visarpa (Erysepales), Yoniroga (Disease of female genital tract)	
DOSE – Kvatha (Decoction): 50 to 100 ml. Curna (Powder): 5 to 10 g.	

VISANIKA (Whole Plant)

Visanika is the whole plant of *Pergularia daemia* (Forsskal) Choiv. Syn. *Daemia extensa* (Jacq.) R.Br. (Fam. Asclepiadaceae), a laticiferous twiner found in the plains throughout the hotter parts of India.

SYNONYMS - Uttamarani, Yugmaphata

REGIONAL LANGUAGE NAMES-

Ben.	:	Chhagal bete
Guj.	:	Amaradudheli, Nagaladudhi
Hin.	:	Utaran
Mal.	:	Veliparuthi
Mar.	:	Mendhadhdhi, Utarana
Ori.	:	Utruli, Juktiruhi
Pun.	:	Karial, Siali
Tam.	:	Uttamani, Velipparuthi
Tel.	:	Gittapakau, Dustapuchettu, Dustuputige

DESCRIPTION -

(a) Macroscopic:

Root - **S**traight or branched, 3 to 7 mm in thickness; pale brown externally and cream coloured in cut surface; fracture short in bark, fibrous and splintery in wood, surface rough; mature roots fibrous; odour hay like and taste bitter.

Stem - Pubescent, pale green to green; 1 to 3 mm diameter and the internodal length 5 to 15 cm; fracture fibrous; pith hollow.

Leaf - Simple, opposite, pubescent, greenish, rarely brownish; petiole 3 to 6 cm, hairy; lamina 5 to 10 cm long and 4 to 9 cm broad, cordate and ovate to broadly ovate, tip acute to acuminate; brittle when dry; margin entire, veins 3 or 4 pairs, alternate, prominent below, about 3 nerves arise from the base.

Flower - Inflorescence umbellate raceme, axillary, peduncle up to 12 cm; pedicels about 2.5 cm, calyx greenish with purple tinge; corolla greenish to cream with purple tinge, pollinia pendulous, yellowish, about 1mm; corona double; ovary bicarpellary; ovules numerous.

Fruit - Follicle, slightly curved, usually in pairs, green; having thick, soft, short, spines throughout; broader at the base and tapering towards the apex, 3 to 7 cm long and 0.5 to 1.5 cm in width.

Seed - Ovate with blunt apex and wavy margin, pale to dark brown in colour, 4 to 6 mm in length, comose with tuft of long, white, silky hairs at apex; surface minutely pubesent.

(b) Microscopic:

Root: TS shows cork composed of elongated, lignified cells of about 20 rows; cortical cells elongated or polygonal; latex cells present in the cortex, cluster of calcium oxalate crystals present in the cortical cells; starch grains also present in most of the cortex and xylem parenchyma; cambium distinct; xylem parenchyma, vessels and tracheids thick walled and lignified; medullary rays uniseriate.

Stem - TS circular in outline; epidermis covered by a thin cuticle; trichomes unicellular 30 to 90 µm in length or multicellular-uniseriate 125 to 400 µm, occasionally with collapsed cell; a single layer of collenchyma followed by cortex of 5 to 12 layers of round to polyhedral cells with interspaces; endodermis present; sclerenchymatous patches of fibres forming a discontinuous pericycle; phloem with companion cells and sieve tubes; xylem forms a continuous ring composed of xylem vessels with much larger ones towards periphery and tracheids with smaller vessels and xylem parenchyma in the rest of the area; broken ring of phloem patches present internal to the xylem and in the periphery of the pith; cells of pith circular to polygonal with intercellular spaces; many laticifers present in the cortex and pith; cluster crystals of calcium oxalate present in the cortex and pith where seen.

Leaf –

Petiole - TS circular in outline with a groove on the adaxial side; epidermis with a thick cuticle; unicellular and multicellular uniseriate trichomes present, followed by 2 or 3 layers of collenchyma, and a cortical region of 5 to 12 layers of parenchyma; stele crescent shaped with about 20 vertical rows of xylem and phloem patches on either side of the xylem; smaller vascular strand with a few xylem vessels present laterally placed on either side of the groove.

Midrib - TS along the midrib shows slightly convex above and prominent below; epidermis followed by 2 to 4 layers of collenchyma on either side of the midrib; cortical parenchyma cells circular to polygonal with intercellular spaces; vascular bundle crescent shaped with xylem in the middle and phloem on either side.

Lamina - Upper epidermis covered by a thin cuticle followed by a single layer of palisade cells; spongy mesophyll of irregular polyhedral cells present; lower epidermal cells smaller than the upper; stomata present only on the lower side, anomocytic; unicellular and multicellular- uniseriate trichomes present; laticifers present throughout.

Powder -Light brown, slightly bitter, no characteristic odour; microscopic examination shows globular to ovate starch grains with central hilum, 10 to 20 µm in size; rosette crystals 10 to 30 µm across and clustered crystals of calcium oxalate; unicellular trichomes of 30 to 90 µm length; multicellular uniseriate trichomes of 130 to 400 µm length; several with collapsed cells; long wiry fibres; elongated stone cells of 70 to 200 µm length; tissue with linear rows of sclerenchymatous cells; vascular elements; spiral, annular, scalariform, reticulate, simple pitted and border pitted vessels; tracheids and epidermal tissue with anomocytic stomata.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	**:**	Not more than 2 per cent, Appendix 2.2.2
Total ash	**:**	Not more than 11 per cent, Appendix 2.2.3
Acid-insoluble ash	**:**	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	**:**	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	**:**	Not less than 14 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2mm thickness) using *n-hexane: chloroform* (3:7), after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105° for 5 minutes, shows spots at R_f. 0.19 (pink), 0.27 (light pink), 0.31 (light pink), 0.39 (violet), 0.42 (light pink), 0.72 (deep violet), 0.79 (pink) and 0.83 (light pink).

CONSTITUENTS - Several cardenolides such as calotropin, calactin, calotropagenin, uzarigenin, coroglaucigenin and triterpenoids, β– amyrin and lupeol.

PROPERTIES AND ACTION –

Rasa	:	Kaṭu, Kaṣāya
Guṇa	:	Laghu, Rūksa, Viṣada
Vīrya	:	Anuṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphaniḥsāraka, Dīpana, Virecana, Kuṣṭhaghna

IMPORTANT FORMULATIONS – Vriscikali Guna

THERAPEUTIC USES -Mahākuṣṭhā (Group of major skin diseases), Agnimāndya (Digestive impairment), Vibandha (Constipation),Yonidoṣa (Disorder of female genital tract), Śvāsa (Asthma), Śotha (Inflammation), Mūtrakṛcchra (Dysuria)

DOSE - Cūrṇa (Powder): 1 to 3 g.

VṚNTĀMLAPHALA (Fruit Rind)

Vṛntāmlaphala consists of the fruit rind of *Garcinia pedunculata* Roxb. (Fam. Guttiferae), a tall stately tree 60 m high with fluted trunk and rather short spreading branches, with fruits of about 10 to 12 cm in length and about 8 cm in width found sporadically in upper Assam up to an altitude of 3000 feet and in Manipur; occasionally cultivated; fresh mature fruits are cut and rind dried before use.

SYNONYMS - Vṛntāmlaphala

REGIONAL LANGUAGE NAMES-

Ass.	: Borthekera
Ben.	: Tikul, Tikur, Thaikal
Hin.	: Amalbeda
Kan.	: Chaarigehuli
Tam.	: Pulivanchi
Tel.	: Pullaprabbali
Urd.	: Amalbeda

DESCRIPTION -

a) Macroscopic:

Freshly dried drug occurs as curved and flat pieces of rind of about 7 cm in length and about 0.2 cm in thickness, leathery, pliable, non fibrous, blackish brown in colour; some of the pieces bear pedicels and the remnants of the persistent calyx having four lobes; no characteristic odour, taste sour;

b) Microscopic:

Pedicel -TS of pedicel shows wavy outline; epidermis single layered; thick cuticle present; cortex parenchymatous with thick walked cells showing intercellular spaces; prismatic and rosette crystals of calcium oxalate and brown contents present throughout cortex; secretory canals present all over the region; pericycle discontinuous with patches of collenchyma; stele shows wavy outline with a continuous band of phloem and xylem interrupted by medullary rays; pith large, parenchymatous showing several isolated anomalous amphicribral vascular bundles at the periphery.

Fruit -TS of fruit rind shows single layered epidermis; cuticle present; unicellular trichome occasionally present; mesocarp parenchymatous; prismatic and rosette crystals of calcium oxalate and brown contents present in cells of several layers of mesocarp, just below the epidermis; secretory cells present all over the region; middle and inner mesocarp shows amphicribral vascular bundles with a clear endodermis.

Powder -Parenchyma cells of epidermal tissue of pedicel in surface view showing paracytic stomata, spiral and scalariform vessels from rind trichomes, rosette crystals of calcium oxalate, non septate fibres up to 400 µ. in length from pedicel.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than	2	per cent,	Appendix 2.2.2
Total ash	-	Not more than	3	per cent,	Appendix 2.2.3

Acid-insoluble ash	-	Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 39 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 42 per cent, Appendix 2.2.7
Fixed oil	-	Not less than 1 per cent, Appendix 2.2.8

T.L.C-

T.L.C. of dichloromethane extract on aluminium plates precoated with silica gel 'G' 60 F_{254} (0.2 mm thickness) using *toluene: ethyl acetate* (5:1.5) under UV 366 nm shows fluorescent zones at R_f. 0.55, 0.93 and 0.96 (all blue). Under UV 254 nm spot appears at R_f.0.3 (green). On exposure to *iodine vapour* spots appear at R_f. 0.61 and 0.65 (both yellow). On dipping in *vanillin-sulphuric acid* and on heating for 5 minutes at 105° shows spots at R_f. 0.25 (blue), 0.44 (greenish blue), 0.84 (dark blue) and 0.95 (greenish blue).

CONSTITUTENTS - Pedunculol; garcinol; cambogin.

PROPERTIES AND ACTION-

Rasa	: Amla, Kaṣāya
Guṇa	: Rūkṣa, Tīkṣṇa, Snigdha, Laghu
Vīrya	: Uṣṇa
Vipāka	: Amla
Karma	: Anulomaka, Bhedana, Dīpana, Kaphahara, Mūtrala, Pācana, Vātahara

IMPORTANT FORMULATIONS-Amlavetasa Guna, Amlavetasa Phala, Amlavetasa Phala Guna

THERAPEUTIC USES- Ānāha (Distension of abdomen due to obstruction to passage of urine and stools), Ajīrṇa (Indigestion), Aśmarī (Calculus), Arśa (Piles), Aruci (Tastelessness), Gulma (Abdominal lump), Hṛdroga (Heart disease), Hikkā (Hiccup), Kṛmi (Worm infestation), Kāsa (Cough), Plīhāroga (Splenic disease), Śūla (Pain / Colic), Śvāsa (Asthma), Udāvarta (Upward movement of gases), Vibandha (Constipation)

DOSE -Svarasa (Juice): 5 to 10 ml.

VṚŚCIKAKANDA (Rhizome)

Vṛścikakanda consists of dried rhizomes of *Doronicum hookeri* C.B.Clarke (Fam. Asteraceae), a robust herb growing in the Sikkim and Himalaya region between 3500 to 4200 m.

REGIONAL LANGUAGE NAMES-

Pun. : Daarunaj-akrabi
Urd. : Darunaj Aqrabi

DESCRIPTION -

a) Macroscopic:

Brown irregular pieces 3 to 5 cm long and 0.2 to 0.8 cm in width; scale leaf scars present; fracture smooth, taste starchy, astringent, odour present but not specific.

b) Microscopic:

TS of rhizome shows 3 or 4 layers of cork containing thin walled cells; cortex parenchymatous; vascular bundles numerous, arranged in a ring in the outer region of the cortex, each surrounded by a bundle sheath of sclerenchymatous fibres; phloem present towards the periphery and xylem towards the pith region, almost all the cells of cortex and pith are compactly filled with simple starch grains of various size ranging from about 10 to 60 µ; some cells of the cortex are filled with yellowish brown colouring matter.

Powder -Light yellowish brown, shows simple and compound starch grains of various sizes, about upto 60 µ and spherical, sub-spherical to ovoid in shape with a radiate hilum and very faint striations that are visible only in large starch grains; individual or groups of parenchymatous cells filled with starch grains; fibres sclerenchymatous, non-septate, lignified with tapering ends, broad lumened, ranging from 76 to 125 µ in length; xylem vessels with spiral and reticulate thickenings; taste slightly astringent; odour present but not specific.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	**-**	Not more than	2	per cent,	Appendix	2.2.2
Total ash	**-**	Not more than	4	per cent,	Appendix	2.2.3
Acid-insoluble ash	**-**	Not more than	0.7	per cent,	Appendix	2.2.4
Alcohol-soluble extractive	**-**	Not less than	6.6	per cent,	Appendix	2.2.6
Water-soluble extractive	**-**	Not less than	20	per cent,	Appendix	2.2.7

T.L.C. –

Take 2 g of the powdered drug and extract with methanol (2 x 25 ml), by refluxing on a water bath. Filter and concentrate the pooled extract. Adjust the volume to 10 ml with ethanol and apply about 20 µl on precoated silica gel 60 F_{254} plate (0.2 mm thickness).

T.L.C. of the methanolic extract on precoated silica gel 'G' plate using *toluene:ethyl acetate* (5:4) after spraying with *anisaldehyde sulphuric acid reagent* and heating at 105^{o} for 5 minutes, shows spots at R_f. 0.15 (light blue), 0.30 (blue), 0.40 (blue), 0.52 (pink), 0.61 (blue), 0.68 (blue) and 0.77 (blue).

CONSTITUENTS- Essential oil.

PROPERTIES AND ACTION –	
Rasa	: Tikta
Guṇa	: Rūkṣa, Laghu, Sugandhi
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Anulomana, Kaphahara, Viṣaghna, Hṛdbalya, Jvaraghna
IMPORTANT FORMULATIONS – Used as single drug	
THERAPEUTIC USES- Ānāha (Distension of abdomen due to obstruction to passage of urine and stools), Ardita (Facial palsy), Daṁśaviṣa (Poisoning due to bites) (Stink), Garbhāśayaśūla (Uterine pain), Hṛdroga (Heart disease), Pakṣavadha (Paralysis/Hemiplegia), Udaraśūla (Pain in the abdomen), Vṛścika Daṁśa (Scorpian bites (Stink), Vātaroga (Disease due to Vata dosa), Vātika Unmāda (Mania / Psychosis), Granthikajvara (Bubonic plague)	
DOSE -Cūrṇa (Powder): 1 to 3 g.	

DĀRUSITĀ TAILA (Cinnamomum Oil)

Dārusitā Taila is distilled from the dried inner bark of the shoots of coppiced tree of *Cinnamomum zeylanicum* Blume.

SYNONYMS- Tanu tvak taila, Darusita taila, Tvak taila

REGIONAL LANGUAGE NAMES-

Ass.	:	Dalcina taila
Ben.	:	Daaruchini taila
Eng.	:	Cinnamon oil
Guj.	:	Taja taila
Hindi	:	Daalchini taila
Mal.	:	Karuva patte enna
Mar.	:	Daalchini taila
Ori.	:	Daalchini taila
Pun.	:	Daalchini taila
Tam.	:	Karuvāpaṭṭai Eṇṇai
Tel.	:	Dalachini nune
Urdu	:	Rogan- dalachini

DESCRIPTION-

A yellow liquid when freshly distilled, gradually becoming reddish-brown with age; odour and taste, characteristic of Cinnamon, taste sweetish and aromatic.

IDENTITY, PURITY AND STRENGTH-

Optical rotation	:	0º to –2º,	Appendix 3.3
Refractive index	:	1.573 to 1.600,	Appendix 3.1.1
Weight per ml	:	1.000 to 1.040g,	Appendix 3.1.2
Assay	:	Contains not less than 55.0 per cent w/w and not more than 70.0 per cent w/w of cinnamaldehyde, C_9H_8O.	
Microbial limits	:	Complies with API	Appendix 2.4
Pesticide residue	:	Complies with API	Appendix 2.5

PROPERTIES AND ACTION-

Rasa : Madhura, Tikta, Kaṭu

Guṇa : Laghu, Ruksa, Tikṣṇa

Virya : Uṣṇa

Vipāka : Katu

Karma : Ārtavapravartaka, Balya, Dantya, Dipana, Kaṇthya, Mukhadurgandhanasana, Pācana, Pittahara, Pratiduṣaka, Sugandhi, Śukrajanana, Uttejaka, Vātahara, Vātanulomaka, Vraṇaśodhaka, Vrāṇaropaka

IMPORTANT FORMULATIONS- Used as single drug

THERAPEUTIC USES-Ādhmāna (Flatulance with gurgling sound), Āmadośa (Products of impaired digestion and metabolism), Āmāsaya śūla (Peptic ulcer), Āntrika pratidūsaka (Entritis), Arśa (Piles), Chardi (Emesis), Dantaśula (Toothache), Dhvajabhaṇga (Failure of penile erection), Krmi (Helminthiasis/Worm infestation), Ksayaja vraṇa (Tubercular wound), Mukhaśosa (Dryness of mouth), Nādiśula (Acute pain of nerbine origin), Pinasa (Chronic rhinitis/Sinusitis), Prātiśyāya (Coryza), Rājayakṣmā (Tuberculosis), Raktavīkāra (Disorders of blood), Śula (Pain), Trsṇā (Thirst), Vrscika damśa (Scorpion bite)

DOSE- 1 to 3 drops.

STORAGE: Cinnamum oil should be stored in a well- filled, well-closed container, protected from light, and stored in cool place.

GANDHAPŪRA PATRA TAILA

Gandhapūra Patra Taila is the oil obtained by the steeping and fermentation of fresh leaves of *Gaultheria fragrantissima* Wall. (Fam. Ericaceae).

SYNONYMS – Gandhapūrna taila, Carmapatra

REGIONAL LANGUAGE NAMES-

Ben.	:	Gandapuro
Eng.	:	Oil of wintergreen, Indian-Wintergreen
Guj.	:	Gandhapuro
Hindi.	:	Gandpuro, Gandhapuraa kaa tel, Machino
Kan.	:	Gandhapura
Mar.	:	Gandhapura
Ori.	:	Gandhapura
Pun.	:	Gandhapura
Tel.	:	Gandhapura tailam
Urdu.	:	Gandhapura
Latin	:	Oleum Gaultheriale

DESCRIPTION –

Gandpura patra taila consists of colourless or nearly colourless oil; odour-strong, characteristic; taste pungent, soluble in 6 parts of alcohol (70 per cent).

IDENTITY, PURITY AND STRENGTH-

Identification- Take 2 ml of oil, add a drop of *ferric chloride solution*; a violet colour is produced.

Specific gravity	: At 15.5°, 1.180 to 1.187,	Appendix 3.1.2
Optical rotation	: At 25°, 0° to-1°,	Appendix 3.3
Refractive index	: At 20°, 1.537 to 1.539,	Appendix 3.1.1
Assay- Determination of esters (methyl salicylate $C_8 H_8 O_3$.)	: Not less than 98 percent,	Appendix 2.2.25

PROPERTIES AND ACTION-

Rasa	:	Madhura, Tikta, Kaṭu
Guṇa	:	Tikṣṇa, Snigdha
Virya	:	Uṣṇa
Vipāka	:	Kaḷu
Karma	:	Putihara, Saṇgrāhi, Svedala, Uttejaka, Vātahara, Vātānulomaka, Vedanasthapana

IMPORTANT FORMULATIONS- Used as single drug

THERAPEUTIC USES- Āmavāta (Rheumatism), Aṇkuša kṛmi (Hookworm), Atisāra (Diarrhoea), Dantaśula (Toothache), Gṛdhrasi (Sciatica), Jvara (Fever), Nāḍiśūla (Acute pain of nerbine origin), Udarakrmi (Intestinal worms), Vāta-rakta (Gout)

DOSE- 0.1 to 0.5 ml.

GOGHṚTA (Clarified Cow's Butter)

Goghṛta consists of clarified butter derived from cow's milk to which no colouring matter or preservative is added and contains not less than 76.0 per cent of milk fat by weight.

SYNONYMS- Ajya, Havisya, Sarpih, Ghrta

REGIONAL LANGUAGE NAMES-

Ass.	:	Ghee
Ben.	:	Gava Ghee, Gava Ghrit
Eng.	:	Clarified butter
Guj.	:	Ghee
Hindi.	:	Gaya Ghee
Kan.	:	Tuppa
Mal.	:	Pasu Ney, Pasu Nei
Mar.	:	Toop
Ori.	:	Gai Ghia
Pun.	:	Ghee
Tam.	:	Nei
Tel.	:	Neyyi, Nei
Urd.	:	Gaya ka ghee

DESCRIPTION-

An oily liquid or a semi solid at room temperature, granular in texture, colour white to light yellow, odour rich, taste pleasant. It shall be free from animal fats, wax, mineral oil, vegetable oils and fats.

IDENTITY, PURITY AND STRENGTH-

Specific gravity	**-**At 25°C,1.01995 ,	Appendix 3.1.2
Reichert Meissel Value	-24-28,	Appendix 3.14
Moisture	- Not more than 0.5 per cent,	Appendix 2.2.10
Saponification Value	- Not more than 225,	Appendix 3.7
Iodine Value	- Not more than 35,	Appendix 3.8
Unsaponifiable matter	- Not more than 1.5 per cent,	Appendix 3.11
Carotene	- Not less than 2000 IU	
Microbial limits	-Complies with API,	Appendix 2.4
Heavy Metals	-Complies with API,	Appendix 2.3

PROPERTIES AND ACTION-

Rasa	:	Madhura
Guṇa	:	Guru, Snigdha, Mṛdu
Virya	:	Śita
Vipāka	:	Madhura
Karma	:	Agnidipana, Anabhiṣyandi, Ayuṣya, Balya, Cakṣuṣya, Dipana, Hṛdya, Kāntipradā, Medhya, Ojovardhaka, Rasāyana, Rucya, Slesmavardhana, Snehana, Śukravardhaka, Tejobalakara, Tvacya, Vātapittapraśamana, Vayaḥsthpaāna, Viṣahara, Vṛṣya.

IMPORTANT FORMULATIONS- Brahmi ghṛta, Triphala ghṛta, Aśoka ghṛta, Elādi ghṛta, Cāngerī ghṛta, Amṛtā ghṛta

THERAPEUTIC USES- Agnidagdha (Accidental burns), Amlapitta (Hyperacidity), Apasmāra (Epilepsy), Aruci (Tastelessness), Grahaṇī (Malabsorption syndrome), Jīrṇajvara (Chronic fever), Karnasula (Otalgia), Ksataksina (Debility due to chest injury), Mada (Intoxication), Murcha (Syncope), Sirahsula (Headache), Smrtinasa (Loss of memory), Sosa (Cachexia), Unmada (Mania/phychosis), Visamajvara (Intermittent fever), Visarpa (Erysepales), Visavikara (Disorders due to poison), Yonisula (Pain in female genital tract)

DOSE -5 to 20 ml.

GUDA (Jaggery)

Guda is the product obtained by concentrating juice expressed from the stems of *Saccharum officinarum* L. (Fam. Poaceae) with or without prior purification of the juice, followed by cooling.

REGIONAL LANGUAGE NAMES-

Beng. : Guda
Eng. : Jaggery
Hin. : Guda
Kan. : Bella
Mal. : Sarkara
Mar. : Guda
Pun. : Guda
Tam. : Vellam
Tel. : Bellam
Urd. : Guda

DESCRIPTION-

Light yellow to reddish brown solid, blocks or spherical solid forms or in the form of coarse granules (Khandsari); pleasant and characteristic odour; does not show the presence of insects, vegetable debris or fibres when examined with unaided eyes in daylight.

IDENTITY, PURITY AND STRENGTH-

Loss on Drying	:	Not more than 10 per cent (other than that of the liquid or semi-liquid variety), Appendix 2.2.10
Total ash	:	Not more than 6 per cent, Appendix 2.2.3
Acid- insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Water- insoluble matter	:	Not more than 2 per cent, Appendix 2.2.11
Total sugars	:	Not less than 90 per cent, Appendix 5.1.3.2
Sucrose	:	Not less than 60 per cent, Appendix 5.1.7
Sulphur dioxide concentration	:	Not more than 70 ppm, Appendix 5.1.6
Heavy metals	:	Complies with API, Appendix 2.3
Microbial limits	:	Complies with API, Appendix 2.4
Pesticide residue	:	Complies with API Appendix 2.5

PROPERTIES AND ACTION -

Rasa : Madhura, Purāna, Havana
Guna : Snigdha, Isatksāriya
Virya : Nātiśita
Vipaka : Madhura
Karma : Svādukara, Mintra śodhaka, Rakta śodhaka, Nātipittagita, Kaphavrddhikara, Vātaghna, Kṛmivṛddhikara, Balya Vrsya, Medovṛddhikara

IMPORTANT FORMULATIONS – Sharavarignda, Kumariasava, Madhavasava.

THERAPEUTIC USES- Mintrakāra , Vātaroga (Disease due to Vāta Doṣa), Daurbalya (Weakness), Dhātuksaya (Tissue wasting)

DOSE- 5 to 30 g

STORAGE- Should be stored preferably between 20 to 25^{o}, away from heat.

Note -

1. **Purana Guda:** Guda after one year of its preparation and storage is known as Purana Guda and it is considered to possess better properties than Guda and also more wholesome.
2. **Prapurana:** Guda after three years of its preparation and storage is known as Prapuranaguda. It is the best one and useful in all diseases; is suitable for preparation of Arista.
3. Guda stored after preparation for four years should not be used as it looses its potency and causes krmi, svasa, kasa and other diseases.

JALA (Potable Water)

DEFINITION-

Jala is a clear, colourless, odourless liquid, obtained from natural sources such as rain, river and lakes and rendered fit for human consumption; it complies with the standards described below, except where any special requirement is indicated for the Jala to be used.

SYNONYMS- Pānīya, Nīra, Udaka, Salila, Toya, Ambu, Daka, Ambha, Meghapuṣpa, Salira, Apa, Vāri, Paya, Kīlāla, Bhuvana, Kabandha, Puṣkara, Pātha, Varuṇam, Varṣhāmbu

REGIONAL LANGUAGE NAMES-

Ass.	:	Pani
Ben.	:	Jal
Eng.	:	Water
Guj.	:	Paani
Hin.	:	Jala, Paani
Kan.	:	Munik
Mal.	:	Vellam
Mar.	:	Paani
Ori.	:	Paani
Pun.	:	Paani
Tam.	:	Tannir
Tel.	:	Neeru, Neellu
Urd.	:	Pani

IDENTITY, PURITY & STRENGTH-

Colour (Hazen Units)	- Not more than 5	
Odour	- None	
Taste	- Agreeable and refreshing	
Turbidity(NTU)	- Not more than 5	
***p*H**	- 6.5-8.5,	Appendix, 3.1.3
Alkalinity (mg/l)	- Not more than 200	
Total hardness (as $CaCO_3$) mg/l	- Not more than 300	
Iron (as Fe) mg/l	- Not more than 0.3,	Appendix 5.2.5
Chlorides (as Cl) mg/l	- Not more than 250,	Appendix 5.2.12
Residual, free Chlorine mg/l	- Not more than 0.2	
Dissolved Solids mg/l)	- Not more than 500	
Calcium (as Ca) mg/l	- Not more than 75,	Appendix 5.2.12
Copper (as Cu) mg/l	- Not more than 0.05,	Appendix 5.2.4
Manganese (as Mn) mg/l	- Not more than 0.1	
Sulphate (as SO_4) mg/l	- Not more than 200,	Appendix 5.2.12
Nitrate (as NO_3) mg/l	- Not more than 45,	
Fluoride (as F) mg/l	- Not more than 1,	

Phenolic Compounds (as C_6H_5OH) Mg/l	- Not more than 0.001,	Appendix 5.1.1
Heavy Metals	**-**Complies with API,	Appendix 2.3
Arsenic	**-**Complies with API,	Appendix 2.3.1
Microbial Limits		
Coliform Organisms	- Absent,	Appendix 2.4
E.coli	- Absent	
Pesticides (mg/l)	**-** Absent**,**	Appendix 2.5

PROPERTIES AND ACTION-

Rasa	:	Madhura
Guṇa	:	Laghu
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Āhaladana, Alasyahara, Balya, Buddhiprada, Dīpana, Hrdya, Hritvalakara, Kaphahara, Klamahara, Medohara, Nidrahara, Pacana, Pathya, Pittasamaka, Rucya, Santarpaṇa, Saumya, Śramhara, Tarpaṇa, Vātahara, Visahara, Vṛṣya

IMPORTANT FORMULATIONS-Aśvagandhādyariṣṭa Drākṣhāsava Kumāryāsava Jīrakādyariṣṭa

THERAPEUTIC USES –Ajirna (Dyspepsia), Bhrānti (Mental confusion), Chardi (Emesis), Dāha (Burning sensation), Krodha (Anger), Moha (Delusion), Mukhasoṣa (Dryness of mouth), Mūrchā (Syncope), Śoṣa (Cachexia), Tandrā (Drowsiness), Tṛṣṇā (Thirst), Vibandha (Constipation), Viṣavikāra (Disoreders due to poison)

DOSE-Q.S.

KARPŪRA (Natural Camphor)

Karpūra (Natural Camphor) is obtained from the leaves, chipped wood and roots of *Cinnamomum camphora* (L.) Nees & Eberm. (Fam. Lauraceae) and whole plant of *Ocimum kilimandscharicum* Guerke (Fam. Lamiaceae) by hydro distillation process.

SYNONYMS- Ghanasāra, Candra, Himāhvā, Himabāluka, Śitašiva

REGIONAL LANGUAGE NAMES-

Ass.	:	Karpura
Ben.	:	Karpur
Eng.	:	Camphor
Guj.	:	Kapur
Hin.	:	Kapur
Kan.	:	Karpur
Mal.	:	Karpuram, Chutakkapuram
Mar.	:	Kaapur
Ori.	:	Karpur
Pun.	:	Kapura
Tam.	:	Karpuram
Tel.	:	Karpram, Karpuraamu
Urd.	:	Riyaahi Kapphur, Kaaphoraa

DESCRIPTION-

Colourless or white crystals, granules or crystalline masses; odour, penetrating and characteristic; taste, pungent, aromatic, and followed by a sensation of cold. Readily pulverisable in the presence of a little alcohol (95 percent), chloroform, or solvent ether.

IDENTITY PURITY AND STRENGTH-

Identification	-	Volatilises at ordinary temperature and readily burns with a smoky flame.	
Melting Range	-	174° to 179°,	Appendix 3.2.1
Specific Optical Rotation	-	+ 41° + 43° (Synthetic Camphor is the optically inactive, racemic form),	Appendix 3.3.B
Non-Volatile Matter	-	Not more than 0.05 per cent	
Pesticide residue	-	Complies with API,	Appendix 2.5

Assay- Camphor contains not less than 96.0 percent of $C_{10}H_{16}O$, when analysed as below:

Weigh accurately about 0.2 g and dissolve in 25 ml of aldehyde-free alcohol, in a 300 ml flask. Slowly add while stirring 75 ml of dinitrophenylhydrazine solution and heat on a water bath for four hours under reflux. Remove alcohol by distillation, allow to cool, dilute to 200 ml with a 2 per cent v/v solution of sulphuric acid. Set aside for twenty- four hours, filter in tared Gooch crucible, and wash the precipitate with successive quantities of 10 ml of cold water until the washings are neutral to litmus paper. Dry to constant weight at 80° and weigh.

Each g of precipitate is equivalent to 0.458 g of $C_{10}H_{16}O$

PROPERTIES AND ACTION-

Rasa	:	Tikta, Kaṭu, Madhura
Guna	:	Laghu, Tiksna, Snigdha
Virya	:	Śīta
Vipaka	:	Kaṭu
Karma	:	Cakṣuṣya, Durgandhanāsaka, Hŕdya, Lekhana, Madakāraka, Medya, Pācana, Tridoṣahara, Vedanāsthapana, Vrṣya

IMPORTANT FORMULATIONS- Karpūra rasa, Karpūrāsava, Arka Kapūra, Khadirādivatī, Mṛdvīkāriṣṭa

THERAPEUTIC USES- **Ā**dhmāna (Flatulance with gurgling sound), Agnimāndya (Digestive impairment), Amavāta (Rheumatism), Aruci (Tastelessness), Atisāra (Diarrhoea), Dāha (Burning sensation), Dantapūya (Pyorrhoea), Dantašūla (Toothache), Jirnapratišyāya (Chronic sinusitis), Kandu (Itching), Kaṇṭharoga (Disease of throat), Kāsa (Cough), Klaibya (Male impotence), Krmi (Helminthiasis/Worm infestation), Kuṣṭha (Diseases of skin), Medoroga (Obesity), Pārśvašūla (Intercoastal neuralgia and pleurodynia), Sandhišūla (Joint pain), Svāsa (Dyspnoea/Asthma), Tṛṣṇā (Thirst), Tvakroga (Skin diseases), Vicarcikā (Eczema), Viṣavikāra (Disorders due to poison), Visūcikā (Gastro-enteritis with piercing pain), Vṛkkaroga (Renal disorder)

DOSE- 125 to 375 mg.

Note : Karpura (Synthetic)- Synthetic camphor is a racemic mixture and is optically inactive. The properties of synthetic camphor are similar to natural camphor.

LAVANGA TAILA (Clove Oil)

Lavanga Taila is the volatile oil obtained by expression or steam distillation from dried, unopened flower buds of *Syzygium aromaticum* Merril & Perry Syn. *Eugenia caryophyllus* (Spreng) Sprague (Fam. Myrtaceae).

SYNONYMS– Sriprasūna, Devakusuma

REGIONAL LANGUAGE NAMES-

Ass.	:	Lavang, Lan, Long
Beng.	:	Lavang
Eng.	:	Clove
Guj.	:	Lavang, Laving
Hin.	:	Lavanga, Laung
Kan.	:	Lavanga enne
Kash.	:	Rung
Mal.	:	Karampu, Karayampoovu, Grampu
Mar.	:	Lavang
Ori.	:	Labanga
Punj.	:	Laung, Long
Tam.	:	Kirambu Tailam
Tel.	:	Lavangalu
Urdu	:	Qarnful, Laung

DESCRIPTION-

A colourless or pale yellow aromatic liquid when freshly obtained, becoming darker and thicker by ageing or on exposure to air; odour and taste characteristic.

IDENTITY, PURITY AND STRENGTH-

Specific gravity	: 1.047-1.060,	Appendix 3.1.2
Optical rotation	: 0º to –1.5º,	Appendix 3.3.A
Refractive index	: 1.528 to 1.537,	Appendix 3.3.1
Weight per ml	: 1.041 to 1.054g,	Appendix 3.1.2
Microbial limits	: Complies with API,	Appendix 2.4
Pesticide residue	: Complies with API,	Appendix 2.5

Assay- It contains not less than 85% w/v of phenolic substances, chiefly eugenol, $C_{10}H_{12}O_2$ when analysed as follows:

Shake 1ml of oil with 20ml hot water; the water shows not more than a scarcely perceptible acid reaction with blue litmus paper. Cool the mixture, passed the layer of water through a wetted filter, and treat the clear filtrate with one drop of ferric chloride test solution. The mixture has only a transient greyish green colour, but not a blue or violet colour.

Pipette 10 ml of clove oil in a Cassia flask, the neck of which is graduated from 0 to 6 ml at intervals of 0.1ml. Add 75ml of potassium hydroxide solution. Shake the mixture for five min. and heat for ten min. in boiling water, shaking the flask at least three times during heating. Cool to room temperature and when liquids have completely separated, add sufficient potassium hydroxide solution to raise the lower level of the oily layer with in the graduated portion of the flask. Keep aside for 18 hours and read the volume of oily layer. Not more than 1.5ml of oil separates indicating the presence of not less than 85 percent of w/v of total eugenol.

PROPERTIES AND ACTION-

Rasa : Kaṭu, Tikta
Guna : Śnigdha, Laghu
Virya : Sita
Vipaka : Katu
Karma : Agnikrta, Kaphaghma, Mukhasodhaka, Durgandhanasana, Vaktrakledanasana,

IMPORTANT FORMULATIONS – Used as single drug.

THERAPEUTIC USES – Trsnā (Thirst), Garbhiṇichardi (Morning sickness), Dantaveṣtaroga (Gingivitis), Kaphajanya piḍa (Pain due to Kapha Dosa)

DOSE -2 to 6 drops.

STORAGE: Clove oil should be kept in a well-filled, well-closed container, protected from light, and stored at a temperature not exceeding 25º.

MADHU (Honey)

Madhu is a naturally occurring sweet fluid produced by the honeybees by enzymatic transformation of floral nectar ingested by them and deposited in the cells of hives or combs.

The Indian species of honeybees belong to the genus *Apis* of which the common ones are *A. indica*, *A. dorsata* and *A. florea* (Fam. Apidae). In commerce, Madhu may be collected from naturally occurring hives in groves and forests, by pressing and squeezing in the traditional method or may be extracted by centrifugation of the combs containing honey in artificially maintained apiaries. Both have to be filtered before storage or use.

SYNONYMS- Puspasava, Pusparasa, Ksaudra, Madhvika

REGIONAL LANGUAGE NAMES-

Ass.	:	Mahu
Ben.	:	Madhu, Mau
Eng.	:	Honey
Guj.	:	Madh
Hin.	:	Madhu, Sahad
Kan.	:	Jenetuppa
Mal.	:	Then
Mar.	:	Madhu
Ori.	:	Mahu
Pun.	:	Sahad
Tam.	:	Thën
Tel.	:	Ten
Urd.	:	Sahad

DESCRIPTION-

A thick, syrupy, translucent yellow to yellowish brown fluid; taste sweet with a pleasant odour and flavour. When poured on to a tray as a thin layer, no impurities like mould, dirt, beeswax, insect fragments, plant debris or any other objectionable foreign matter should be visible to the naked eye in daylight.

IDENTITY, PURITY AND STRENGTH-

Microscopy:-Take about 20 g (or 15 ml) of sample, after stirring the contents with a glass rod thoroughly, in a 100 ml beaker, dilute with about 20 ml of distilled water and stir with the glass rod to a homogenous mixture. Transfer the same to a centrifuge tube and centrifuge at 3000 rpm for about 5 minutes. Remove the tube and carefully transfer about 30 ml from the top to a second tube, reserving the sediment. Centrifuge similarly the second tube and again remove about 25 ml from the top, this time rejecting it. Combine the sediments, wash the empty tube with about 5 ml of distilled water and add to the combined mixture. Centrifuge the mixture at about 2000 rpm for about two minutes. Pipette off carefully as much of the supernatant without the sediment getting disturbed. Using a tube finely drawn into a capillary, remove small portions from the bottom of the tube and place in a small drop of chloral hydrate solution on a micro slide. Drop a cover slip in place without mountant exceeding the boundary of the cover slip. Prepare several such slides and examine under low and high power. **:** Different types of pollen grains with differing micromorphology must be present, indicating various source plants.

Test for Adulterant: 1.Cotton wick soaked in honey when ignited burns without crepitating noise or any burnt sugar smell, whereas honey adulterated with sugar or jaggery will give typical jaggery or burnt sugar smell on

burning.

2. Furfural Test - Warm a few drops of honey with concentrated hydrochloric acid, add a few crystals of resorcinol. No red colour produced.

Wt. per ml. at 25º : Not less than 1.35, Appendix 3.1.2
Moisture content (LOD) : Not more than 25 per cent by wt., Appendix 2.2.10
Reducing sugars : Not more than 65 per cent by wt., Appendix 5.1.3.1
Sucrose : Not more than 5.0 per cent by wt., Appendix 5.1.7
Fructose-Glucose ratio : Not less than 1 per cent by wt., Appendix 5.1.7
Ash : Not more than 0.50 per cent by wt.,Appendix 2.2.3
Acidity (expressed as Formic acid): Not more than 0.2 per cent by wt. Appendix 2.2.22
Fiehe's Test : Negative Appendix 5.1.4
Aniline Chloride Test : Negative Appendix 5.1.5
Heavy metals : Complies with API, Appendix 2.3
Microbial limits : Complies with API, Appendix 2.4
Pesticide residue : Complies with API, Appendix 2.5

PROPERTIES AND ACTION-

Rasa : Madhura, Kaṣāya

Guṇa : Laghu (Susruta), Guru (Carak), Ruksa, Picchila, Yogāvahī

Virya : Śīita

Vipāka : Kaṭu

Karma : Agnidipana, Cakśusya, Pittapraśamana, Prasādana, Ropana, Sandhāna, Ślesmaprasamana, Śodhana, Tridośapraśamana, Vatapittaghna, Viśaghna

IMPORTANT FORMULATION- Mahdwaasav, Cyavanapraśā, Kutajavaleha.

THERAPEUTIC USES-Arśa (Piles), Atisāra (Diarrhoea), Chardi (Emesis), Dāha (Burning sensation), Hikkā (Hiccup), Kāsa (Cough), Kṛmi (Helminthiasis / Worm infestation), Kṣata (Wound), Kṣaya (Pthisis), Kuṣṭha (Diseases of skin), Medoroga (Obesity), Prameha (Increased frequency and turbidity of urine), Raktapitta (Bleeding disorder), Raktavikāra (Disorders of blood), Śvāsa (Asthma), Tṛṣṇā (Thirst), Visavikara (Disorders due to poison)

DOSE- 1 to 10 ml.

STORAGE - Should be stored preferably at 20 to 25º away from heat; should not be refrigerated.

PEPPERMINṬ- SATVA (Menthol)

Peppermiṇṭ- Satva is the natural laevo rotatory menthol obtained from various species of *Mentha* (Fam. Lamiaceae).

Other Common Name: Pipermint

DESCRIPTION-

Colourless, hexagonal crystals, usually needle-like, or in fused masses or crystalline powder; odour, pleasant and peppermint-like; taste, warm and aromatic, followed by a cool sensation.

IDENTITY, PURITY AND STRENGTH-

Acidity or Alkalinity : A solution in alcohol is neutral to litmus.
Non-volatile matter : Not more than 0.05 per cent,
Melting range : Between 42° and 44°,Appendix 3.2.1
Specific optical rotation : Between -49° and -50°, Appendix 3.3.B
Congealing range : Between 27° and 28°; on prolonged stirring the temperature rises between 30° and 32°, Appendix 3.2.2

Identification-

(A) Dissolve 10 mg in 1 ml of of conc. sulphuric acid and add 1 ml of a 1 per cent w/v solution of vanillin in sulphuric acid; an orange-yellow colour is produced; on adding 1 ml of water the colour changes to violet (distinction from thymol).

(B) Dissolve a few crystals in 1 ml of glacial acetic acid, add three drops of conc. Sulphuric acid and one drop of nitric acid; no green colour is developed (distinction from thymol).

(C) When triturated with about an equal amount of camphor, chloral hydrate or Phenol, the mixture liquefies.

Microbial limits : Complies with API, Appendix 2.4
Pesticide residue : Complies with API, Appendix 2.5

PROPERTIES AND ACTION-

Rasa : Tikta, Kaṭu
Guṇa : Tikṣṇa, Snigdha, Laghu, Viśada
Virya : Uṣṇa
Vipāka : Kaṭu
Karma : Dipana, Kaphahara, Mukha-śodhana, Pācana, Putihara, Śulapraśamana, Uttejaka Vātahara, Vedanāsthāpana

IMPORTANT FORMULATIONS- Used as single drug

THERAPEUTIC USES- Ajirṇa (Dyspepsia), Dantaśūla (Toothache), Jīrṇa jvara (Chronic fever),

Kaphaja vikrāa (Disorders due to Kapha Dosa), Mukha-Roga (Diseases of mouth), Udaraśula (Pain in the abdomen), Śūla (Pain / Colic), Vraṇa (Ulcer)

DOSE- 10 to 30 mg.

STORAGE -Store in well-closed container at a temperature not above 30°.

ŚARKARĀ (Sugar)

Śarkarā is a powder prepared from sugarcane juice by open pan process.

SYNONYMS - Minandi, Matsyaṇḍikā, Sitā, Siktā, Sitopalā, Sukla, Subhra

REGIONAL LANGUAGE NAMES-

Ass.	:	Chini
Ben.	:	Chini
Eng.	:	Sugar
Guj.	:	Shaakar
Hin.	:	Chini
Kan.	:	Sakkare
Mal.	:	Panchasara
Mar.	:	Sakhara
Ori.	:	Chini
Pun.	:	Chini
Tam.	:	Sarkkarai
Tel.	:	Panchadhara, Chekkera
Urd.	:	Sakkara

DESCRIPTION-

A brown to yellowish brown powder with sweet taste. When a representative sample is spread in a thin layer, it should be free from dirt, filth, iron filings and similar foreign matter.

IDENTITY PURITY AND STRENGTH-

Moisture content	: Not more than 1.5 percent by wt.,	Appendix 2.2.10
Acid -Insoluble Ash	: Not more than 0.7 percent by wt.,	Appendix 2.2.4
Sucrose	: Not more than 93 percent by wt.,	Appendix 5.1.7
Sulphur dioxide	: Absent,	Appendix 5.1.6
Calcium Oxide	: Not more than 100 (mg/100g),	Appendix 2.3.9
Heavy Metal	: Complies with API,	Appendix 2.3
Microbial Limit	: Complies with API,	Appendix 2.4
Pesticide Residue	: Complies with API,	Appendix 2.5
Storage	: Should be stored in air tight container.	

PROPERTIES AND ACTION-

Rasa	:	Madhura
Guṇa	:	Snigdha
Virya	:	Sita
Vipāka	:	Madhura
Karma	:	Cakṣuṣya, Dhātuvardhaka, Hṛdya, Pittahara, Vātahara, Vṛṣya

IMPORTANT FORMULATIONS- Cyavanapraśā, Vāsāvaleha, Kantakāryāvaleha

THERAPEUTIC USES- Arśa (Piles), Aruci (Tastelessness), Bhrama (Vertigo), Chardi (Emesis), Dāha (Burning sensation), Daurbalya (Weakness), Jvara (Fever), Kṛmi (Helminthiasis / Worm infestation), Kṣata (Wound), Kṣiṇa (Impaired), Kṣaya (Madātyaya (Alcoholism), Moha (Delusion), Mūrcha (Syncope), Raktapitta (Bleeding disorder), Raktasruti (Haemorrage), Raktavikāra (Disorders of blood), Śrama (Fatigue / Lethargy), Tṛṣṇā (Thirst), Vātarakta (Gout), Viṣavikāra (Disorders due to poison)

DOSE- 5 to 30 g.

SARṢAPA TAILA (Mustard Oil)

Sarṣapa Taila consists of the fixed oil expressed from clean and healthy seeds of *Brassica campestris* L. (Fam. Brassicaceae), cultivated widely in India.

SYNONYMS- Katusneha, Katutaila

REGIONAL LANGUAGE NAMES-

Ass.	:	Sariah
Ben.	:	Sarishaa
Eng.	:	Mustard oil
Guj.	:	Sarasiya Tail
Hin.	:	Kaduva Taila
Kan.	:	Saasve, Saasive
Mal.	:	Kadukuenna
Mar.	:	Shirsiche Taila
Ori.	:	Sorisha Tela
Pun.	:	Sarso ka Saka
Tam.	:	Kaduguennai
Tel.	:	Aavanune
Urd.	:	Rogana Sarsafa

DESCRIPTION-

A pale yellow oil with a slightly pungent recalling sulphurous odour.

IDENTITY, PURITY AND STRENGTH-

Specific gravity at 15^0	: 0.9140-0.9206,	Appendix 3.1.2
Refractive Index at 40^0	: 1.4630-1.4670**,**	Appendix 3.1.1
Essential Oil Content	**:** Not less than 0.4%	Appendix 2.2.12
Acid value	: Not more than 6.0**,**	Appendix 3.9
Iodine value	: Between115and 125**,**	Appendix 3.8
Saponification value	: Between 190 and 198**,**	Appendix 3.7
Unsaponifiable matter	: Not more than 1.5 per cent by weight,	Appendix 3.11
Test for Sulphur	: Positive,	Appendix 5.1.6
Test for Argemone oil	: Negative,	Appendix 2.2.
Heavy Metals	: Complies with API**,**	Appendix 2.3
Microbial limits	: Complies with API,	Appendix 2.4
Pesticide residue	: Complies with API,	Appendix 2.5

PROPERTIES AND ACTION-

Rasa : Tikta, Kaṭu
Guṇa : Snigdha, Tikṣṇa, Laghu
Virya : Uṣṇa
Vipāka : Kaṭu
Karma : Dipana, Garbhāśayottejaka, Kaphara, Kṛmighna, Lekhana, Mūtrajanana, Snehana, Tvacya, Vātahara, Vedanāsthapana, Vidāhi

IMPORTANT FORMULATIONS- Unmatta Taila, Pancānana Taila, Sindurādya Taila, Jirakādya Taila, Arkamanḥsilā Taila

THERAPEUTIC USES- Aṅgamarda (Bodyache), Arśa (Piles), Dantapūya (Pyorrhoea), Duṣṭakṛmi(Worm infestation), Kaṇḍu (Itching), Kasanaroga, Kotha (Urticaria), Krmi (Helminthiasis / Worm infestation), Kustha (Diseases of skin), Netraroga (Diseases of eyes), Pliha (Splenic disease), Siroroga (Disease of head), Slipada (Filariasis), Svetakushtha (Leucoderma), Tvak roga (Skin disease), Vata vikara (Disorder due to Vāta Doṣa), Vrana (Ulcer)

DOSE- 5 to 10 ml.

STORAGE- Should be stored in well closed containers away from heat, preferably between 20 to 25^0.

TAILAPARṆA TAILA (Eucalyptus Oil)

Tailaparṇa Taila is the essential oil obtained by steam distillation of the fresh leaves of *Eucalyptus globulus* Labill or from other species of Eucalyptus (Fam. Myrtaceae).

SYNONYMS- Sugandhapatra taila, Ekalipta, Nilagiri taila, Tailaparna

REGIONAL LANGUAGE NAMES-

Eng.	:	Eucalyptus
Guj.	:	Nilgiri tail
Hin.	:	Nilagiri, Yukeliptus
Kan.	:	Nilagiri enne
Mal.	:	Nilagiri
Mar.	:	Nilagiri
Ori.	:	Nilagiri
Pun.	:	Eucalyptus
Tam.	:	NilagiriTailam
Tel.	:	Nilagiri, Eucalyptus
Urdu	:	Rogan Eucalyptus

DESCRIPTION-

A colourless to pale-yellow liquid; odour, aromatic and camphoraceous; taste, pungent and camphoraceous, followed by a cold sensation.

IDENTITY, PURITY AND STRENGTH-

Wt. per ml at 25º	:	0.901 to 0.920g,	Appendix 3.1.2
Optical rotation	:	5º to + 10º,	Appendix 3.3
Refractive Index (at 25º)	:	1.457 to 1.469,	Appendix 3.1.1
Standard	**:**	It contains not less than 60.0 per cent w/w of Cineole $C_{10}H_{18}O$,	Appendix 2.2.21

Identification Test indicating the presence of Phellandrene - Mix 1 ml oil with 2 ml of glacial acetic acid and 5 ml of light petroleum (b.p/ 60ºto 80º), add 2 ml of a saturated solution of sodium nitrite and shake the mixture gently; no crystalline precipitate forms in the apex layer.

Determination of Aldehydes – Place 10 ml in a glass-stoppered tube about 25 mm. in diameter and 150 mm, long, add 5 ml, of benzene and 4 ml of hydroxyammonium chloride reagent in alcohol (60 per cent), shake vigorously, and titrate immediately with 0.5 N potassium hydroxide in alcohol (60 percent) until the colour changes to yellow. Continue the shaking and neutralizing until the full yellow colour of the indicator is permanent in the lower layer after shaking vigorously for two minutes and allowing separation to take place; the reaction is complete in about fifteen minutes. Repeat the operation using a further 10 ml. of the eucalyptus oil and, as the standard for the end-point, the titrated point of the first determination with the addition of 0.5ml. of 0.5 N potassium hydroxide in alcohol (60 per cent). Not more than 2 ml, of N/2 potassium hydroxide in alcohol (60 per cent) is required in the second determination.

PROPERTIES AND ACTION-

Rasa	:	Kaṭu, Tikta, Kasāya
Guṇa	:	Laghu, Snigdha
Virya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Anulamāna, Dipana, Durgandhanāśaka, Kaphanihsāraka, K¨imighna, Mutrala, Pācana, Pratidusaka, Pūtihara, Śulaghna, Svedajanana, Uttejaka, Vātahara, Vedanāsthāpaka, Visamajvarapratibandhaka

IMPORTANT FORMULATIONS- Pañcaguṇa Taila

THERAPEUTIC USES- Agnimāndya (Digestive impairment), Amāvata (Rheumatism), Bāla pratisyaya (Sinusitis in children) , Bastiśotha (Cystitis) , Dusta vrana (Non-healing ulcer) , Jirnapūyāmeha (Chronic pyaemia) , Jvara (Fever), Kāsa (Cough), Krmi (Helminthiasis / worm infestation), Pinasa (chronic rhinitis / Sinusitis), Pratisyāya (Coryza), Sandhivata (Osteo arthritis) , Siraśūla (Headache), Sūtikā Jvara (Puerperal fever), Śvāsa (Dyspnoea / Asthma), Tvakroga (Skin disease), Yaksmā (Tuberculosis)

DOSE – 1 to 5 drops.

STORAGE- Eucalyptus Oil should be kept in well-filled, well-closed container, protected from light, and stored in cool place.

TILA TAILA (Sesamum Oil)

Tila Taila is a fixed oil expressed from clean and healthy seeds of *Sesamum indicum* L. (Fam. Pedaliaceae) widely cultivated in India. It has light golden colour with pleasant aroma.

SYNONYMS- Taila

REGIONAL LANGUAGE NAMES-

Ass.	:	Tila taila
Ben.	:	Tilataila
Eng.	:	Sesamum oil, Gingely oil
Guj.	:	Tal taila
Hin.	:	Til taila, Tilli taila
Kan.	:	Ellu, Wollelu
Mal.	:	Elluenna
Mar.	:	Tila taila
Ori.	:	Rasi tel
Pun.	:	Tila tail
Tam.	:	Nalennai
Tel.	:	Nuvvulanune
Urd.	:	Rogana taila

DESCRIPTION –

A light golden colour with pleasant aroma. Slightly soluble in *alcohol,* miscible with chloroform, solvent ether, light petroleum and with carbon disulphide. Does not solidify when cooled to 0º.

IDENTITY PURITY AND STRENGTH-

Identification: Shake 2 ml with 1 ml of hydrochloric acid containing 1 per cent w/v solution of sucrose and allow to stand for five minutes; the acid layer acquires a pink colour and changes to red on standing (distinction from other fixed oils).

Specific gravity	: 0.9160-0.9190,	Appendix 3.1.2
Refractive index (at 40º)	: 1.4650 to 1.4665,	Appendix 3.1.1
Wt. per ml (at 25º)	: 0.916 to 0.921g,	Appendix 3.1.2
Acid value	: Not more than 2.0,	Appendix 3.9
Iodine value	: Between 103 and 116,	Appendix 3.8
Saponification value	: Between 188 and 195,	Appendix 3.7
Unsaponifiable matter	: Not more than 1.5 per cent,	Appendix 3.11
Cottonseed oil	: Absent,	Appendix 2.2.19
Microbial limits	: Complies with API,	Appendix 2.4
Pesticide residue	: Complies with API,	Appendix 2.5

PROPERTIES AND ACTION-

Rasa	:	Madhura
Anurasa	:	Tikta, Kaṣāya
Guṇa	:	Snigdha, Guru, Suksma, Vyavayi, Visada, Sara, Vikasi
Virya	:	Usna
Vipaka	:	Madhura
Karma	:	Balya, Cakṣuṣya, Dipana, Garbhāśaya Śodhana, Keśya, Medhya, Sandhāniya, Snehana, Stanyajanana, Tvak prasādana, Vātahara, Vranaropana, Vranaśodhana, Vṛśya

IMPORTANT FORMULATIONS- Narayana, Mrhrmara Taila, Bala Taila

THERAPEUTIC USES-Agnidagdha (Accidental burns), Ardita (Facial palsy), Bhagna (Fracture) , Dantaśūla (Toothache), Kaṇḍu (Itching), Karnaśūla (Otalgia), Kṛmi (Helminthiasis / Worm infestation), Mastiṣka (Brain tonic), Daurbalya (Weakness) , Pakṣāghāta (Paralysis / Hemiplegia), Pūyameha (Gonorrhoea), Siraḥśūla (Headache), Sula (Pain), Vatavikara (Disorders due to Vāta Doṣa), Vrana (Ulcer)

DOSE- 5 to 20 ml.

YAVĀNĪ SATVA (Thymol)

Yavānī satva (Thymol) is a crystalline phenolic component, chemically 2-isopropyl-5-methylphenol) obtained from the volatile oil of *Thymus vulgaris* L. and *Trachyspermum ammi* (L.) Sprague (Fam. Lamiaceae)

SYNONYMS-Yamāni ghanasara

REGIONAL LANGUAGE NAMES-

Ass.	:	Ajaina satva
Ben.	:	Yamaani sattva
Eng.	:	Thymol
Guj.	:	Yavaan sara, Javaain sara
Hin.	:	Ajvayana sat, Ajavaan phulla
Mar.	:	Ovaa phul
Ori.	:	Juaani saram
Pun.	:	Ajvaayan kaa Sat
Tel.	:	Vaamu satva
Urd.	:	Sat-ajavayan

DESCRIPTION-

Colourless crystals or white, crystalline powder; odour; pungent and aromatic, thyme like; taste, pungent and aromatic.

Identification: A solution in alcohol (90 per cent) is optically inactive.

Heat 1 g of the test sample in a test-tube in a water-bath with 5 ml of a 10 per cent w/v solution of sodium hydroxide a clear, colourless or pale-red solution is formed which becomes darker on standing, but no oily drops are separated. On adding a few drops of chloroform and agitating the mixture, a violet colour is produced.

Dissolve a small crystal of the test sample in 1 ml of glacial acetic acid and add 6 drops of sulphuric acid and 1 drop of nitric acid; the liquid shows a deep bluish-green colour when viewed by reflected light.

It sinks in cold water and, when the temperature is raised to about 45^0, it melts and rises to the surface.

IDENTITY PURITY AND STRENGTH-

Melting range : Between 48º and 51ºC, Appendix 3.2.1
Non-volatile matter : Not more than 0.05 per cent
Acidity or Alkalinity : A 4.0 w/v solution in alcohol (50 per cent) is neutral to litmus solution.

Assay: Thymol contains not less than 99 percent of $C_{10}H_{14}O$, when analysed as below:

Weigh accurately about 0.1 g, transfer to an iodine flask and dissolve in 25 ml of 1N sodium hydroxide. Add 20 ml of hot dilute hydrochloric acid and immediately titrate with 0.1 N bromine (1 to 2 ml). Warm the solution to about 75º, add two drops of methyl orange solution and continue the titration slowly, swirling vigorously after each addition, When the colour of the methyl orange is bleached, add two drops of 0.1 N bromine,

shake well, add one drop of methyl orange solution and shake vigorously. If the solution is red, continue the titration, drop wise and with shaking until the red colour does not appear. Repeat the alternate addition of 0.1 N bromine and methyl orange solution until the red colour is discharged after the addition of the methyl orange solution.

Each ml of 0.1 N bromine is equivalent to 0.003755 g of $C_{10}H_{14}O$.

Microbial limits	**-** Complies with API,	Appendix 2.4
Pesticide residue	**-** Complies with API,	Appendix 2.5

PROPERTIES AND ACTION-

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu, Ruksa, Tiksna
Virya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dipana, Lekhana, Pācana, Partidusaka, Slesmaghna, Sulghna, Uttejaka, Vātanulomana, Vedanśamaka, Visaghna

IMPORTANT FORMULATIONS-

THERAPEUTIC USES- Ajirṇa (Dyspepsia), Āmavāta (Rheumatism), Ānāha (Distension of abdomen due to obstruction to passage of urine and stool), Aṅkuśa kṛmi (Hookworms) , Aruci (Tastelessness), Bālātisāra (Infantile diarrhoea), Chardi (Emesis), Dantaśūla (Toothache), Gulma (Abdominal lump), Krm (Helminthiasis / Worm infestation), Mūtrakrcchra (Dysuria), Plihodara (Splenomegaly), Sandhiśūla , Śirahśula (Headache), Tvakroga (skin disease), Udara (Diseases of abdomen), Udaraśūla (Pain in the abdomen), Vātarśa (Dry piles), Visūcikā (Gastro-entritis with piercing pain)

DOSE: 25 to 125 mg.

STORAGE: Store in tightly-closed, light-resistant containers.

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APPENDICES

APPENDIX-1

1.1 APPARATUS FOR TESTS AND ASSAYS

1.1.1 -Nessler Cylinders

Nessler cylinders which are used for comparative tests are matched tubes of clear colourless glass with a uniform internal diameter and flat, transparent base. They comply with Indian Standard 4161-1967. They are of transparent glass with a nominal capacity of 50 ml. The overall height is about 150 mm, the external height to the 50 ml mark 110 to 124 mm, the thickness of the wall 1.0 to 1.5 mm and the thickness of the base 1.5 to 3.0 mm. The external height to the 50 ml mark of the cylinder used for a test must not vary by more than 1 mm.

Sieves for pharmacopoeial testing are constructed from wire cloth with square meshes, woven from wire of brass, bronze, stainless steel or any other suitable material. The wires should be of uniform circular cross-section and should not be coated or plated. There must be no reaction between the material of the sieve and the substance being sifted.

Sieves conform to the following specifications –

Approximate sieve number*	Nominal mesh aperture size mm	Tolerance average aperture size ± mm
4	4.0	0.13
6	2.8	0.09
8	2.0	0.07
10	1.7	0.06
12	1.4	0.05
16	1.0	0.03
--	µm	±µm
22	710	25
25	600	21
30	500	18
36	425	15
44	355	13
60	250	3(9.9) **
85	180	11(7.6)
100	150	9.4(6.6)
120	125	8.1(5.8)
150	106	7.4(5.2)
170	90	6.6(4.6)
200	75	6.1(4.1)
240	63	5.3(3.7)
300	53	4.8(3.4)
350	45	4.8(3.1)

* Sieve number is the number of meshes in a length of 2.54 cm. in each transverse direction parallel to the wires.

** Figures in brackets refer to close tolerances, those without brackets relate to full tolerances.

1.1.3. -Thermometers un Toi di lang thang lan trong bong toi buot gia, ve dau khi da mat em roi? Ve dau khi bao nhieu mo mong gio da vo tan... Ve dau toi biet di ve dau?
http://www.freewebtown.com/gaigoisaigon/

Toi di lang thang lan trong bong toi buot gia, ve dau khi da mat em roi? Ve dau khi bao nhieu mo mong gio da vo tan... Ve dau toi biet di ve dau? http://www.freewebtown.com/gaigoisaigon/

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Indian Standard 4825-1968 and are standardised in accordance with the 'Indian Standard Method of Calibrating Liquid-in-Glass Thermometers', 6274-1971.

The thermometers are of the mercury-in-glass type and are filled with a dried inert gas, preferably nitrogen. They may be standardised for total immersion or for partial immersion. Each thermometer should be employed according to the condition of immersion under which it was standardised. In the selection of the thermometer it is essential to consider the conditions under which it is to be used.

1.1.4. –Ultra-Violet Lamp (For general purposes and for chromatography work)

An instrument consisting of mercury vapour lamp and a filter which gives an emission band with maximum intensity at about 254 nm (near UV rays) and 366 nm (far UV rays) is used. To ensure that the required emission is being given by the lamp, carry out the following test periodically.

Apply to a plate coated with *silica gel* G, 5 µl of a 0.04 per cent w/v solution of *sodium salicylate* in *ethanol* (95%) for lamps of maximum output at 254 nm and 5 µl of a 0.2 per cent w/v solution in *ethanol* (95%) for lamps of maximum output at 365 nm. Examine the spot in a position normal to the radiation. The distance between the lamp and the plate under examination used in a pharmacopoeial test should not exceed the distance used to carry out the above test.

1.1.5. -Volumetric Glassware

Volumetric apparatus is normally calibrated at 27^0. However, the temperature generally specified for measurements of volume in the analytical operations of the pharmacopoeia, unless otherwise stated, is 25^0. The discrepancy is inconsequential as long as the room temperature in the laboratory is reasonably constant and is around 27^0.

Pharmacopoeial assays involving volumetric measurements require the use of accurately calibrated glassware. Volumetric apparatus must be suitably designed to assure accuracy. The design, construction and capacity of volumetric glassware should be in accordance with those laid down by the Bureau of Indian Standards. The tolerances on capacity for volumetric flasks, pipettes and burettes, as laid down in the relevant Indian Standards, are permisibile.

1.1.6. -Weights and Balances

Pharmacopoeial tests and assays require the use of analytical balances that vary in capacity, sensitivity and reproducibility. The accuracy needed for a weighing should dictate the type of balance.

Where substances are to be “accurately weighed”, the weighing is to be performed so as to limit the error to not more than 0.1 per cent. For example, a quantity of 50 mg is to be weighed to the nearest 0.05 mg; a quantity of 0.1 g is to be weighed to the nearest 0.1 mg; and quantity of 10 g is to be weighed to the nearest 10 mg. A balance should be chosen such that the value of three times the standard deviation of the reproducibility of the balance, divided by the amount to be weighed, does not exceed 0.001.

1.1.7. -Muslin Cloth

Muslin cloth is a cotton fabric where warp is 22 per cm±1 and weft is 18 ±1 per centimeter.

Method: Take a cardboard or an aluminium plate with a centimeter square opening. Keep the plate on the cloth to be used, so that the edges on the X or Y axis coincides with a warp or weft yarn in the fabric.Count the number of the threads of both warp and weft within the opening.

APPENDIX - 2

2.1 TESTS AND DETERMINATIONS

2.1.1. - Microscopic Identification

Microscopic identification of the botanical ingredients is a standard for statutory purposes in several solid and semi-solid compound formulations. Microscopic identification tests are confined to those formulations where the botanical ingredients are **not more than ten**, and where they are added *'in situ'* in powder form as '*Praksepa Dravyās'*. Such comminuted ingredients lend themselves for microscopic identification, as they are not drastically changed in cell structure or contents while processing, and appear intact in microscopic slide preparations, after proper treatment.

Appropriate processing for separation and isolation of botanical debris from a formulation without loss of debris, by hand picking, shifting, washing, sedimentation, density separation or by floatation etc., are the preliminary steps. This is followed by clearing the debris in chemical reagents, reacting it with suitable reagents and stains and finally mounting a little part on a slide in a medium of suitable refractive index (see later part) that helps to show the unit structures in good relief. Identification of the discrete, but disoriented units from the botanical ingredients in a formulation will not be possible without proper isolation, and should not be attempted.

Monographs where the test is prescribed give both a relevant method of isolation and diagnostic features specific to the expected ingredients in that formulation. Only a brief method and a few of the characteristics for each ingredient are given, but an analyst may use other methods of isolation and choose more characteristics to draw a correct conclusion.

Although monographs prescribe standards only for the '*Praksepa Dravyas',* characteristics from other ingredients that are processed into extracts or decoctions prior to their addition to a formulation may also be seen in a slide preparation, giving rise to recognisable unique characteristics. In addition, cell or tissue structures common to several ingredients added to a formulation, and therefore not specific to any one of them, would also be present. Caution should therefore be exercised so that such features are not construed as parts from adulterants or substitutes or foreign parts. Proper study of the individual ingredients using authentic material and reference to their monographs in the Ayurvedic Pharmacopoeia for Single Drugs would help avoid errors of this nature. Skill in the recognition of discrete and disoriented tissue components and the knowledge required to ascribe them to their correct source should be acquired by the analyst.

Stains and Reagents for Microchemical Reactions

The Ayurvedic Pharmacopoeia volumes on single drugs already include microchemical reactions for ergastic substances and may be consulted in addition to the following for use on isolated debris:

Acetic acid: Dilute 6 ml of glacial acetic acid with 100 ml of distilled water; *used for identification of cystoliths, which dissolve with effervescence.*

Aniline chloride solution: Dissolve 2 g in a mixture of 65 ml of 30 per cent ethyl alcohol and 15 ml distilled water and add 2 ml of conc. Hydrochloric acid. *Lignified tissues are stained bright yellow.*

Bismarck brown: Dissolve 1 g in 100 ml of 95 per cent of ethyl alcohol; *used as a general stain for macerated material (with Schultze's).*

Breamer's reagent: Dissolve 1 g of sodium tungstate and 2 g of sodium acetate in sufficient quantity of water to make 10 ml yellowish to brown precipitates; *indicate the presence of tannin.*

Chlorinated soda solution (Bleaching solution): Dissolve 75 g of sodium carbonate in 125 ml of distilled water; triturate 50 g of chlorinated lime (bleaching powder) in a mortar with 75 ml of distilled water, adding it little by little. Mix the two liquids and shake occasionally for three or four hours. Filter and store, protected from light. *Used for lighting highly coloured material, by warming in it and washing the tissues thoroughly.*

Canada balsam (as a Mountant): Heat Canada balsam on a water bath until volatile matter is removed and the residue sets to a hard mass on cooling. Dissolve residue in xylene to form a thin syrupy liquid. *Used for making permanent mounts of reference slides of selected debris.*

Chloral hydrate solution: Dissolve 50 g of chloral hydrate in 20 ml of distilled water. *A valuable clarifying agent for rendering tissues transparent and clear, by freeing them from most of the ergastic substances, but leaving calcium oxalate crystals unaffected.*

Chloral iodine: Saturate chloral hydrate solution with iodine, leaving a few crystals undissolved; useful *for detecting minute grains of starch otherwise undetectable.*

Chlorziniciodine (Iodinated zinc chloride solution): Dissolve 20 g of zinc chloride and 6.5 g of potassium iodide in 10 ml of distilled water. Add 0.5 g of iodine and shake for about fifteen minutes before filtering. Dilute if needed prior to use. *Renders cellulosic walls bluish violet and lignified walls yellowish brown to brown.*

Chromic acid solution: 10 g of dissolved in 90 ml of dilute sulphuric acid: *macerating agent similar to Schultze's.*

Corallin soda: Dissolve 5 g of corallin in 100 ml of 90 per cent ethyl alcohol. Dissolve 25 g of sodium carbonate in 100 ml distilled water; keep the solutions separate and mix when required, by adding 1 ml of the corallin solution to 20 ml of the aqueous sodium carbonate solution. Prepare fresh each time, as the mixture will not keep for long. *Used for staining sieve plates and callus bright pink and imparts a reddish tinge to starch grains and lignified tissues.*

Ammoniacal solution of Copper oxide (Cuoxam): Triturate 0.5 g of copper carbonate in a mortar with 10 ml of distilled water and gradually add 10 ml of strong solution of ammonia (sp. gr. 0.880) with continued stirring; *used for dissolving cellulosic materials.*

Eosin: 1 per cent solution in 90 per cent ethyl alcohol; *stains cellulose and aleurone grains red.*

Ferric chloride solution: A per cent solution ferric chloride in distilled water. *Taninn containing tissues coloured bluish or greenish black.*

Glycerin: Pure or diluted as required with one or two volumes of distilled water. *Used as a general mountant.*

Haematoxylin, Delafield's: Prepare a saturated solution of ammonia alum. To 100 ml of this add a solution of 1 g of Haematoxylin in 6 ml of ethyl alcohol (97 per cent). Leave the mixed solution exposed to air and light in an unstopped bottle for three or four days. Filter and add to the filtrate 25 ml of glycerin and 25 ml of methyl alcohol. Allow the solution to stand exposed to light, till it acquires a dark colour (about two months). Refilter and store as a stock solution. Dilute it 3 or 4 times volumes with distilled water. *Stains cellulosic fibers blue; used only on water washed material.*

Iodine water: Mix 1 volume of decinormal iodine with 4 volumes of distilled water. *Stains starch blue, and reveals crystalloids and globoids when present in aleurone grains.*

Iodine and Potassium iodide solution: Dissolve 1 g of *potassium iodide* in 200 ml of distilled water and 2 g of iodine; *stains lignified walls yellow and cellulosic walls blue.*

Lactophenol (Amman's Fluid): *Phenol* 20 g, *lactic acid* 20 g, *glycerin* 40 g, *distilled water* 20 ml dissolve; *reveals starch grains in polarised light with a well marked cross at hilum, and also minute crystals of calcium oxalate as brightly polarising points of light.*

Methylene blue: A solution in 25 ml of *ethyl alcohol* (95 per cent). *A general stain for nucleus and bacteria.*

Millon''s reagent: Dissolve 1 volume of mercury in 9 volumes of fuming nitric acid (sp. Gr. 1.52), keeping the mixture well cooled during reaction. Add equal volume distilled water when cool. *Stains proteins red.*

Naphthol solution: Dissolve 10 g of Naphthol in 100 ml of *ethyl alcohol*; *a specific stain for detection of inulin; cells containing inulin turn deep reddish violet.*

Pholorglucinol: 1 g of *phloroglucinol* dissolved in 100 ml of 90 per cent *ethyl alcohol*; mount debris in a few drops, allow to react for a minute, draw off excess of reagent with a filter paper strip, and add a drop of conc. hydrochloric acid to the slide; *lignified tissues acquire a deep purplish red colour; very effective on water washed material but not in chloral hydrate washed debris.*

Picric acid solution (Trinitrophenol Solution): A saturated aqueous solution made by dissolving 1 g of picric acid in 95 ml of distilled water; *stains animal and insect tissues, a light to deep yellow; in a solution with ethyl alcohol, aleurone grains and fungal hyphae are stained yellow.*

Potash, Caustic: A 5 per cent aqueous solution*; used to separate tenacious tissues of epidermis and also laticiferous elements and vittae, both of which are stained brown.*

Ruthenium red: Dissolve 0.008 g of ruthenium red in 10 ml of a 10 per cent solution of lead acetate; (to be freshly prepared) *used for identification of most kinds of mucilage containing tissues, which turn pink. A 0.0008 g ruthenium red dissolved in 10 ml of distilled water and used immediately stains cuticular tissues in debris to a light pink*.

Safranin: A 1 per cent solution in ethyl alcohol 50 per cent; *used to stain lignified cell walls deep red, even after clearing with choral hydrate.*

Schultze's Maceration fluid: Add isolated debris to 50 per cent conc. *nitric acid* in a test tube and warm over water bath: add a few crystals of *potassium chlorate* while warming, till tissues soften; cool, wash with water thoroughly and tease out for mounting hard tissues; *isolated cell structures are clearly revealed, but the structures are not useful for measurement of dimensions*.

Sudan Red III: Dissolve 0.01 g of sudan red III in 5 ml of *ethyl alcohol* (90 per cent) and 5 ml of pure *glycerin*; *suberised walls of cork cells, and fatty material in cells are stained bright red.*.

Sulphovanadic acid (Mandelin's reagent): Triturate 1 g of ammonium vandate with 100 ml conc. s*ulphuric acid*. Allow the deposit to subside and use the clear liquid. *This is to be prepared fresh; useful for identification of alkaloids, particularly strychnine which turns violet in the cells containing it.*

Refractive Indices of Certain Mountants

Water	1.333
Lactophenol	1.444
Chloral Hydrate solution	1.44 to 1.48
Olive oil	1.46 to 1.47
Glycerol	1.473
Castor oil	1.48
Clove oil	1.53
Cresol	1.53
Cassia oil	1.6
Xylol	1.49
Alcohol	1.36
Chloroform	1.44

2.1.2. Microscopical Methods of Examining Crude Vegetable Drugs

Methods of preparing specimens of crude materials of vegetable drugs for microscopical studies vary, depending on the morphological groups of drugs to be examined and also on the natures of the material i.e., entire, cut or powdered.

I. LEAVES, HERBS AND FLOWERS

For examining leaves, herbs and flowers (entire or cut) under microscope, following methods are employed for clarification:

A. Entire and cut materials

(i) ***Entire materials*** – When examining entire leaves, herbs and flowers, take pieces of leaf (margin and vein of leaves only), herbs (only leaf) and flowers (only calyx and corolla) in test tube. Add a solution of caustic alkali or nitric acid to the test tube and boil for 1-2 minutes, pour the contents into a porcelain dish, drain off the liquid, wash the material with water and leave for sometimes. Remove the pieces of the material from the water with a spatula and put on the slide, add a few drops of the solution of glycerol or chloral hydrate. Crush the material with scalpel and cover with cover slip before examining.

(ii) ***Cut materials*** – For examining cut leaves, herbs and flowers, take several pieces in a test tube and employ the same methods as described for entire materials.

Other methods employed for clarification of the material (leaf and stem) are described below :-

(a) ***Leaf*** – Boil pieces of leaves in a test tube with chloral hydrate for several minutes until completely clarified and then examine them in chloral hydrate solution. After clarification, leaf pieces are divided into two parts with the help of a scalpel or needle, and carefully turn one part. The leaf can be examined from both the dorsal and ventral surfaces.

(b) ***Stem*** – To examine stem material (without leaf) boil pieces in a solution of caustic alkali or in nitric acid. Remove the epidermis with a scalpel or a needle for examining the surface. For examining pressed specimen of stem, take separate tissue and press them with a scalpel on the slide.

B. Powder

For examining characters of the powder take sufficient amount of powder in Chloral-hydrate solution on a slide and cover it with a cover slip, warm over a low flame for a short time.

II. FRUITS AND SEEDS

A. Entire materials

For microscopical examination of fruit and seed take the specimens or outer coat of seed or fruit and examine as described below :

(i) ***Outer Coat*** – For examining the outer coat boil 3 or 4 seeds or fruits in caustic alkali solution in a test tube for 1-2 minutes (outer coat specimens with intensive pigmentation are boiled for longer period). After boiling, place the pieces on slide, remove the layers of the coat and examine them after mounting in glycerol solution.

(ii) ***Section*** – If fruits or seeds are too hard to cut then boil them for 15-30 minutes or more depending on their hardness or keep them in moistening chamber or absorb in water and chloroform solution or soften them with stem and then cut the specimen for examining purpose. For cutting small, flat seeds (which are difficult to hold) place them in a pith or potato slit for section cutting. Small, round or smooth seeds cannot be cut into section in the pith, then in such cases, they may be embedded in paraffin wax blocks for section cutting. For this, a block of paraffin ($0.6 \times 0.5 \times 1.5$ cms. in size) is made and the seed is embedded in the block by making a cavity or a pit in the block with a hot teasing needle. Cut the section with a sharp razor (through the object) together with the paraffin, place them on to the slide, remove paraffin with a needle or wash it with xylene and examine the section in chloral-hydrate solution.

B. Powder

For examining the structure of the cells of the seed coat and the cells of the embryo take a small amount of powder of the material on a slide in glycerol and cover it with a cover slip and examine.

1. ***Starch*** – For examining the presence of starch in the seed, take two specimens, one in iodine solution and the other in water. With iodine solution starch turns blue. Shape and the structure of starch grains can be seen in water and their size is measured.

When examining objects containing starch, prepare specimen by slightly warming in chloral-hydrate solution.

2. ***Fixed Oil*** – For examining the presence of fixed oil, prepare a specimen in a solution of Sudan III droplets of fixed oil are coloured orange pink. When examining objects containing small amount of fixed oil, prepare a specimen by slightly warming in chloral-hydrate solution, and when examining objects containing large amount of fixed oil, then the powder is de-fatted and clarified as follows:

Place 0.5 g. of the powder in a porcelain dish, add 5-10 ml. of dilute nitric acid
and boil for 1 minute, then strain off the liquid through a cloth, wash the residue with hot water and return it to the porcelain dish with a spatula, boil it with 5-10 ml of caustic alkali solution for 1 minute and again strain it through the cloth and wash with water. Examine the residue in a glycerol solution, after the treatment the structure of the layers of the coat and their cells can be seen very distinctly.

3. Mucilage – Prepare a specimen in Ruthenium Red and examine it under a low power microscope or under dissecting microscope. Mucilage appears as pinkish-red or yellow coloured masses.

III. BARKS

A. Entire material

Prepare transverse or longitudinal section of bark. To soften bark break it into pieces of about 1-2 cm long and 0.5-1 cm wide and boil with in a test tube for 1-3 minutes. Soft pieces are then straightened with a scalpel so as to have a exact transverse or longitudinal direction. Cut the section with razor, moisten the surface of the bark with glycerol solution. Remove the sections with a brush and place them on the slide. Thin pieces of the bark are cut by placing them in the pith (potato or carrot). The sections are treated with various reagents before examining.

1. ***Lignified elements*** – For testing lignin add several drops of phloroglucinol and a drop of concentrated hydrochloric acid to the section on a slide then draw off the liquid, immerse the section in chloral hydrate solution and cover with a cover slip (the specimen should not be heated); the lignified elements are coloured crimson. Phloroglucinol can be substituted by saffranine, and the lignified elements are coloured pink. The excessive stain can be washed out with acidified alcohol.

2. ***Starch*** – Starch is detected by treating with iodine solution.

3. ***Tannin*** –Tannin is detected by treating with ferric ammonium sulphate solution (blue-black or green black colour shows the presence of Tannin) or with potassium-bichromate solution (brown colour indicates the presence of Tannin).

4. ***Anthraquinone derivatives*** –Anthraquinone derivatives are detected by treating with alkali solution (blood-red colour shows the presence of anthraquinone derivatives).

B. Cut materials

Prepare small pieces or scraping of bark and boil them for 3-5 minutes in a solution of caustic alkali or potassium hydroxide or in nitric acid solution and then mount in glycerin for examination on a slide covered with a cover slip.

C. Powder

Prepare specimen for examination by placing a little amount of powder on a slide, add 1-2 drops of phloroglucinol and a drop of concentrated hydrochloric acid, cover it with a cover slip, draw off the liquid from one side of the slide with filter paper, and then apply 1-2 drops of chloral-hydrate solution from the other side of the slide, lignified elements are stained crimson-red. Specimen may also be prepared with caustic alkali or ferric ammonium sulphate for this purpose.

IV. ROOTS AND RHIZOMES

A. Entire materials

For anatomical examination of entire roots and rhizomes cut transverse and longitudinal sections. For this, soften small pieces of roots without heating in glycerol solution for 1-3 days, depending on their hardness. The softened roots are straightened with the help of a scalpel in the right direction and then cut a section with the razor. First, cut thicker entire slices and then make thin, smaller sections. Stain the entire slices with phloroglucinol and concentrated hydrochloric acid or with safranin examine the specimen under a dissecting microscope. For micro-chemical test the small and thin sections are examined under microscope, as follows:

1. ***Starch*** – Starch is detected with iodine solution. For this, prepare specimen with water to measure the granule of starch with an occular micrometer.

2. ***Inulin*** –Inulin is detected with Molish's reagent. For this place a little powder on a slide and apply 1-2 drops of naphthol and a drop of concentrated sulphuric acid, if inulin is present, the powder will appear reddish-violet coloured. Starch also gives this test, so the test for inulin can be done in the absence of starch.

3. ***Lignified elements*** –Lignified elements (fibrovascular bundles, mechanical tissue etc.) are detected with phloroglucinol and concentrated hydrochloric acid or safranine solution as mentioned above for barks.

4. ***Fixed oil*** –For fixed oil detection use Sudan IV, as mentioned above for fruits and seeds.

If required for tannin, anthraquinone derivatives test as mentioned above.

B. Cut material

Make small pieces or scrapping of roots or rhizomes and boil them for 3-5 minutes in caustic alkali, or in nitric acid and then make pressed specimen and immerse them in glycerol.

Microchemical tests can be performed with scrapings for various chemicals as mentioned above.

C. Powder

Prepare several specimens of the powder on slides in chloral hydrate solution and perform the above mentioned standard tests for detection of starch, fixed oil, inulin, lignified elements, anthraquinone derivatives, tannins, mucilage, etc.

2.1.3. Types of Stomata

There are several types of stomata, distinguished by the form and arrangement of the surrounding cells. The following descriptions apply to mature stomata.

1. Anomocytic (irregular-celled) –Previously known as ranunculaceous. The stoma is surrounded by a varying number of cells in no way differing form those of the epidermis generally.

2. Anisocytic (unequal-celled) –Previously known as cruciferous or solanaceous. The stoma is usually surrounded by three subsidiary cells, of which one is markedly smaller than the others.

3. Diacytic (cross-celled) –previously known as caryophyllaceous. The stoma is accompanied by two subsidiary cells whose common wall is at right angles to the guard cells.

4. Paracytic (parallel-celled) –Previously known as rubiaceous. The stoma has one each side one or more subsidiary cells parallel to the long axis of the pore and guard cells.

2.1.4. Determination of Stomatal Index

The stomatal index is the percentage of the number of stomata formed by the total number of epidermal cells, including the stomata, each stoma being counted as one cell.

Place leaf fragments of about 5 × 5 mm in size in a test tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minutes or until the fragments become transparent. Transfer a

fragment to a microscopic slide and prepare the mount, the lower epidermis uppermost, in chloral hydrate solution and put a small drop of glycerol-ethanol solution on one side of the cover-glass to prevent the preparation from drying. Examine with a 40x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Mark on the drawing paper a cross (x) for each epidermal cell and a circle (o) for each stoma. Calculate the result as follows:

$$\text{Stomatal index} = \frac{S \times 100}{E + S}$$

Where

S = the number of stomata in a given area of leaf ; and

E = the number of epidermal cells (including trichomes) in the same area of leaf.

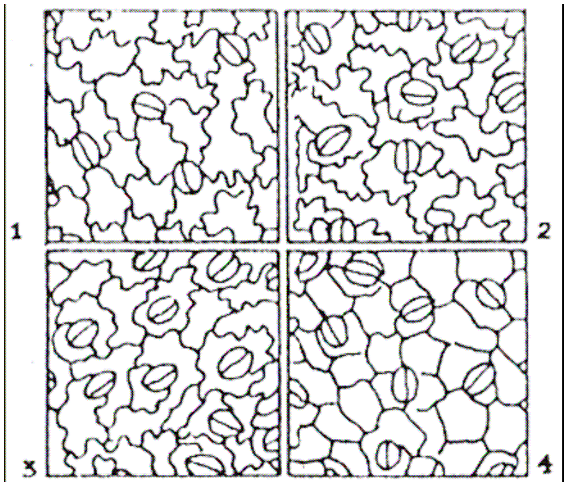

Fig. 1 Various types of stomata

For each sample of leaf make not fewer than ten determinations and calculate the average index.

2.1.5. Determination of Palisade Ratio

Palisade ratio is the average number of palisade cells under one epidermal cell.

Place leaf fragments of about 5 × 5 mm in size in a test-tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minutes or until the fragments become transparent. Transfer a fragment to a microscopical slide and prepare the mount of the upper epidermis in chloral hydrate solution and put a small drop of glycerol solution on one side of the cover-glass to prevent the preparation from drying. Examine with a 40x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Trace four adjacent epidermal cells on paper; focus gently downward to bring the palisade into view and trace sufficient palisade cells to cover the area of the outlines of the four epidermal cells. Count the palisade cells under the four epidermal cells. Where a cell is intersected, include it in the count only when more than half of it is within the area of the epidermal cells. Calculate the average number of palisade cells beneath one epidermal cell, dividing the count by 4; this is the"Palisade ratio" (See Fig. 2).

For each sample of leaf make not fewer than ten determinations and calculate the average number.

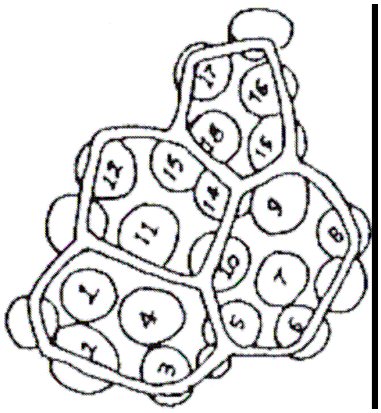

Fig. 2 Palisade ratio= $\frac{18.4}{4} = 4.5$

2.1.6. Determination of Vein-Islet Number

The mesophyll of a leaf is divided into small portions of photosynthetic tissue by anastomosis of the veins and veinlets; such small portions or areas are termed "Vein-Islets". The number of vein-islets per square millimeter is termed the "Vein-Islet number". This value has been shown to be constant for any given species and, for full-grown leaves, to be unaffected by the age of the plant or the size of the leaves. The vein-islet number has proved useful for the critical distinction of certain nearly related species. The determination is carried out as follows :

For Whole or Cut leaves –-Take pieces of leaf lamina with an area of not less than 4 square millimeters from the central portion of the lamina and excluding the midrib and the margin of the leaf. Clear the pieces of lamina by heating in a test tube containing chloral hydrate solution on a boiling water-bath for 30 to 60 minutes or until clear and prepare a mount in glycerol-solution or, if desired, stain with safranin solution and prepare the mount in Canada Balsam. Place the stage micrometer on the microscope stage and examine with 4x objective and a 6x eye piece. Draw a line representing 2 mm on a sheet of paper by means of a microscopical drawing apparatus and construct a square on the line representing an area of 4 square millimeters. Move the paper so that the square is seen in the centre of the field of the eyepiece. Place the slide with the cleared leaf piece on the microscope stage and draw in the veins and veinlets included within the square, completing the outlines of those vein-islets which overlap two adjacent sides of the square. Count the number of vein-islets within the square including those overlapping on two adjacent sides and excluding those intersected by the other two sides. The result obtained is the number of vein-islets in 4 square millimeters. For each sample of leaf make not fewer than three determinations and calculate the average number of vein-islets per square millimeter.

For Leaf Fragments having an area less than 4 square millimeters – Take fragments of leaf lamina each with an area of not less than 1 square millimeter, excluding the midrib and the margin of the leaf. Clear and prepare a mount as stated above. Use a 10x objective and a 6x eyepiece and draw a line representing 1 mm on a sheet of paper by means of a microscopial drawing apparatus and construct a square on this line representing an area of 1 square millimetre. Carry out the rest of the procedure as stated above. The result obtained is the number of vein-islets in 1 square millimetre. For each sample of leaf make no less than 12 determinations and calculate the average number.

2.1.7. Determination of Stomatal Number

Place leaf fragments of about 5x5 mm in size in a test tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minutes or until the fragments become transparent. Transfer a fragments to a microscopic slide and prepare the mount the lower epidermis uppermost, in chloral hydrate solution and put a small drop of glycerol-ethanol solution on one side of the cover glass to prevent the preparation from drying. Examine with a 40 x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Mark on the drawing paper a cross (x) for each stomata and calculate the average number of stomata per square millimeter for each surface of the leaf.

2.2. -DETERMINATION OF QUANTITATIVE DATA

2.2.1. - Net Content

The content of the final or retail pack shall not be less than 98 percent of the declared net content.

2.2.2. - Foreign Matter

The sample shall be free from visible signs of mold growth, sliminess, stones, rodent excreta, insects or any other noxious foreign matter when examined as given below.

Take a representative portion from a large container, or remove the entire contents of the packing if 100 g or less, and spread in a thin layer in a suitable dish or tray. Examine in daylight with unaided eye.Transfer suspected particles, if any, to a petri dish, and examine with 10x lens in daylight.

2.2.3. - Determination of Total Ash

Incinerate about 2 to 3 g accurately weighed, of the ground drug in a tared platinum or silica dish at a temperature not exceeding 450^0 until free from carbon, cool and weigh. If a carbon free ash cannot be obtained in this way, exhaust the charred mass with hot water, collect the residue on an ashless filter paper, incinerate the residue and filter paper, add the filtrate, evaporate to dryness, and ignite at a temperature not exceeding 450^0. Calculate the percentage of ash with reference to the air-dried drug.

2.2.4. - Determination of Acid Insoluble Ash

To the crucible containing total ash, add 25 ml of *dilute hydrochloric acid*. Collect the insoluble matter on an ashless filter paper (Whatman 41) and wash with hot water until the filtrate is neutral. Transfer the filter paper containing the insoluble matter to the original crucible, dry on a hot-plate and ignite to constant weight. Allow the residue to cool in a suitable desiccator for 30 minutes and weigh without delay. Calculate the content of acid-insoluble ash with reference to the air-dried drug.

2.2.5. - Determination of Water Soluble Ash

Boil the ash for 5 minutes with 25 ml of water; collect insoluble matter in a Gooch crucible or on an ashless filter paper, wash with hot water, and ignite for 15 minutes at a temperature not exceeding 450^0. Subtract the weight of the insoluble matter from the weight of the ash; the difference in weight represents the water-soluble ash. Calculate the percentage of water-soluble ash with reference to the air-dried drug.

2.2.6. - Determination of Sulphated Ash

Heat a silica or platinum crucible to redness for 10 minutes, allow to cool in a desiccator and weigh. Put 1 to 2 g of the substance, accurately weighed, into the crucible, ignite gently at first, until the substance is thoroughly charred. Cool, moisten the residue with 1 ml of *sulphuric acid,* heat gently until white fumes are no longer evolved and ignite at $800^0 \pm 25^0$ until all black particles have disappeared. Conduct the ignition in a place protected from air currents. Allow the crucible to cool, add a few drops of *sulphuric acid* and heat. Ignite as before, allow to cool and weigh. Repeat the operation until two successive weighing do not differ by more than 0.5 mg.

2.2.7. - Determination of Alcohol Soluble Extractive

Macerate 5 g of the air dried drug, coarsely powdered, with 100 ml of alcohol the specified strength in a closed flask for twenty-four hours, shaking frequently during six hours and allow to stand for eighteen hours. Filter rapidly, taking precautions against loss of solvent, evaporate 25 ml of the filtrate to dryness in a tared flat bottomed shallow dish, and dry at 105^0, to constant weight and weigh. Calculate the percentage of alcohol-soluble extractive with reference to the air-dried drug.

2.2.8. - Determination of Water Soluble Extractive

Proceed as directed for the determination of alcohol-soluble extractive, using *chloroform-water* instead of ethanol.

2.2.9. - Determination of Ether Soluble Extractive (Fixed Oil Content)

Transfer a suitably weighed quantity (depending on the fixed oil content) of the air-dried, crushed drug to an extraction thimble, extract with *solvent ether* (or *petroleum ether,* b.p. 40^0 to 60^0) in a continuous extraction apparatus (Soxhlet extractor) for 6 hours. Filter the extract quantitatively into a tared evaporating dish and evaporate off the solvent on a water bath. Dry the residue at 105^0 to constant weight. Calculate the percentage of ether-soluble extractive with reference to the air-dried drug.

2.2.10. - Determination of Moisture Content (Loss on Drying)

Procedure set forth here determines the amount of volatile matter (i.e., water drying off from the drug). For substances appearing to contain water as the only volatile constituent, the procedure given below, is appropriately used.

Place about 10 g of drug (without preliminary drying) after accurately weighing (accurately weighed to within 0.01 g) it in a tared evaporating dish. For example, for unground or unpowderd drug, prepare about 10 g of the sample by cutting shredding so that the parts are about 3 mm in thickness.

Seeds and fruits, smaller than 3 mm should be cracked. Avoid the use of high speed mills in preparing the samples, and exercise care that no appreciable amount of moisture is lost during preparation and that the portion taken is representative of the official sample. After placing the above said amount of the drug in the tared evaporating dish, dry at 105^0 for 5 hours, and weigh. Continue the drying and weighing at one hour interval until difference between two successive weighing corresponds to not more than 0.25 per cent. Constant weight is reached when two consecutive weighing after drying for 30 minutes and cooling for 30 minutes in a desiccator, show not more than 0.01 g difference.

2.2.11. - Determination of Water Insoluble Matter

Take 10 gm of sample, add 200 ml hot distilled H2O and bring to boiling. Allow to cool to room temperature. Filter through a tared gooch crucible having a bed of asbestos or sintered glass filter Wash the residue with hot water till the filtrate is sugar-free (perform Molisch test). Dry the gooch crucible or sintered glass filter at 135 20 C and weigh. Express as % insoluble matter.
(Ref :- I.S.I Handbook of Food Analysis (Part II) – 1984 page10)

2.2.12. - Determination of Volatile Oil in Drugs

The determination of volatile oil in a drug is made by distilling the drug with a mixture of *water* and *glycerin,* collecting the distillate in a graduated tube in which the aqueous portion of the distillate is automatically separated and returned to the distilling flask, and measuring the volume of the oil. The content of the volatile oil is expressed as a percentage v/w.

The apparatus consists of the following parts (see Fig.1). The clevenger's apparatus described below is recommended but any similar apparatus may be used provided that it permits complete distillation of the volatile oil. All glass parts of the apparatus should be made of good quality resistance glass.

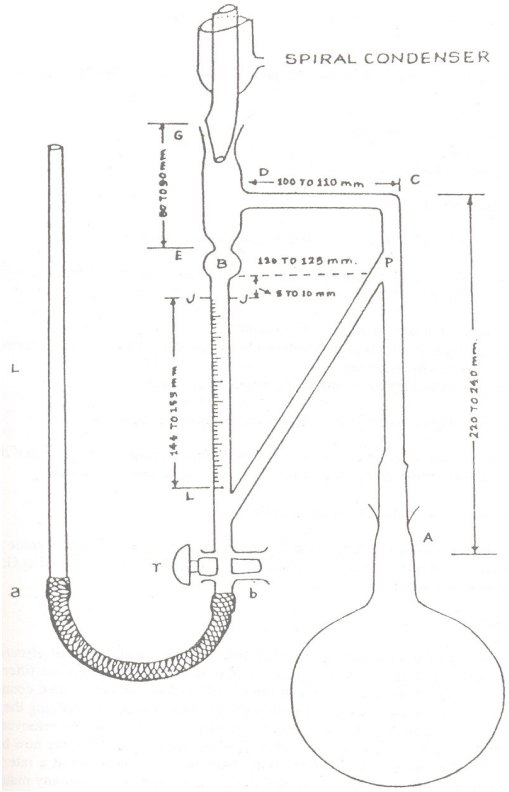

Fig.1 Apparatus for volatile oil determination

The apparatus is cleaned before each distillation by washing successively with *acetone* and *water,* then inverting it, filling it with *chromic sulphuric acid* mixture, after closing the open end at G, and allowing to stand, and finally rinsing with water.

Method of determination

A suitable quantity of the coarsely powdered drug together with 75 ml of *glycerin* and 175 ml of *water* in the one litre distilling flask, and a few pieces of porous earthen ware and one filter paper 15 cm cut into small strips, 7 to 12 mm wide, are also put in the distilling flask, which is then connected to the still head. Before attaching the condenser, water is run into the graduated receiver, keeping the tap T open until the water overflows, at P. Any air bubbles in the rubber tubing a—b are carefully removed by pressing the tube. The tap is then closed and the condenser attached. The contents of the flask are now heated and stirred by frequent agitation until ebullition commences. The distillation is continued at a rate, which keeps the lower end of the condenser cool. The flask is rotated occasionally to wash down any material that adheres to its sides.

At the end of the specified time (3 to 4 hours) heating is discontinued, the apparatus is allowed to cool for 10 minutes and the tap T is opened and the tube L_1 lowered slowly; as soon as the layer of the oil completely enters into the graduated part of the receiver the tap is closed and the volume is read.

The tube L_1 is then raised till the level of water in it is above the level of B, when the tap T is slowly opened to return the oil to the bulb. The distillation is again continued for another hour and the volume of oil is again read, after cooling the apparatus as before. If necessary, the distillation is again continued until successive readings of the volatile oil do not differ.

The measured yield of volatile oil is taken to be the content of volatile oil in the drug. The dimensions of the apparatus may be suitably modified in case of necessity.

2.2.13. - Special Processes Used in Alkaloidal Assays

2.2.13.a - Continuous extraction of drug

Where continuous extraction of a drug of any other substance is recommended in the monograph, the process consists of percolating it with suitable solvent at a temperature approximately that of the boiling point of the solvent. Any apparatus that permits the uniform percolation of the drug and the continuous flow of the vapour of the solvent around the percolator may be used. The type commonly known as the Soxhlet apparatus (see fig. 2) is suitable for this purpose.

2.2.13.b - Tests for complete extraction of alkaloids

Complete extraction is indicated by the following tests:

When extracting with an aqueous or alcoholic liquid - After extracting at least three times with the liquid, add to a few drops of the next portion, after acidifying with 2 *N hydrochloric acid* if necessary, 0.05 ml of *potassium mercuri-iodide solution* or for solanaceous alkaloids 0.05 ml of *potassium iodobismuthate solution;* no precipitate or turbidity, is produced.

When extracting with an immiscible solvent - After extracting at least three times with the solvent, add to 1 to 2 ml of the next portion 1 to 2 ml of 0.1 *N hydrochloric acid,* remove the organic solvent by evaporation, transfer the aqueous residue to a test tube, and add 0.05 ml of *potassium mercuri-iodide solution* for solanaceous alkaloids 0.05 ml of *potassium iodobismuthate solution* or for emetine, 0.05 ml of *iodine solution;* not more than a very faint opalescenece is produced.

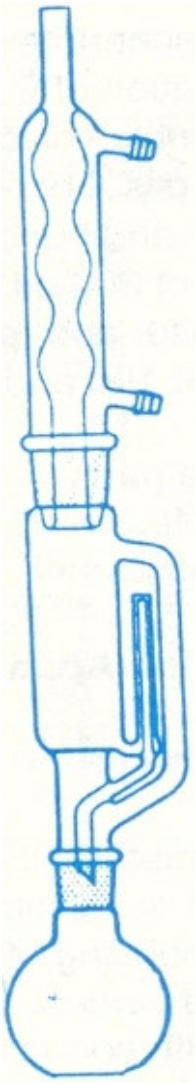

Fig. 2 - Apparatus for the continuous extraction of Drugs (Soxhlet apparatus)

2.2.14. - Thin-Layer Chromatography (TLC)

Thin-layer chromatography is a technique in which a solute undergoes distribution between two phases, stationary phase acting through adsorption and a mobile phase in the form of a liquid. The adsorbent is a relatively thin, uniform layer of dry finely powdered material applied to a glass, plastic or metal sheet or plate. Precoated plates are most commonly used. Separation may also be achieved on the basis of partition or a combination of partition and adsorption, depending on the particular type of support, its preparation and its use with different solvent.

Identification can be effected by observation of spots of identical R_f value and about equal magnitude obtained, respectively, with an unknown and a reference sample chromatographed on the same plate. A visual comparison of the size and intensity of the spots usually serves for semi-quantitative estimation.

Apparatus

(a) Flat glass plates of appropriate dimensions which allow the application at specified points of the necessary quantities of the solution being examined and appropriate reference solutions and which allow accommodation of the specified migration path-length. The plates are prepared as described below; alternatively, commercially prepared plates may be used.

(b) An aligning tray or a flat surface on which the plates can be aligned and rested when the coating substance is applied.

(c) The adsorbent or coating substance consisting of finely divided adsorbent materials, normally 5 µm to 40 µm in diameter is suitable for chromatography. It can be applied directly to the plate or can be bonded to the plate by means of plaster of paris (Hydrated Calcium Sulphate) or with any other suitable binders. The adsorbent may contain fluorescing material to help in visualising spots that absorb ultra-violet light.

(d) A spreader which, when moved over the glass plate, will apply a uniform layer of adsorbent of desired thickness over the entire surface of the plate.

(e) A storage rack to support the plates during drying and transportation.

(f) A developing chamber that can accommodate one or more plates and can be properly closed and sealed. The chamber is fitted with a plate support rack that supports the plates, back to back, with lid of the chamber in place.

(g) Graduated micro-pipettes capable of delivering microlitre quantities say 10 µl and less.

(h) A reagent sprayer that will emit a fine spray and will not itself be attacked by the reagent.

(i) An ultra-violet light, suitable for observation at short (254 nm) and long (365 nm) ultra-violet wavelengths.

Preparation of plates

Unless otherwise specified in the monograph, the plates are prepared in the following manner. Prepare a suspension of the coating substance in accordance with the instructions of the supplier and, using the spreading device designed for the purpose, spread a uniform layer of the suspension, 0.20 to 0.30 mm thick, on a flat glass plate 20 cm long. Allow the coated plates to dry in air, heat at 100^0 to 105^0 for at least 1 hour (except in the case of plates prepared with cellulose when heating for 10 minutes is normally sufficient) and allow to cool, protected from moisture. Store the plates protected from moisture and use within 3 days of preparation. At the time of use, dry the plates again, if necessary, as prescribed in the monographs. Now a days pre coated plates of silica gel on glass/aluminium/ plastic sheets are also available.

Method

Unless unsaturated conditions are prescribed, prepare the tank by lining the walls with sheets of filter paper; pour into the tank, saturating the filter paper in the process, sufficient of the mobile phase to form a layer of solvent 5 to 10 mm deep, close the tank and allow to stand for 1 hour at room temperature. Remove a narrow strip of the coating substance, about 5 mm wide, from the vertical sides of the plate. Apply the solutions being examined

in the form of circular spots about 2 to 6 mm in diameter, or in the form of bands (10 to 20 mm x 2 to 6 mm unless otherwise specified) on a line parallel with, and 20 mm from, one end of the plate, and not nearer than 20 mm to the sides; the spots should be 15 mm apart. If necessary, the solutions may be applied in portions, drying between applications. Mark the sides of the plate 15 cm, or the distance specified in the monograph, from the starting line. Allow the solvent to evaporate and place the plate in the tank, ensuring that it is as nearly vertical as possible and that the spots or bands are above the level of the mobile phase. Close the tank and allow to stand at room temperature, until the mobile phase has ascended to the marked line. Remove the plate and dry and visualise as directed in the monograph; where a spraying technique is prescribed it is essential that the reagent be evenly applied as a fine spray.

For two-dimensional chromatography dry the plate after the first development and carry out the second development in a direction perpendicular to the first.

When the method prescribed in the monograph specifies 'protected from light' or 'in subdued light' it is intended that the entire procedure is carried out under these conditions.

Visualisation

The phrases *ultra-violet light (254 nm)* and *ultra-violet light (365 nm)* indicate that the plate should be examined under an ultra-violet light having a maximum output at about 254 or at about 365 nm, as the case may be.

The term *secondary spot* means any spot other than the principal spot. Similarly, a *secondary band* is any band other than the principal band.

R_f Value

Measure and record the distance of each spot from the point of its application and calculate the R_f value by dividing the distance travelled by the spots by the distance travelled by the front of the mobile phase.

2.2.15. - Starch Estimation (Mont Gomery, 1957) [Spectrophotometric method]

Prepare 10 per cent homogenate of the plant tissue in 80 per cent *ethanol*. Centrifuge at 2000 rpm for 15 minutes. To the residue thus obtained, add 4 ml of *distilled water*, heat on a water bath for 15 minutes and macerate with the help of glass rod. To each of the samples, add 3 ml of *52* per cent *perchloric acid* and centrifuge at 2000 rpm for 15 minutes. The supernatant thus obtained is made upto known volume (generally upto 10 ml or depending on the expected concentration of starch). Take 0.1 ml aliquot, add 0.1 ml of 80 per cent *phenol* and 5 ml conc. sulphuric acid, cool and then read the absorbance at 490 nm.

2.2.16. - Sugar Estimation (Mont Gomery, 1957) [Spectrophotometric Method]

Prepare 10 per cent homogenate of the plant tissue in 80 per cent *ethanol*. Centrifuge at 2000 rpm for 15 minutes. The supernatant obtained is made upto known volume (generally upto 10 ml or depending on the expected concentration of sugar). Take 0.1 ml aliquot, add 0.1 ml of 80 per cent phenol and 5 ml conc. sulphuric acid, cool and then read the absorbance at 490 nm.

2.2.17. - Fatty Oil Estimation

To estimate fatty oils, extract accurately weighed air-dried powdered plant material with *petroleum ether* ($40\text{-}60^0$) in a Soxhlet apparatus. Dry the extract over *anhydrous sodium sulphate* and remove the solvent under vacuum at 40^0. Weigh the residue and calculate the percentage with reference to the weight of plant material used.

2.2.18. - Test for Argemone Oil (Mustard Oil)

Take 2-3 drops of the oil in a dry test tube and mix successively with one drop of liquid phenol and 2-4 ml of conc. Sulphuric acid and shake. A deep red colour develops with in 10-20 seconds if argemone oil is present as adulterant.

2.2.19. - Test for the Presence of Cottonseed oil (Halphen Test)

Take about 5ml of the oil in a test tube and add equal amount of Sulphur solution (1% solution of Sulphur in carbon disulphide and then add an equal volume of amyl alcohol). Mix thoroughly by shaking and heating gently in a water bath (70-80º) for a few minutes with occasional shaking until the carbon disulphide has boiled off and the sample stops foaming. Place the tube in an oil bath or a saturated brine bath maintained at 110 to 115º, and hold for 1 to 2 hours. A red colour at the end of this period indicates the presence of cottonseed oil. This test is sensitive to the extent of 0.5 percent of cottonseed oil in other oils.

2.2.20. - Test for Clove Oil -Alkali-Soluble Matter

Place 80 ml of a 5 per cent w/v solution of potassium hydroxide in a 150-ml flask with a long neck, which is graduated in tenths of an ml and is of such diameter that not less than 15cm in length has a capacity of 10ml. The flask before use is cleaned with Sulphuric acid and well rinsed with water. Add 10ml of the oil, cleared by filtration if necessary, and shake thoroughly at five-minute intervals for half an hour, at ambient temperature. Raise the undissolved portion of the oil into the graduated part of the neck of the flask by gradual addition of more of the potassium hydroxide solution; allow standing for not less than twenty-four hours, and read off the volume of the undissolved portion of the oil. The undissolved portion of the oil measures not less than 1.0 ml and not more than 1.5 ml.

2.2.21. - Test for Eucalyptus Oil

Determination of Cineole

Into a stout-walled test tube, about 15 mm in diameter and 80 mm in length place 3 g, accurately weighed, of the oil preciously dried by shaking with anhydrous calcium chloride together with 2.1 g, accurately weighed, of melted o-cresol. Insert a thermometer, graduated in fifths of a degree, and stir the mixture well in order to induce crystallization; note the highest reading of the thermometer. Warm three tube gently, until the contents are completely melted, insert the tube through a bored cork into a wide-mouthed bottle which is to act as an air jacked; allow to cool slowly, until crystallization commences, or until the temperature has fallen to the point previously noted. Stir the contents of the tube vigorously with the thermometer, running the latter on the side of the tube with an up and down motion in order to induce rapid crystallisatiojn' continue the string and rubbing a long as the temperature rises. Take the highest point as the freezing point.

Remelt the mixture and repeat the determination of the freezing point until two consecutive concordant results are obtained, because the first temperature noted is always lower than the true freezing point.

Find the percentage w/w of cineole corresponding to the freezing-point from the table, obtaining intermediate value, by interpolation (Table 2.1).

Table 2.1

Freezing-Point	Percent w/w of Cineole	Freezing – point	Percent w/w of Cineole
24^0 . . .	45.6	30^0 . . .	53.4
25^0 . . .	46.9	31^0 . . .	54.7
26^0 . . .	48.2	32^0 . . .	56.0
27^0 . . .	49.5	33^0 . . .	57.3
28^0 . . .	50.8	34^0 . . .	58.6
29^0 . . .	53.1	35^0 . . .	59.9
36^0 . . .	61.2	47^0 . . .	80.0
37^0 . . .	62.5	48^0 . . .	82.1
38^0 . . .	63.8	49^0 . . .	84.2
39^0 . . .	65.2	50^0 . . .	86.3
40^0 . . .	66.8	51^0 . . .	88.8
41^0 . . .	68.6	52^0 . . .	91.3
42^0 . . .	70.5	53^0 . . .	93.8
43^0 . . .	72.3	54^0 . . .	96.3
44^0 . . .	74.2	55^0 . . .	99.3
45^0 . . .	76.1	55.2^0 . . .	100.0
46^0 . . .	78.0	. . .	

The *o*-cresol used must be pure and dry with a freezing-point not below 30^0. It is hygroscopic, and should be stored in a small welt-stoppered bottle because the presence of moisture may lower the results, even to the extent of 5 per cent.

2.2.22.- Determination of Acidity

Reagents

(1) Standard Sodium Hydroxide solution – 0.05 N
(2) Phenolpthalein indicator – Dissolve 0.5 gm Phenolpthalein in 100 ml of 50% ethyl alcohol (v/v)

Procedure

Take 10 gm of the sample in a suitable titration flask and dissolve in 75 ml of carbon dioxide free water. Mix thoroughly. Titrate against standard sodium hydroxide solution using 4-6 drops of phenolpthalein indicator till pink colour persists for 10 seconds.
Determine blank on water and indicator and correct the volume of sodium hydroxide solution used.

Calculation

Acidity as formic acid (%) by weight = $\frac{0.23 \times V}{M}$

Where V = corrected volume of 0.05 N sod. Hydroxide used
M = weight in gm of the sample taken for test
(Ref :- I.S.I. Handbook of Food Analysis(Part II) 1984 page 37)

2.2.23. –Protein Estimation (Lowry *et. al* 1951)

Homogenise 100 mg plant metarial with 3 ml of 10% *trichloroacetic acid*. Centrifuge the homogenate at 10,000 rpm. Discard the supernatant. Treat the pallets obtained after centrifugation with 3 ml *1N sodium hydroxide*, heat on water bath for 7 minutes and cool. Centrifuge the solution again for five to ten minutes at 5000 rpm. To 0.5 ml of supernatant thus obtained after centrifugation, add 5 ml reagent containing 100 parts of 2% solution of sodium carbonate and one part of 2% solution of *sodium potassium* tartrate. Allow it so stand for ten to fifteen minutes. Then add 5 ml *Folin and Ciocalteu's Phenol reagent* (diluted with distilled water in ratio of 1:1) and allow to stand for half-hour for development of colour and then finally measure the absorbance at 700 nm.

2.2.24. - Method for Alkaloid Estimation

Macerate the plant material with 2 per cent acetic acid in water, filter and concentrate the filtrate under reduced pressure at 45^0 to one third of the original volume. Adjust the pH to 2 by *4 M hydrochloric acid*. The yellow precipitate will be separated from the solution (A). Dissolve in it 0.1 M to give solution (B). Add *Mayer's reagent* to the solution A and B to give precipitate of alkaloid-Mayers reagent complex. Dissolve it again in *acetone - methanol - water* (6 : 2 : 10) to give solution. Pass this complex finally through Amberlite IRA 400 anion exchange resin (500 g) to give an aqueous solution of alkaloid chlorides.

2.2.25. -Determination of Esters – Boil a convenient quantity of alcohol (90%) thoroughly to expel CO_2 and neutralize it to solution of phenolphthalein. Dissolve about 2 g of the oil or ester, accurately weighed, in 5 ml of the neutralized alcohol contained in a hard glass flask, and neutralize the free acid in the solution with N/10 alcoholic KOH, using 0.2 ml of solution of phenolphthalein as indicator. Add 20 ml of N/2 alcoholic KOH, attach the flask to a reflux condenser, boil on a water bath for 1 hour, and immediately titrate the excess of alkali with N/2 H_2SO_4, using a further 0.5 ml of solution of phenolphthalein as indicator. Repeat the operation without the oil or ester. The difference between the titrations is equivalent to the alkali required to saponify the esters.

Each ml of N/2 alcoholic KOH is equivalent to-

0.0981 g	of	Bornyl Acetate
0.0364 g	of	Grlyceryl Triacetate
0.0981 g	of	Linalyl Acetate
0.0991 g	of	Menthyl Acetate
0.0761 g	of	Menthyl Salicylate

2.3. - LIMIT TESTS

Table 2.2 - Permissible Limits of Heavy Metals

S.No.	Heavy Metal contents	Permissible limits
1.	Lead	10 ppm
2	Arsenic	3 ppm
3.	Cadmium	0.3 ppm
4.	Mercury	1 ppm

2.3.1. - Limit Test for Arsenic

In the limit test for arsenic, the amount of arsenic is expressed as arsenic, As ppm

Apparatus

A wide-mouthed bottle capable of holding about 120 ml is fitted with a rubber bung through which passes a glass tube. The latter, made from ordinary glass tubing, has a total length of 200 mm and an internal diameter of exactly 6.5 mm (external diameter about 8 mm). It is drawn out at one end to a diameter of about 1 mm and a hole not less than 2 mm in diameter is blown in the side of the tube, near the constricted part. When the bung is inserted in the bottle containing 70 ml of liquid, the constricted end of the tube is above the surface of the liquid, and the hole in the side is below the bottom of the bung. The upper end of the tube is cut off square, and is either slightly rounded or ground smooth.

Two rubber bungs (about 25 mm x 25 mm), each with a hole bored centrally and true, exactly 6.5 mm in diameter, are fitted with a rubber band or spring clip for holding them tightly together. Alternatively the two bungs may be replaced by any suitable contrivance satisfying the conditions described under *the General Test.*

Reagents

Ammonium oxalate AsT: *Ammonium oxalate* which complies with the following additional test:

Heat 5 g with 15 ml of *water,* 5 ml of *nitric acid AsT,* and 10 ml of *sulphuric acid AsT* in narrow necked, round-bottomed flask until frothing ceases, cool, and apply the General Test; no visible stain is produced.

Arsenic solution, dilute, AsT:

Strong Arsenic solution AsT	1 ml
Water sufficient to produce	100 ml

Dilute arsenic solution, AsT must be freshly prepared.
1 ml contains 0.01 mg of arsenic, as.

Arsenic solution, strong, AsT:

Arsenic trioxide	0.132 g
Hydrochloric acid	50 ml
Water sufficient to produce	***100 ml***

Brominated hydrochloric acid AsT:

Bromine solution AsT	1 ml
Hydrochloric acid AsT	100 ml

Bromine solution AsT:

Bromine	30 g
Potassium bromide	30 g
Water sufficient to produce	100 ml

It complies with the following test:

Evaporate 10 ml on a water-bath nearly to dryness, add 50 ml of purified water, 10 ml of *hydrochloric acid AsT* and sufficient *stannous chloride solution AsT* to reduce the remaining bromine and apply the General Test; the

stain produced is not deeper than 1 ml *standard stain,* showing that the proportion of arsenic present does not exceed 1 part per million.

Citric acid AsT: *Citric acid* which complies with the following additional tests: Dissolve 10 g in 50 ml of water add 10 ml of *stannated hydrochloric acid AsT* and apply the General Test; no visible stain is produced.

Hydrochloric acid AsT: *Hydrochloric acid* diluted with *water* to contain about 32 per cent w/w of *hydrochloride acid* and complying with the following additional tests:

(i) Dilute 10 ml with sufficient water to produce 50 ml, add 5 ml of *ammonium thiocyanate solution* and stir immediately; no colour is produced.

(ii) To 50 ml add 0.2 ml of *bromine solution AsT,* evaporate on a water-bath until reduced to 16 ml adding more *bromine solution AsT,* if necessary, in order that an excess, as indicated by the colour, may be present throughout the evaporation; add 50 ml of *water* and 5 drops of *stannous chloride solution AsT,* and apply the General Test; the stain produced is not deeper than a 0.2 ml *standard stain* prepared with the same acid, showing that the proportion of arsenic present does not exceed 0.05 part per million.

Hydrochloric acid (constant-boiling composition) AsT : ***Boil*** **hydrochloric acid** ***AsT to constant boiling Composition in the presence of*** **hydrazine hydrate*, using 1 ml of 10 per cent w/v solution in*** **water** ***per litre of the acid.***

***Mercuric Chloride Paper:** Smooth white filter paper, not less than 25 mm in width, soaked in a saturated solution of *mercuric chloride,* pressed to remove superfluous solution, and dried at about 60^0, in the dark. The grade of the filter paper is such that the weight is between 65 and 120 g per sq. mm; the thickness in mm of 400 papers is approximately equal numerically, to the weight in g per sq. mm.

Nitric acid AsT: *Nitric acid* which complies with the following additional test:

Heat 20 ml in a porcelain dish with 2 ml of *sulphuric acid AsT,* until white fumes are given off. Cool, add 2 ml of water, and again heat until white fumes are given off; cool, add 50 ml of water and 10 ml of *stannated hydrochloric acid AsT,* and apply the General Test; no visible stain is produced.

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*NOTE –*Murcuric chloride paper should be stored in a stoppered bottle in the dark. Paper which has been exposed to sunlight or to the vapour of ammonia affords a lighter stain or no stain at all when employed in the limit test for arsenic.*

Potassium chlorate AsT: *Potassium chlorate* which complies with the following additional test:

Mix 5 g in the cold with 20 ml of *water* and 22 ml of *hydrochloric acid AsT;* when the first reaction has subsided, heat gently to expel chlorine, remove the last traces with a few drops of *stannous chloride solution AsT,* add 20 ml of water, and apply the General Test; no visible stain is produced.

Potassium iodide AsT: *Potassium iodide* which complies with the following additional test:

Dissolve 10 g in 25 ml of *hydrochloric acid AsT* and 35 ml of *water,* add 2 drops of *stannous chloride solution AsT* and apply the General Test; no visible stain is produced.

Sodium carbonate, anhydrous AsT: *Anhydrous sodium carbonate* which complies with the following additional test:

Dissolve 5 g in 50 ml of *water,* add 20 ml of *brominated hydrochloric acid AsT,* remove the excess of bromine with a few drops of *stannous chloride solution AsT,* and apply the General Test; no visible stain is produced.

Sodium Salicylate: Of the Indian Pharmacopoeia.

Stannated hydrochloric acid AsT:

Stannous chloride solution AsT	1 ml
Hydrochloric Acid AsT	100 ml

Stannous Chloride solution AsT: Prepared from *stannous chloride solution* by adding an equal volume of *hydrochloric acid*, boiling down to the original volume, and filtering through a fine-grain filter paper.

It complies with the following test:

To 10 ml add 6 ml of water and 10 ml of *hydrochloric acid AsT,* distil and collect 16 ml. To the distillate and 50 ml of *water* and 2 drops of *stannuous chloride solution AsT* and apply the General Test; the stain produced is not deeper than a 1-ml *standard stain,* showing that the proportion of arsenic present does not exceed 1 part per million.

Sulphuric acid AsT: *Sulphuric acid* which complies with the following additional test:

Dilute 10 g with 50 ml of water, add 0.2 ml of *stannous chloride solution AsT,* and apply the General Test; no visible stain is produced.

Zinc AsT: *Granulated Zinc* which complies with following additional test:

Add 10 ml of *stannated hydrochloric acid AsT* to 50 ml of *water,* and apply the General Test, using 10 of the zinc and allowing the action to continue for one hour; no visible stain is produced (limit of arsenic). Repeat the test with the addition of 0.1 ml of *dilute arsenic solution AsT;* a faint but distinct yellow stain is produced (test for sensitivity).

General Method of Testing - ***By a variable method of procedure suitable to the particular needs of each substance, a solution is prepared from the substance being examined which may or may not contain that substance, but contains the whole of the arsenic (if any) originally present in that substance. This solution, referred to as the `test solution', is used in the actual test.***

General Test - The glass tube is lightly packed with cotton wool, previously moistened with *lead acetate solution* and dried, so that the upper surface of the cotton wool is not less than 25 mm below the top of the tube. The upper end of the tube is then inserted into the narrow end of one of the pair of rubber bungs, either to a depth of about 10 mm when the tube has a rounded-off end, or so that the ground end of the tube is flush with the larger end of the bung. A piece of *mercuric chloride paper* is placed flat on the top of the bung and the other bung placed over it and secured by means of the rubber band or spring clip in such a manner that the borings of the two bungs (or the upper bung and the glass tube) meet to form a true tube 6.5 mm in diameter interrupted by a diaphragm of *mercuric chloride paper.*

Instead of this method of attaching the *mercuric chloride paper,* any other method may be used provided (1) that the whole of the evolved gas passes through the paper; (2) that the portion of the paper in contact with the gas is a circle 6.5 mm in diameter; and (3) that the paper is protected from sunlight during the test. The test solution prepared as specified, is placed in the wide-mouthed bottle, 1 g of *potassium iodide AsT* and 10 g of *zinc AsT* added, and the prepared glass tube is placed quickly in position. The action is allowed to proceed for 40 minutes. The yellow stain which is produced on the *mercuric chloride paper* if arsenic is present is compared by day light with the *standard stains* produced by operating in a similar manner with known quantities of *dilute arsenic solution*

AsT. The comparison of the stains is made immediately at the completion of the test. The standard stains used for comparison are freshly prepared; they fade on keeping.

By matching the depth of colour with *standard stains*, the proportion of arsenic in the substance may be determined. A stain equivalent to the 1-ml standard stain, produced by operating on 10 g of substance indicates that the proportion of arsenic is 1 part per million.

NOTE: (1) The action may be accelerated by placing the apparatus on a warm surface, care being taken that the *mercuric chloride paper* remains dry throughout the test.

(2) The most suitable temperature for carrying out the test is generally about 40^0 but because the rate of the evolution of the gas varies somewhat with different batches zinc AsT, the temperature may be adjusted to obtain a regular, but not violent, evolution of gas.

(3) The tube must be washed with *hydrochloric acid AsT*, rinsed with water and dried between successive tests.

Standard Stains - Solutions are prepared by adding to 50 ml of water, 10 ml of *stannated hydrochloric acid AsT* and quantities of *dilute arsenic solutions AsT* varying from 0.2 ml to 1 ml. The resulting solutions, when treated as described in the General Test, yield stains on the *mercuric chloride paper* referred to as the standard stains.

Preparation of the Test Solution

In the various methods of preparing the test solution given below, the quantities are so arranged unless otherwise stated, that when the stain produced from the solution to be examined is not deeper than the 1-ml standard stain, the proportion of arsenic present does not exceed the permitted limit.

Ammonium chloride - Dissolve 2.5 g in 50 ml of *water,* and 10 ml of *stannated hydrochloric acid AsT.*

Boric acid - Dissolve 10 g with 2 g of *citric acid AsT* in 50 ml water, and add 12 ml of *stannated hydrochloric acid AsT.*

Ferrous sulphate - Dissolve 5 g in 10 ml of *water and 15 ml of stannated hydrochloric* acid *AsT and* disitil 20 ml; to the distillate add a few drops of *bromine solution AsT.* Add 2 ml of *stannated hydrochloric acid AsT,* heat under a reflux condenser for one hour, cool, and add 10 ml of *water* and 10 ml of *hydrochloric acid AsT.*

Glycerin - Dissolve 5 g in 50 ml of water, and add 10 ml of *stannated hydrochloric acid AsT.*

Hydrochloric acid - Mix 10 g with 40 ml of water and 1 ml of *stannous chloride solution AsT.*

Magnesium sulphate - Dissolve 5 g in 50 ml of *water* and add 10 ml of stannated *hydrochloric acid AsT.*

Phosphoric acid - Dissolve 5 g in 50 ml of *water* and add 10 ml of *stannated hydrochloric acid AsT*
Potassium iodide - Dissolve 5 g in 50 ml of *water* and add 2 ml of *stannated hydrochloric acid AsT.*

Sodium bicarbonate - Dissolve 5 g in 50 ml of *water* and add 15 ml of *brominated hydrochloric acid AsT,* and remove the excess of bromine with a few drops of *stannous chloride solution AsT.*

Sodium hydroxide - Dissolve 2.5 g in 50 ml of *water,* add 16 ml of *brominated hydrochloric acid AsT,* and remove the excess of *bromine* with a few drops of *stannous chloride solution AsT.*

2.3.2. - Limit Test for Chlorides

Dissolve the specified quantity of the substance in *water* or prepare a solution as directed in the text and transfer to a *Nessler cylinder.* Add 10 ml of *dilute nitric acid,* except when nitric acid is used in the preparation of the solution, dilute to 50 ml with water, and add 1 ml of *silver nitrate solution.* Stir immediately with a glass rod and allow to stand for 5 minutes. The opalescence produced is not greater than the *standard opalescence,* when viewed transversely.

Standard Opalescence

Place 1.0 ml of a 0.05845 per cent w/v solution of *sodium chloride* and 10 ml of *dilute nitric acid* in a *Nessler cylinder*. Dilute to 50 ml with water and add 1 ml of *silver nitrate solution*. Stir immediately with a glass rod and allow to stand for five minutes.

2.3.3. - Limit Test for Heavy Metals

The test for heavy metals is designed to determine the content of metallic impurities that are coloured by sulphide ion, under specified conditions. The limit for heavy metals is indicated in the individual monographs in terms of the parts of lead per million parts of the substance (by weight), as determined by visual comparison of the colour produced by the substance with that of a control prepared from a standard lead solution.

Determine the amount of heavy metals by one of the following methods and as directed in the individual monographs. Method A is used for substances that yield clear colourless solutions under the specified test conditions. Method B is used for substances that do not yield clear, colourless solutions under the test conditions specified for method A, or for substances which, by virtue of their complex nature, interfere with the precipitation of metals by sulphide ion. Method C is used for substances that yield clear, colourless solutions with *sodium hydroxide solution.*

Special Reagents

Acetic acid Sp.: *Acetic acid* which complies with the following additional test : Make 25 ml alkaline with *dilute ammonia solution Sp.,* add 1 ml of *potassium cyanide solution Sp.,* dilute to 50 ml with *water* and add two drops of *sodium sulphide* solution; no darkening is produced.

Dilute acetic acid Sp.: *Dilute acetic acid,* which complies with the following additional test – Evaporate 20 ml in a porcelain dish, nearly to dryness on a water-bath. Add to the residue 2 ml of the acid and dilute with water to 25 ml, add 10 ml of *hydrogen sulphide solution.* Any dark colour produced is not more than that of a control solution consisting of 2 ml of the acid and 4.0 ml of *standard lead solution* diluted to 25 ml with *water.*

Ammonia solution Sp.: *Strong ammonia solution* which complies with the following additional test: Evaporate 10 ml to dryness on a water-bath; to the residue add 1 ml of *dilute hydrochloric acid Sp. a*nd evaporate to dryness. Dissolve the residue in 2 ml of dilute acetic acid Sp. Add sufficient water to produce 25 ml.

Add 10 ml of *hydrogen sulphide solution.* Any darkening produced is not greater than in a blank solution containing 2 ml of dilute acetic acid Sp. 1.0 ml of *standard lead solution* and sufficient *water* to produce 25 ml.

Dilute ammonia solution Sp.: *Dilute ammonia solution* which complies with the following additional test: To 20 ml add 1 ml of *potassium cyanide solution Sp.,* dilute to 50 ml with *water,* and add two drops of *sodium sulphide solution;* no darkening is produced.

Hydrochloric acid: *Hydrochloric acid* which complies with the following additional test: Evaporate off the acid in a beaker to dryness on a water-bath. Dissolve the residue in 2 ml of *dilute acid Sp.,* dilute to 17 ml with water and add 10 ml of *hydrogen sulphide solution;* any darkening produced is not greater than in a blank solution containing 2.0 ml of *standard lead solution,* 2 ml of *dilute acetic acid Sp.* and dilute to 40 ml with water.

Dilute hydrochloric acid Sp.: *Dilute hydrochloric acid,* which complies with the following additional test: Treat 10 ml of the acid in the manner described under *Hydrochloric acid Sp.*

Lead nitrate stock solution: Dissolve 0.1598 g of *lead nitrate* in 100 ml of *water* to which has been added 1 ml of *nitric acid,* then dilute with *water* to 1000 ml. This solution must be prepared and stored in polyethylene or glass containers free from soluble lead salts.

Standard lead solution: On the day of use, dilute 10.0 ml of *lead nitrate* stock solution with *water* to 100.0 ml. Each ml of *standard lead solution* contains the equivalent of 10 µg of lead. A control comparison solution prepared with 2.0 ml of standard lead solution contains, when compared to a solution representing 1.0 g of the substance being tested, the equivalent of 20 parts per million of lead.

Nitric acid Sp.: *Nitric acid* which complies with the following additional test: Dilute 10 ml with 10 ml of *water,* make alkaline with *ammonia solution Sp.,* add 1 ml of *potassium cyanide solution Sp.,* dilute to 50 ml with water, and add two drops of *sodium sulphide solution;* no darkening is produced.

Potassium cyanide solution Sp.: See Appendix 2.3.5.

Sulphuric acid Sp.: Sulphuric acid which complies with following additional test: Add 5 g to 20 ml of *water* make alkaline with *ammonia solution Sp.,* add 1 ml of *potassium cyanide solution Sp.*, dilute to 50 ml with *water* and add two drops of *sodium sulphide solution;* no darkening is produced.

Method A

Standard solution - Into a 50 ml *Nessler cylinder,* pipette 2 ml of *standard lead solution* and dilute with *water* to 25 ml. Adjust with *dilute acetic acid Sp.* or *dilute ammonia solution Sp* to a pH between 3.0 and 4.0, dilute with *water* to about 35 ml, and mix.

Test solution - In to a 50 ml *Nessler cylinder,* place 25 ml of the solution prepared for the test as directed in the individual monograph, or using the stated volume of acid when specified in the individual monograph, dissolve and dilute with *water* to 25 ml the specified quantity of the substance being tested. Adjust with *dilute acetic acid Sp.* or *dilute ammonia solution Sp.* to a pH between 3.0 and 4.0, dilute with *water* to about 35 ml and mix.

Procedure - To each of the cylinders containing the *standard solution* and test solution, respectively, add 10 ml of freshly prepared *hydrogen sulphide solution,* mix, dilute with *water* to 50 ml, allow to stand for five minutes, and view downwards over a white surface; the colour produced in the *test solution* is not darker than that produced in the *standard solution.*

Method B

Standard solution - Proceed as directed under Method A.

Test solution - Weigh in a suitable crucible the quantity of the substance specified in individual monograph, add sufficient *sulphuric acid Sp.* to wet the sample, and ignite carefully at a low temperature until thoroughly charred. Add to the charred mass 2 ml of *nitric acid Sp.* and five drops of *sulphuric acid Sp.* and heat cautiously until white

fumes are no longer evolved. Ignite, preferably in a muffle furnace, at 500^0 to 600^0 until the carbon is completely burnt off. Cool, add 4 ml of *hydrochloric acid Sp.,* cover, digest on a water bath for 15 minutes, uncover and slowly evaporate to dryness on a water-bath. Moisten the residue with one drop of *hydrochloric acid Sp.,* add 10 ml of hot water and digest for two minutes. Add *ammonia solution* sp*.,* dropwise, until the solution is just alkaline to *litmus paper,* dilute with *water* to 25 ml and adjust with dilute acetic acid Sp. to a pH between 3.0 and 4.0. Filter if necessary, rinse the crucible and the filter with 10 ml of water, combine the filtrate and washings in a 50 ml *Nessler cylinder,* dilute with *water,* to about 35 ml, and mix. Procedure: Proceed as directed under Method A.

Method C

Standard solution - Into a 50 ml *Nessler cylinder,* pipette 2 ml of *standard lead solution,* add 5 ml of *dilute sodium hydroxide solution.,* dilute with *water* to 50 ml and mix.

Test solution - Into a 50 ml *Nessler cylinder,* place 25 ml of the solution prepared for the test as directed in the individual monograph; or, if not specified otherwise in the individual monograph, dissolve the specified quantity in a mixture of 20 ml of *water* and 5 ml of *dilute sodium hydroxide solution.* Dilute 50 ml with water and mix.

Procedure - To each of the cylinders containing the *standard solution* and the *test solution,* respectively add 5 drops of *sodium sulphide solution,* mix, allow to stand for five minutes and view downwards over a white surface; the colour produced in the *test solution* is not darker than that produced in the *standard solution.*

2.3.4. - Limit Test for Iron

Standard Iron solution - Weigh accurately 0.1726 g of *ferric ammonium sulphate* and dissolve in 10 ml of 0.1 *N sulphuric acid* and sufficient *water* to produce 1000.0 ml. Each ml of this solution contains 0.02 mg of Fe.

Method

Dissolve the specified quantity of the substance being examined in 40 ml of *water,* or use 10 ml of the solution prescribed in the monograph, and transfer to a *Nessler cylinder.* Add 2 ml of a 20 per cent w/v solution of *iron-free citric acid* and 0.1 ml of *thioglycollic acid,* mix, make alkaline with *iron-free ammonia solution,* dilute to 50 ml with *water* and allow to stand for five minutes. Any colour produced is not more intense than the standard colour.

Standard colour - Dilute 2.0 ml of *standard iron solution* with 40 ml of *water* in a *Nessler cylinder.* Add 2 ml of a 20 per cent w/v solution of *iron-free citric acid* and 0.1 ml of *thioglycollic acid,* mix, make alkaline with *iron-free ammonia solution,* dilute to 50 ml with *water* and allow to stand for five minutes.

2.3.5. - Limit Test for Lead

The following method is based on the extraction of lead by solutions of *dithizone*. All reagents used for the test should have as low a content of lead as practicable. All reagent solutions should be stored in containers of borosilicate glass. Glassware should be rinsed thoroughly with warm *dilute nitric acid,* followed by *water.*

Special Reagents

(1) Ammonia-cyanide solution Sp.: Dissolve 2 g of *potassium cyanide* in 15 ml of *strong ammonia solution* and dilute with *water* to 100 ml.

(2) Ammonium citrate solution Sp.: Dissolve 40 g of *citric acid* in 90 ml *water.* Add two drops of phenol *red solution* then add slowly *strong ammonia solution* until the solution acquires a reddish colour. Remove any lead present by extracting the solution with 20 ml quantities of *dithizone* extraction solution until the *dithizone* solution retains its orange-green colour.

(3) Dilute standard lead solution: Dilute 10.0 ml of *standard lead solution* with sufficient 1 per cent v/v solution of nitric acid to produce 100 ml. Each ml of this solution contains 1 µg of lead per ml.

(4) Dithizone extraction solution: Dissolve 30 mg of *diphenylthiocarbazone* in 1000 ml of *chloroform* and add 5 ml of *alcohol.* Store the solution in a refrigerator. Before use, shake a suitable volume of the solution with about half its volume of 1 per cent v/v solution of *nitric acid* and discard the acid.

(5) Hydroxylamine hydrochloride solution Sp.: Dissolve 20 g of *hydroxylamine hydrochloride* in sufficient *water* to produce about 65 ml. Transfer to separator, add five drops of *thymol blue solution*, add *strong ammonia solution* until the solution becomes yellow. Add 10 ml of a 4 per cent w/v solution of *sodium diethyldithiocarbamate* and allow to stand for five minutes. Extract with successive quantities, each of 10 ml, of *chloroform* until a 5 ml portion of the extract does not assume a yellow colour when shaken with dilute copper sulphate solution. Add *dilute hydrochloric acid* until the solution is pink and then dilute with sufficient water to produce 100 ml.

(6) Potassium cyanide solution Sp.: Dissolve 50 g of *potassium cyanide* in sufficient *water* to produce 100 ml. Remove the lead from this solution by extraction with successive quantities, each of 20 ml of *dithizone extraction solution* until the dithizone solution retains its orange-green colour. Extract any dithizone remaining in the cyanide solution by shaking with *chloroform.* Dilute this cyanide solution with sufficient *water* to produce a solution containing 10 g of *potassium cyanide* in each 100 ml.

(7) Standard dithizone solution: Dissolve 10 ml of *diphenylthiocarbazone* in 1000 ml of *chloroform.* Store the solution in a glass-stoppered, lead-free bottle, protected from light and in a refrigerator.

(8) Citrate-cyanide wash solution: To 50 ml of *water* add 50 ml of *ammonium citrate solution Sp.* and 4 ml of *potassium cyanide solution Sp.,* mix, and adjust the pH, if necessary, with strong *ammonia solution* to 9.0.

(9) Buffer solution pH 2.5: To 25.0 ml of 0.2 *M potassium hydrogen phthalate add* 37.0 ml of 0.1 N *hydrochloric acid,* and dilute with sufficient *water* to produce 100.0 ml.

(10) Dithizone-carbon tetrachloride solution: Dissolve 10 mg of *diphenylthiocarbazone* in 1000 ml of carbon tetrachloride. Prepare this solution fresh for each determination.

(11) pH 2.5 wash solution: To 500 ml of a 1 per cent v/v *nitric acid* add *strong ammonia solution* until the pH of the mixture is 2.5, then add 10 ml of *buffer solution* pH 2.5 and mix.

(12) Ammonia-cyanide wash solution: To 35 ml of pH 2.5 *wash solution* add 4 ml of *ammonia-cyanide solution Sp.,* and mix.

Method

Transfer the volume of the prepared sample directed in the monograph to a separator and unless otherwise directed in monograph, add 6 ml of *ammonium citrate solution Sp.,* and 2 ml *hydroxylamine hydrochloride solution Sp.,* (For the determination of lead in iron salts use 10 ml of *ammonium citrate solution Sp.).* Add two drops of

phenol red solution and make the solution just alkaline (red in colour) by the addition *of strong ammonnia solution.* Cool the solution if necessary, and add 2 ml of *potassium cyanide solution* Sp. Immediately extract the solution with several quantities each of 5 ml, of *dithizone extraction solution,* draining off each extract into another separating funnel, until the dithizone extraction solution retains its green colour. Shake the combine dithizone solutions for 30 seconds with 30 ml of a 1 per cent w/v solution of *nitric acid* and discard the chloroform layer. Add to the solution exactly 5 ml of *standard dithizone solution* and 4 ml of *ammonia-cyanide solution* Sp. and shake for 30 seconds; the colour of the chloroform layer is of no deeper shade of violet than that of a control made with a volume of *dilute standard lead solution* equivalent to the amount of lead permitted in the sample under examination.

2.3.6. - Limit Test for Sulphates

Reagents

Barium sulphate reagent: Mix 15 ml of 0.5 *M barium chloride,* 55 ml of *water,* and 20 ml of *sulphate free alcohol,* add 5 ml of a 0.0181 per cent w/v solution of potassium sulphate, dilute to 100 ml with *water,* and mix. Barium sulphate reagent must be freshly prepared.

0.5 M Barium chloride: *Barium chloride* dissolved in *water* to contain in 1000 ml 122.1 g of $BaCl_2$, $2H_2O$.

Method

Dissolve the specified quantity of the substance in *water,* or prepare a solution as directed in the text, transfer to a *Nessler cylinder,* and add 2 ml of *dilute hydrochloric acid,* except where *hydrochloric acid* is used in the preparation of the solution. Dilute to 45 ml with *water*, add 5 ml of barium sulphate reagent. Stir immediately with a glass rod, and allow to stand for five minutes. The turbidity produced is not greater than the *standard turbidity*, when viewed transversely. Standard turbidity: Place 1.0 ml of 0.1089 per cent w/v solution of potassium sulphate and 2 ml of *dilute hydrochloric acid* in a *Nessler cylinder*,dilute to 45 ml with *water*, add 5 ml of barium sulphate reagent, stir immediately with a glass rod and allow to stand for five minutes.

2.3.7. - Heavy Metals by Atomic Absorption Spectrophotometry

Atomic absorption spectrophotometry is used in the determination of heavy metal elements and some nonmetal elements in the atomic state.

The light of characteristic wave length emitted from a cathodic discharge lamp is absorbed when it passes through the atomic vapor generated from sample containing the element being examined atomized to the ground state. The assay of the element being examined is tested by determining the decreased degree of light intensity of radiation. Atomic absorption obeys the general rule for absorption spectrophotometry. The assay is carried out by comparing the abosorbance of the test preparation with that of the reference preparation.

Apparatus

An atomic absorption spectrophotometer consists of a light source, an atomic generator, a monochromator and a detector system. Some are equipped with a background compensation system and automatic sampling system, etc.

1. Light Source: A hollow-cathode discharge lamp is usually used. The cathode is made of the element being examined.

2. Atomic Generator: There are four main types : flame atomizer, graphite furnace atomizer, hydride-generated atomizer, cold vapor atomizer.

(1) **Flame atomizer:** It mainly consists of a nebulizer and a burner. Its function is to nebulize the test solution into aerosol, which is mixed with combustion gas. And the mixture is introduced into the flame generated by the burner. So that the substance being examined is to be dried, evaporated to form the ground state atoms of the element being examined. The burning flame is generated by different mixtures of gases, acetylene-air is mostly used. By modifying the proportion of combustion gas, the temperature of the flame can be controlled and a better stability and a better sensitivity can be obtained.

(2) **Furnace atomizer:** It consists of electric furnace and a power supply. Its function is to dry and incinerate the substance being examined. During the stage of high temperature atomization, the ground state atoms of the element being examined are to be formed. Graphite is commonly used as the heater. Protection gas is introduced into the furnace to avoid oxidation and used to transfer the sample vapor.

(3) **Hydride-generated atomizer:** It consists of hydride generator and atomic absorption cell. It is used for the determination of the elements such as arsenic, selenium and antimony etc. Its function is to reduce the element to be examined in acidic medium to the low-boiling and easily pyrolyzed hydride. The hydride is then swept by a stream of carrier gas into the atomic absorption cell which consists of quartz tube and heater etc., in which the hydride is pyrolyzed by heating to form the ground-state atom.

(4) **Cold vapor atomizer:** It consists of a mercury vapor atomizer and an absorption cell. It is suitable for the determination of mercury. Its function is to reduce the mercuric ion into mercury vapor which is swept into the quartz absorption cell by carrier gas.

3. Monochromator: Its function is to separate the specified wavelength radiation from the electromagnetic radiations erradiated from the light source. The optical path of the apparatus should assure the good spectra resolution and has the ability to work well at the condition of narrow spectral band (0.2 nm). The commonly used wavelength region is 190.0 - 900.0 nm.

4. Detector system: It consists of a detector, a signal processor and a recording system. It should have relatively higher sensitivity and better stability and can follow the rapid change of the signal absorption.

5. Background compensation system: System employed for the correction of atmospheric effects on the measuring system. Four principles can be utilized for background compensation: continuous spectrum sources (a deuterium lamp is often used in the UV region), the Zeeman effect, the self inversion phenomenon and the non resonance spectrum. In the analysis using atomic absorption spectrophotometry, the interference to the determination caused by background and other reasons should be noticed. Changes of some experimental conditions, such as the wavelength, the slit width, the atomizing condition, etc., may affect the sensitivity, the stability and the interference. If it is flame, the suitable wavelength, slit width and flame temperature, the addition of complexing agents and releasing agents and the use of Standard addition method may eliminate interference. If it is furnace, system, the selection of suitable background compensation system and the addition of suitable matrix modifying agents, etc may remove the interference. Background compensation method shall be selected as specified in the individual monograph.

Procedure

Method (direct calibration method)

Prepare not less than 3 reference solutions of the element being examined of different concentrations, covering the range recommended by the instrument manufacturer and add separately the corresponding reagents as that for the test solution and prepare the blank reference solution with the corresponding reagents. Measure the absorbances of the blank reference solution and each reference solution of different concentrations separately, record the readings and prepare a calibration curve with the average value of 3 readings of each concentration on the ordinate and the corresponding concentration on the abscissa.

Prepare a test solution of the substance being examined as specified in the monograph, adjust the concentration to fall within the concentration range of the reference solution. Measure the absorbance 3 times, record the readings and calculate the average value. Interpolate the mean value of the readings on the calibration curve to determine the concentration of the element.

When used in the test for impurities, prepare two test preparations of the same concentration as specified in the monograph. To one of the test preparation add an amount of the reference substance equivalent to the limit of the element specified in the monograph. Proceed as directed above and measure this solution to give an appropriate reading a; then measure the test preparation without the addition of the reference substance under the same condition and record the reading b; b is not greater than (a-b).

2.3.8. - Determination of Lead, Cadmium, Arsenic, Mercury and Copper

(1) Determination of Lead(Pb) (Graphite Oven Method):

Determination conditions: Reference condition: dry temperature: 100-120^0, maintain 20 seconds; ash temperature: 400-750^0, maintain 20-25 seconds; atomic temperature: 1700-2100^0 , maintain 4-5 seconds; measurement wavelength: 283.3 nm; background calibration: deuterium lamp (D lamp) or Zeeman effect.

Preparation of lead standard stock solution: Measure accurately a quantity of lead single-element standard solution to prepare standard stock solution with 2 per cent nitric acid solution, which containing 1 µg per ml, stored at 0-5^0.

Preparation of calibration curve: Measure accurately a quantity of lead standard stock solutions respectively, diluted with 2 per cent nitric acid solution to the concentration of 0, 5, 20, 40, 60, 80 ng per ml, respectively. Measure respectively accurately 1 ml the above solution, add respectively 1 ml of 1 per cent ammonium dihydrogen phosphate and 0.2 per cent *magnesium nitrate* mix well, pipette accurately 20 µl to inject into the atomic generator of graphite oven and determine their absorbance, then draw the calibration curve with absorbance as vertical axis and concentration as horizontal ordinate.

Preparation of test solution

Method

Weigh accurately 0.5 g of the coarse powder of the substance being examined, transfer into a casparian flask, add 5-10 ml of the mixture of *nitric acid* and *perchloric acid* (4 : 1), add a small hopper on the flask-top, macerate overnight, heat to slake on the electric hot plate, keep somewhat-boiling, if brownish-black, add again a quantity of the above mixture, continuously heat till the solution becomes clean and transparent, then raise temperature, heat continuously to thick smoke, till white smoke disperse, the slaked solution becomes colourless and transparent or a little yellow, cool, transfer it into a 50 ml volumetric flask, wash the container with 2 per cent *nitric acid solution* add the washing solution into the same volumetric flask and dilute with the same solvent to the volume, shake well. Prepare synchronously the reagent blank solution according to the above procedure.

Determination: Measure accurately 1 ml of the test solution and its corresponding reagent blank solution respectively, add 1 ml of solution containing 1per cent *ammonium dihydrogen phosphate* and 0.2 per cent *magnesium nitrate*, shake well, pipette accurately 10-20 μl to determine their absorbance according to the above method of "Preparation of calibration curve". Calculate the content of lead (Pd) in the test solution from the calibration curve.

(2) Determination of Cadmium (Cd) (Graphite Oven Method)

Determination conditions: Reference condition: dry temperature: 100-120^0 , maintain 20 seconds; ash temperature: 300-500^0 , maintain 20-25 seconds; atomic temperature: 1500-1900^0, maintain 4-5 seconds; measurement wavelength: 228.8 nm; background calibration: deuterium lamp (D lamp) or Zeeman effect.

Preparation of Cd standard stock solution: Measure accurately a quantity of Cd single-element standard solution to prepare standard stock solution Cd with 2 per cent nitric acid, which containing 0.4 μg per ml Cd, stored at 0-5^0.

Preparation of calibration curve: Measure accurately a quantity of cadmium standard stock solutions, diluted to the concentration of 1.6, 3.2, 4.8, 6.4 and 8.0 ng per ml with 2 per cent nitric acid, respectively. Pipette accurately 10 μl the above solutions respectively, inject them into the graphite oven, determine their absorbance, and then draw the calibration curve with absorbance as vertical axis and concentration as horizontal ordinate.

Preparation of test solution: Reference to "Preparation of test solution" of Pb in the above.

Determination: Pipette accurately 10-20 μl of the test solution and its corresponding reagent blank solution respectively, determine their absorbance according to the above method of "Preparation of calibration curve. If interference occurs, weigh accurately respectively 1 ml of the standard solution, blank solution and test solution, add 1 ml of a solution containing 1per cent *ammonium dihydrogen phosphate* and 0.2 per cent *magnesium nitrate*, shake well, determine their absorbance according to the method above, calculate the content of Cd in the test solution from the calibration curve.

(3) Determination of Arsenic (As) (Hydride Method)

Determination conditions: Apparatus: suitable hydride generator device, reducing agent: a solution containing 1 per cent *sodium borohydride* and 0.3 per cent *sodium hydroxide*; carrier liquid: 1 per cent *hydrochloric acid*; carrier gas: nitrogen; measurement wavelength: 193.7 nm; background calibration: deuterium lamp (D lamp) or Zeeman effect.

Preparation of As standard stock solution: Measure accurately a quantity of As single-element standard solution to prepare standard stock solution with 2 per cent *nitric acid* solution, which containis 1.0 μg per ml As, stored at 0-5^0.

Preparation of calibration curve: Measure accurately proper quantity of arsenic standard stock solutions, diluted with 2 per cent *nitric acid* to the concentration of 2, 4, 8, 12 and 16 ng per ml respectively. Accurately transfer 10 ml of each into 25 ml volumetric flask respectively, add 1 ml of 25 per cent *potassium iodide solution* (prepared prior to use), shake well, add 1 ml of *ascorbic acid solution* (prepared prior to use), shake well, dilute with hydrochloric acid solution (20-100) to the volume, shake well, close the stopper and immerse the flask in a water bath at 80^0 for 3 minutes. Cool, transfer proper quantities of each solution respectively into the hydride generator device, determine the absorbance, then plot the calibration curve with peak area (absorbance) as vertical axis and concentration as horizontal ordinate.

Preparation of test solution: Reference to A or B method of "Preparation of test solution" of Pb in the above.

Determination: Pipette accurately 10 ml of the test solution and its corresponding reagent blank solution respectively, proceed as described under "Preparation of calibration curve" beginning at the words "add 1 ml of 25 per cent *potassium iodide solution*". Calculate the content of As in the test solution from the calibration curve.

(4) Determination of Mercury (Hg) (Cold Absorption Method)

Determination conditions: Apparatus: suitable hydride generator device; reducing agent: a solution containing 0.5 per cent *sodium borohydride* and 0.1 per cent *sodium hydroxide*; carrier liquid: 1 per cent *hydrochloric acid*; carrier gas: nitrogen; measurement wavelength: 253.6 nm; background calibration: deuterium lamp (D lamp) or Zeeman effect.

Preparation of mercury standard stock solution: Measure accurately a proper quantity of mercury single-element standard solution to prepare standard stock solution with 2 per cent nitric acid solution, which containing 1.0 µg per ml Hg, stored at $0\text{-}5^0$.

Preparation of calibration curve: Measure accurately 0, 0.1, 0.3, 0.5, 0.7 and 0.9 ml of mercury standard stock solution, transfer into a 50 ml volumetric flask respectively, add 40 ml 4 per cent *sulphuric acid solution* and 0.5 ml of 5 per cent *potassium permanganate solution*, shake well, drop 5 per cent *hydroxylamine hydrochloride solution* until the violet red just disappears, dilute with 4 per cent *sulfuric acid solution* to the volume, shake well. A quantity of each solution is injected to the hydride generator device, determine the absorbance, then plot the calibration curve with peak area (absorbance) as vertical axis and concentration as horizontal ordinate.

Preparation of test solution

Method

Transfer 1 g of the coarse powder of the substance being examined, accurately weighed, into a casparian flask, add 5-10 ml of the mixture solution of *nitric acid* and *perchloric acid* (4 : 1), mix well, fix a small hopper on the flask-top, immerse overnight, heat to slake on the electric hot plate at $120\text{-}140^0$ for 4-8 hours until *slaking* completely, cool, add a quantity of 4 per cent *sulfuric acid solution* and 0.5 ml of 5 per cent *potassium permanganate solution*, shake well, drop 5 per cent *hydroxylamine hydrochloride solution* until the violet red colour just disappears, dilute with 4 per cent *sulphuric acid solution*s to 25 ml, shake well, centrifugate if necessary, the supernatant is used as the test solution. Prepare synchronally the reagent blank solute based on the same procedure.

Determination: Pipette accurately a quantity of the test solution and its corresponding reagent blank solution, respectively, proceed as described under "Preparation of calibration curve" beginning at the words "add 1 ml of 25 per cent *potassium iodide solution*". Calculate the content of mercury (Hg) in the test solution from the calibration curve.

(5) Determination of Copper(Cu) (Flame Method)

Determination conditions: Measurement wavelength: 324.7 nm; flame: air -acetylene flame; background calibration: deuterium lamp or Zeeman effect.

Preparation of copper standard stock solution: Measure accurately a proper quantity of copper single-element standard solution, to prepare the standard stock solution with 2 per cent *nitric acid solution*, which containing 10 µg per ml Cu, stored at $0\text{-}5^0$.

Preparation of calibration curve: Measure accurately a quantity of copper standard stock solutions, dilute with 2 per cent *nitric acid* to the concentrations of 0.05, 0.2, 0.4, 0.6 and 0.8 µg per ml, respectively. Inject each standard solution into the flame and determine the absorbance, respective, then plot the calibration curve with absorbance as vertical axis and concentration as horizontal ordinate.

Preparation of test solution: Reference to "Preparation of test solution" of Pb in the above.

Determination: Pipette accurately quantities of the test solution and its corresponding reagent blank solution respectively, proceed as described under "Preparation of calibration curve". Calculate the content of Cu in the test solution from the calibration curve.

2.3.9 Determination of Calcium Oxide

Apparatus

(1) Calibrated Brix spindle
(2) Brix Cylinder
(3) Conical flasks - 250 ml capacity
(4) Beakers – 100 and 200 ml capacity
(5) Funnels
(6) Pipettes- calibrated at 10 ml

Reagents

(1) EDTA solution – Weigh accurately 6.6473 gm EDTA into a beaker , dissolve in distilled water and make upto 1000 ml to obtain exactly M / 56 solution
(2) Ammonia Liquor
(3) Lead Subacetate
(4) Potassium Ferrocyanide powder
(5) Potassium iodide
(6) Eriochrome Black – T – weigh 0.1 eriochrome black T in a 100 ml volumetric flask and dissolve the same in rectified spirit or absolute alcohol. Make upto volume and use as indicator

Procedure

Make a 15 0 Brix solution of the sample. Transfer about 150 ml of the solution to a conical flask. Clarify the solution with Lead subacetate. Transfer about 60 ml of the clarified solution to a dry conical flask or flask previously rinsed with the clarified solution. Add Potassium Ferrocyanide powder little by little till no further precipitate forms. Shake thoroughly and filter. Test the filterate with Pot. Iodide.. Collect the lead free filterate in a conical flask Pipette out 10 ml of lead free filterate in a clean conical flask previously rinsed with distilled water and dried. Add 5 – 6 drops of liquor ammonia and 4-5 drops of indicator when a pink colour appears. Titrate against EDTA solution shaking the flask after each addition of EDTA solution. The end point is indicated by a sharp change of colour from red to blue. Note down the volume of the titrant

Calculation

Calcium oxide mg / 100 gm = V X 100 mg per litre of diluted solution

(Ref :- I.S.I. Handbook of Food Analysis (Part II) – 1984 page 9)

CCC

2.4. - MICROBIAL LIMIT TESTS

The following tests are designed for the estimation of the number of viable aerobic micro-organisms present and for detecting the presence of designated microbial species in pharmaceutical substances. The term 'growth' is used to designate the presence and presumed proliferation of viable micro-organisms.

Preliminary Testing

The methods given herein are invalid unless it is demonstrated that the test specimens to which they are applied do not, of themselves, inhibit the multiplication under the test conditions of micro-organisms that can be present. Therefore, prior to doing the tests, inoculate diluted specimens of the substance being examined with separate viable cultures of *Escherichia coli*, *Salmonella* species, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. This is done by adding 1 ml of not less than 10^{-3} dilutions of a 24 h broth culture of the micro-organisms to the first dilution (in buffer solution pH 7.2, fluid soyabean-casein digest medium or fluid lactose medium) of the test material and following the test procedure. If the organisms fail to grow in the relevant medium the procedure should be modified by (a) increasing the volume of diluent with the quantity of test material remaining the same, or (b) incorporating a sufficient quantity of a suitable inactivating agent in the diluents, or (c) combining the aforementioned modifications so as to permit growth of the organisms in the media. If inhibitory substances are present in the sample, 0.5 per cent of soya lecithin and 4 per cent of polysorbate 20 may be added to the culture medium. Alternatively, repeat the test as described in the previous paragraph, using fluid casein digest-soya lecithin-polysorbate 20 medium to demonstrate neutralization of preservatives or other antimicrobial agents in the test material. Where inhibitory substances are contained in the product and the latter is soluble, the Membrane filtration method described under Total Aerobic Microbial Count may be used.

If in spite of incorporation of suitable inactivating agents and a substantial increase in the volume of diluent it is still not possible to recover the viable cultures described above and where the article is not suitable for applying the membrane filtration method it can be assumed that the failure to isolate the inoculated organism may be due to the bactericidal activity of the product. This may indicate that the article is not likely to be contaminated with the given species of micro-organisms. However, monitoring should be continued to establish the spectrum of inhibition and bactericidal activity of the article.

Media

Culture media may be prepared as given below or dehydrated culture media may be used provided that, when reconstituted as directed by the manufacturer, they have similar ingredients and / or yield media comparable to those obtained from the formulae given below.

Where agar is specified in a formula, use agar that has a moisture content of not more than 15 per cent. Where water is called for in a formula, use purified water. Unless otherwise indicated, the media should be sterilized by heating in an autoclave at 115^0 for 30 minutes.

In preparing media by the formulas given below, dissolve the soluble solids in the water, using heat if necessary, to effect complete solution and add solutions of hydrochloric acid or sodium hydroxide in quantities sufficient to yield the required *p*H in the medium when it is ready for use. Determine the *p*H at $25^0 \pm 2^0$.

Baird-Parker Agar Medium

Pancreatic digest of casein	10.0	g
Beef extract	5.0	g
Yeast extract	1.0	g
Lithium chloride	5.0	g

Agar	20.0	g
Glycine	12.0	g
Sodium pyruvate	10.0	g
Water to	1000	ml

Heat with frequent agitation and boil for 1 minute. Sterilise, cool to between 45^0 and 50^0, and add 10 ml of a one per cent w/v solution of sterile *potassium tellurite* and 50 ml of egg-yolk emulsion. Mix intimately but gently and pour into plates. (Prepare the egg-yolk emulsion by disinfecting the surface of whole shell eggs, aseptically cracking the eggs, and separating out intact yolks into a sterile graduated cylinder. Add sterile saline solution, get a 3 to 7 ratio of egg-yolk to saline. Add to a sterile blender cup, and mix at high speed for 5 seconds). Adjust the *p*H after sterilization to 6.8 ± 0.2.

Bismuth Sulphite Agar Medium

Solution (1)

Beef extract	6	g
Peptone	10	g
Agar	24	g
Ferric citrate	0.4	g
Brilliant green	10	mg
Water to	1000	ml

Dissolve with the aid of heat and sterilise by maintaining at 115º for 30 minutes.

Solution (2)

Ammonium bismuth citrate	3	g
Sodium sulphite	10	g
Anhydrous disodium hydrogen Phosphate	5	g
Dextrose monohydrate	5	g
Water to	100	ml

Mix, heat to boiling, cool to room temperature, add 1 volume of solution (2) to 10 volumes of solution (1) previously melted and cooled to a temperature of 55^0 and pour.

Bismuth Sulphite Agar Medium should be stored at 2^0 to 8^0 for 5 days before use.

Brilliant Green Agar Medium

Peptone	10.0	g
Yeast extract	3.0	g
Lactose	10.0	g
Sucrose	10.0	g
Sodium chloride	5.0	g
Phenol red	80.0	g
Brilliant green	12.5	mg
Agar	12.0	g

Water to	1000	ml

Mix, allow to stand for 15 minutes, sterilise by maintaining at 115^0 for 30 minutes and mix before pouring.

Buffered Sodium Chloride-Peptone Solution pH 7.0

Potassium dihydrogen phosphate	3.56	g
Disodium hydrogen phosphate	7.23	g
Sodium chloride	4.30	g
Peptone (meat or casein)	1.0	g
Water to	1000	ml

0.1 to 1.0 per cent w/v polysorbate 20 or polysorbate 80 may be added. Sterilise by heating in an autoclave at 121^0 for 15 minutes.

Casein Soyabean Digest Agar Medium

Pancreatic digest of casein	15.0	g
Papaic digest of soyabean meal	5.0	g
Sodium chloride	5.0	g
Agar	15.0	g
Water to	1000	ml

Adjust the pH after sterilization to 7.3±0.2.

Cetrimide Agar Medium

Pancreatic digest of gelatin	20.0	g
Magnesium chloride	1.4	g
Potassium sulphate	10.0	g
Cetrimide	0.3	g
Agar	13.6	g
Glycerin	10.0	g
Water to	1000	ml

Heat to boiling for 1 minute with shaking. Adjust the *p*H so that after sterilization it is 7.0 to 7.4. Sterilise at 121^0 for 15 minutes.

Desoxycholate-Citrate Agar Medium

Beef extract	5.0	g
Peptone	5.0	g
Lactose	10.0	g
Trisodium citrate	8.5	g
Sodium thiosulphate	5.4	g
Ferric citrate	1.0	g
Sodium desoxycholate	5.0	g
Neutral red	0.02	g
Agar	12.0	g
Water to	1000	ml

Mix and allow to stand for 15 minutes. With continuous stirring, bring gently to the boil and maintain at boiling point until solution is complete. Cool to 80^0, mix, pour and cool rapidly.

Care should be taken not to overheat Desoxycholate Citrate Agar during preparation. It should not be remelted and the surface of the plates should be dried before use.

Fluid Casein Digest-Soya Lecithin-Polysorbate 20 Medium

Pancreatic digest of casein	20	g
Soya lecithin	5	g
Polysorbate 20	40	ml
Water to	1000	ml

Dissolve the pancreatic digest of casein and soya lecithin in water, heating in a water-bath at 48^0 to 50^0 for about 30 minutes to effect solution. Add polysorbate 20, mix and dispense as desired.

Fluid Lactose Medium

Beef extract	3.0	g
Pancreatic digest of gelatin	5.0	g
Lactose	5.0	g
Water to	1000	ml

Cool as quickly as possible after sterilization. Adjust the pH after sterilization to 6.9 ± 0.2.

Lactose Broth Medium

Beef extract	3.0	g
Pancreatic digest of gelatin	5.0	g
Lactose	5.0	g
Water to	1000	ml

Adjust the pH after sterilisation to 6.9±0.2.

Levine Eosin-Methylene Blue Agar Medium

Pancreatic digest of gelatin	10.0	g
Dibasic potassium phosphate	2.0	g
Agar	15.0	g
Lactose	10.0	g
Eosin Y	400	mg
Methylene blue	65	mg
Water to	1000	ml

Dissolve the pancreatic digest of gelatin, dibasic potassium phosphate and agar in water with warming and allow to cool. Just prior to use, liquefy the gelled agar solution and the remaining ingredients, as solutions, in the following amounts and mix. For each 100 ml of the liquefied agar solution use 5 ml of a 20 per cent w/v solution of lactose, and 2 ml of a 2 per cent w/v solution of eosin Y, and 2 ml of a 0.33 per cent w/v solution of methylene blue. The finished medium may not be clear. Adjust the *p*H after sterilisation to 7.1±0.2.

MacConkey Agar Medium

Pancreatic digest of gelatin	17.0	g
Peptone (meat and casein, equal parts)	3.0	g
Lactose	10.0	g
Sodium chloride	5.0	g
Bile salts	1.5	g
Agar	13.5	g
Neutral red	30	mg
Crystal violet	1	mg
Water to	1000	ml

Boil the mixture of solids and water for 1 minute to effect solution. Adjust the *p*H after sterilisation to 7.1 ± 0.2.

MacConkey Broth Medium

Pancreatic digest of gelatin	20.0	g
Lactose	10.0	g
Dehydrated ox bile	5.0	g
Bromocresol purple	10	mg
Water to	1000	ml

Adjust the *p*H after sterilisation to 7.3±0.2.

Mannitol-Salt Agar Medium

Pancreatic digest of gelatin	5.0	g
Peptic digest of animal tissue	5.0	g
Beef extract	1.0	g
D-Mannitol	10.0	g
Sodium chloride	75.0	g
Agar	15.0	g
Phenol red	25	mg
Water to	1000	ml

Mix, heat with frequent agitation and boil for 1 minute to effect solution. Adjust the *p*H after sterilisation to 7.4 ± 0.2.

Nutrient Agar Medium: Nutrient broth gelled by the addition of 1 to 2 per cent w/v of agar.

Nutrient Broth Medium

Beef extract	10.0	g
Peptone	10.0	g
Sodium chloride	5	mg
Water to	1000	ml

Dissolve with the aid of heat. Adjust the pH to 8.0 to 8.4 with *5M sodium hydroxide* and boil for 10 minutes. Filter, and sterilise by maintaining at 115^0 for 30 minutes and adjust the *p*H to 7.3±0.1.

Pseudomonas Agar Medium for Detection of Flourescein

Pancreatic digest of casein	10.0	g
Peptic digest of animal tissue	10.0	g
Anhydrous dibasic potassium phosphate	1.5	g
Magnesium sulphate hepta hydrate	1.5	g
Glycerin	10.0	ml
Agar	15.0	g
Water to	1000	ml

Dissolve the solid components in water before adding glycerin. Heat with frequent agitation and boil for 1 minute to effect solution. Adjust the *p*H after sterilisation to 7.2±0.2.

Pseudomonas Agar Medium for Detection of Pyocyanin

Pancreatic digest of gelatin	20.0	g
Anhydrous magnesium chloride	1.4	g
Anhydrous potassium sulphate	10.0	g
Agar	15.0	g
Glycerin	10.0	ml
Water to	1000	ml

Dissolve the solid components in water before adding glycerin. Heat with frequent agitation and boil for 1 minute to effect solution. Adjust the *p*H after sterilisation to 7.2±0.2.

Sabouraud Dextrose Agar Medium

Dextrose	40	g
Mixture of equal parts of peptic digest of animal tissue and Pancreatic digest of casein	10	g
Agar	15	g
Water to	1000	ml

Mix, and boil to effect solution. Adjust the *p*H after sterilisation to 5.6 ± 0.2.

Sabouraud Dextrose Agar Medium with Antibiotics

To 1 liter of Sabouraud Dextrose Agar Medium add 0.1 g of benzylpenicillin sodium and 0.1 g of tetracycline or alternatively add 50 mg of chloramphenicol immediately before use.

Selenite F Broth

Peptone	5	g
Lactose	4	g
Disodium hydrogen phosphate	10	g
Sodium hydrogen selenite	4	g

Water to	1000	ml

Dissolve, distribute in sterile containers and sterilise by maintaining at 100º for 30 minutes.

Fluid Selenite-Cystine Medium

Pancreatic digest of casein	5.0	g
Lactose	4.0	g
Sodium phosphate	10.0	g
Sodium hydrogen selenite	4.0	g
L-Cystine	10.0	mg
Water to	1000	ml

Mix and heat to effect solution. Heat in flowing steam for 15 minutes. Adjust the final *p*H to 7.0±0.2. Do not sterilise.

Tetrathionate Broth Medium

Beef extract	0.9	g
Peptone	4.5	g
Yeast extract	1.8	g
Sodium chloride	4.5	g
Calcium carbonate	25.0	g
Sodium thiosulphate	40.7	g
Water to	1000	ml

Dissolve the solids in water and heat the solution to boil. On the day of use, add a solution prepared by dissolving 5 g of potassium iodide and 6 g of iodine in 20 ml of water.

Tetrathionate-Bile-Brilliant Green Broth Medium

Peptone	8.6	g
Dehydrated ox bile	8.0	g
Sodium chloride	6.4	g
Calcium carbonate	20.0	g
Potassium tetrathionate	20.0	g
Brilliant green	70	mg
Water to	1000	ml

Heat just to boiling; do not reheat. Adjust the *p*H so that after heating it is 7.0±0.2.

Triple Sugar-Iron Agar Medium

Beef extract	3.0	g
Yeast extract	3.0	g
Peptone	20.0	g
Lactose	10.0	g
Sucrose	10.0	g
Dextrose monohydrate	1.0	g

Ferrous sulphate	0.2	g
Sodium chloride	5.0	g
Sodium thiosulphate	0.3	g
Phenol red	24	mg
Agar	12.0	g
Water to	1000	ml

Mix, allow standing for 15 minutes, bringing to boil and maintain at boiling point until solution is complete, mix, distributing in tubes and sterilising by maintaining at 115^0 for 30 minutes. Allow to stand in a sloped form with a butt about 2.5 cm long.

Urea Broth Medium

Potassium dihydrogen orthophosphate	9.1	g
Anhydrous disodium hydrogen phosphate	9.5	g
Urea	20.0	g
Yeast extract	0.1	g
Phenol red	10	mg
Water to	1000	ml

Mix, sterilise by filtration and distribute aseptically in sterile containers.

Vogel-Johnson Agar Medium

Pancreatic digest of casein	10.0	g
Yeast extract	5.0	g
Mannitol	10.0	g
Dibasic potassium phosphate	5.0	g
Lithium chloride	5.0	g
Glycerin	10.0	g
Agar	16.0	g
Phenol red	25.0	mg
Water to	1000	ml

Boil the solution of solids for 1 minute. Sterilise, cool to between 45^0 to 50^0 and add 20 ml of a 1 per cent w/v sterile solution of potassium tellurite. Adjust the *p*H after sterilisation to 7.0±0.2.

Xylose-Lysine-Desoxycholate Agar Medium

Xylose	3.5	g
L-Lysine	5.0	g
Lactose	7.5	g
Sucrose	7.5	g
Sodium chloride	5.0	g
Yeast extract	3.0	g
Phenol red	80	mg
Agar	13.5	g
Sodium desoxycholate	2.5	g
Sodium thiosulphate	6.8	g

Ferric ammonium citrate	800	mg
Water to	1000	ml

Heat the mixture of solids and water, with swirling, just to the boiling point. Do not overheat or sterilise. Transfer at once to a water-bath maintained at about 50^0 and pour into plates as soon as the medium has cooled. Adjust the final *p*H to 7.4 ± 0.2.

Sampling: Use 10 ml or 10 g specimens for each of the tests specified in the individual monograph.

Precautions: The microbial limit tests should be carried out under conditions designed to avoid accidental contamination during the test. The precautions taken to avoid contamination must be such that they do not adversely affect any micro-organisms that should be revealed in the test.

2.4.1. - Total Aerobic Microbial Count

Pretreat the sample of the product being examined as described below.

Water-soluble products: Dissolve 10 g or dilute 10 ml of the preparation being examined, unless otherwise specified, in buffered sodium chloride-peptone solution *p*H 7.0 or any other suitable medium shown to have no antimicrobial activity under the conditions of test and adjust the volume to 100 ml with the same medium. If necessary, adjust the *p*H to about 7.

Products insoluble in water (non-fatty): Suspend 10 g or 10 ml of the preparation being examined, unless otherwise specified, in buffered sodium chloride-peptone solution *p*H 7.0 or any other suitable medium shown not to have antimicrobial activity under the conditions of the test and dilute to 100 ml with the same medium. If necessary, divide the preparation being examined and homogenize the suspension mechanically.

A suitable surface-active agent such as 0.1 per cent w/v of polysorbate 80 may be added to assist the suspension of poorly wettable substances. If necessary, adjust the pH of the suspension to about 7.

Fatty products: Homogenise 10 g or 10 ml of the preparation being examined, unless otherwise specified, with 5 g of polysorbate 20 or polysorbate 80. If necessary, heat to not more than 40^0. Mix carefully while maintaining the temperature in the water-bath or in an oven. Add 85 ml of buffered sodium chloride-peptone solution pH 7.0 or any other suitable medium shown to have no antimicrobial activity under the conditions of the test, heated to not more than 40^0 if necessary. Maintain this temperature for the shortest time necessary for formation of an emulsion and in any case for not more than 30 minutes. If necessary, adjust the pH to about 7.

Examination of the sample: Determine the total aerobic microbial count in the substance being examined by any of the following methods.

Membrane filtration: Use membrane filters 50 mm in diameter and having a nominal pore size not greater than 0.45 µm the effectiveness of which in retaining bacteria has been established for the type of preparation being examined.

Transfer 10 ml or a quantity of each dilution containing 1 g of the preparation being examined to each of two membrane filters and filter immediately. If necessary, dilute the pretreated preparation so that a colony count of 10 to 100 may be expected. Wash each membrane by filtering through it three or more successive quantities, each of about 100 ml, of a suitable liquid such as *buffered sodium chloride-peptone solution pH 7.0.* For fatty substances add to the liquid *polysorbate 20* or *polysorbate 80.* Transfer one of the membrane filters, intended for the enumeration of bacteria, to the surface of a plate of *casein soyabean digest agar* and the other, intended for the enumeration of fungi, to the surface of a plate of *Sabouraud dextrose agar* with antibiotics.

Incubate the plates for 5 days, unless a more reliable count is obtained in shorter time, at 30^0 to 35^0 in the test for bacteria and 20^0 to 25^0 in the test for fungi. Count the number of colonies that are formed. Calculate the number of micro-organisms per g or per ml of the preparation being examined, if necessary counting bacteria and fungi separately.

Plate count for bacteria: Using Petri dishes 9 to 10 cm in diameter, add to each dish a mixture of 1 ml of the pretreated preparation and about 15 ml of liquefied *casein soyabean digest agar* at not more than 45^0. Alternatively, spread the pretreated preparation on the surface of the solidified medium in a Petri dish of the same diameter. If necessary, dilute the pretreated preparation as described above so that a colony count of not more than 300 may be expected. Prepare at least two such Petri dishes using the same dilution and incubate at 30^0 to 35^0 for 5 days, unless a more reliable count is obtained in a shorter time. Count the number of colonies that are formed. Calculate the results using plates with the greatest number of colonies but taking 300 colonies per plate as the maximum consistent with good evaluation.

Plate count for fungi: Proceed as described in the test for bacteria but use *Sabouraud dextrose agar with antibiotics* in place of *casein soyabean digest agar* and incubate the plates at 20^0 to 25^0 for 5 days, unless a more reliable count is obtained in a shorter time. Calculate the results using plates with not more than 100 colonies.

Multiple-tube or serial dilution method: In each of fourteen test-tubes of similar size place 9.0 ml of sterile *fluid soyabean casein digest medium.* Arrange twelve of the tubes in four sets of three tubes each. Put aside one set of three tubes to serve as controls. Into each of three tubes of one set ("100") and into fourth tube (A) pipette 1 ml of the solution of suspension of the test specimen and mix. From tube A pipette 1 ml of its contents into the one remaining tube (B) not included in the set and mix. These two tubes contain 100 mg (or 100 µl) and 10 mg (or 10 µl) of the specimen respectively. Into each of the second set ("10") of three tubes pipette 1 ml from tube

A, and into each tube of the third set ("1") pipette 1 ml from tube B. Discard the unused contents of tube A and B. Close well and incubate all of the tubes. Following the incubation period, examine the tubes for growth. The three control tubes remain clear. Observations in the tubes containing the test specimen, when interpreted by reference to Table 2.3, indicate the most probable number of micro-organisms per g or per ml of the test specimen.

Table 2.3 – Most Probable Total Count by Multiple-Tube Or Serial Dilution Method

Observed combination of numbers of tubes showing growth in each set			Most probable number of micro-organisms per g or per ml
No.of mg (or ml) of specimen per tube			
100 (100 µl)	10 (10 µl)	1 (1 µl)	
3	3	3	>1100
3	3	2	1100
3	3	1	500
3	3	0	200
3	2	3	290
3	2	2	210
3	2	1	150
3	2	0	90

3	1	3	160
3	1	2	120
3	1	1	70
3	1	0	40
3	0	3	95
3	0	2	60
3	0	1	40
3	0	0	23

2.4.2. - Tests for Specified Micro-Organisms

Pretreatment of the sample being examined: Proceed as described under the test for total aerobic microbial count but using lactose broth or any other suitable medium shown to have no antimicrobial activity under the conditions of test in place of buffered sodium chloride-peptone solution *p*H 7.0.

Escherichia coli : Place the prescribed quantity in a sterile screw-capped container, add 50 ml of nutrient broth, shake, allow to stand for 1 hour (4 hours for gelatin) and shake again. Loosen the cap and incubate at 37^0 for 18 to 24 hours.

Primary test: Add 1.0 ml of the enrichment culture to a tube containing 5 ml of MacConkey broth. Incubate in a water-bath at 36^0 to 38^0 for 48 hours. If the contents of the tube show acid and gas carry out the secondary test.

Secondary test: Add 0.1 ml of the contents of the tubes containing (a) 5 ml of MacConkey broth, and (b) 5 ml of peptone water. Incubate in a water-bath at 43.5^0 to 44.5^0 for 24 hours and examine tube (a) for acid and gas and tube (b) for indole. To test for indole, add 0.5 ml of Kovac's reagent, shake well and allow to stand for 1 minute; if a red colour is produced in the reagent layer indole is present. The presence of acid and gas and of indole in the secondary test indicates the presence of *Escherichia coli*.

Carry out a control test by repeating the primary and secondary tests adding 1.0 ml of the enrichment culture and a volume of broth containing 10 to 50 *Escherichia coli* (NCTC 9002) organisms, prepared from a 24-hour culture in nutrient broth, to 5 ml of MacConkey broth. The test is not valid unless the results indicate that the control contains *Escherichia coli*.

Alternative test: By means of an inoculating loop, streak a portion from the enrichment culture (obtained in the previous test) on the surface of MacConkey agar medium. Cover and invert the dishes and incubate. Upon examination, if none of the colonies are brick-red in colour and have a surrounding zone of precipitated bile the sample meets the requirements of the test for the absence of *Escherichia coli*.

If the colonies described above are found, transfer the suspect colonies individually to the surface of Levine eosin-methylene blue agar medium, plated on Petri dishes. Cover and invert the plates and incubate. Upon examination, if none of the colonies exhibits both a characteristic metallic sheen under reflected light and a blue-black appearance under transmitted light, the sample meets the requirements of the test for the absence of *Escherichia coli*. The presence of *Escherichia coli* may be confirmed by further suitable cultural and biochemical tests.

Salmonella : Transfer a quantity of the pretreated preparation being examined containing 1 g or 1 ml of the product to 100 ml of nutrient broth in a sterile screw-capped jar, shake, allow to stand for 4 hours and shake again. Loosen the cap and incubate at 35^0 to 37^0 for 24 hours.

Primary test: Add 1.0 ml of the enrichment culture to each of the two tubes containing (a) 10 ml of selenite F broth and (b) tetrathionate-bile-brilliant green broth and incubate at 36^0 to 38^0 for 48 hours. From each of these two cultures subculture on at least two of the following four agar media: bismuth sulphate agar, brilliant green agar, deoxycholatecitrate agar and xylose-lysine-deoxycholate agar. Incubate the plates at 36^0 to 38^0 for 18 to 24 hours. Upon examination, if none of the colonies conforms to the description given in Table 2.4, the sample meets the requirements of the test for the absence of the genus *Salmonella*.

If any colonies conforming to the description in Table 2.4 are produced, carry out the secondary test.

Secondary test: Subculture any colonies showing the characteristics given in Table 2.4 in triple sugar-iron agar by first inoculating the surface of the slope and then making a stab culture with the same inoculating needle, and at the same time inoculate a tube of urea broth. Incubate at 36^0 to 38^0 for 18 to 24 hours. The formation of acid and gas in the stab culture (with or without concomitant blackening) and the absence of acidity from the surface growth in the triple sugar iron agar, together with the absence of a red colour in the urea broth, indicate the presence of *Salmonella*. If acid but no gas is produced in the stab culture, the identity of the organisms should be confirmed by agglutination tests.

Carry out the control test by repeating the primary and secondary tests using 1.0 ml of the enrichment culture and a volume of broth containing 10 to 50 *Salmonella abony* (NCTC 6017) organisms, prepared from a 24-hour culture in nutrient broth, for the inoculation of the tubes (a) and (b). The test is not valid unless the results indicate that the control contains *Salmonella.*

Table 2.4 – Test for *Salmonella*

Medium	Description of colony
Bismuth sulphite agar	Black or green
Brilliant green agar	Small, transparent and colourless, or opaque, pinkish or white (frequently surrounded by a pink or red zone)
Deoxycholate-citrate agar	Colourless and opaque, with or without black centers
Xylose-lysine-desoxy-cholate agar	Red with or without black centres

Pseudomonas aeruginosa: Pretreat the preparation being examined as described above and inoculate 100 ml of fluid soyabean-casein digest medium with a quantity of the solution, suspension or emulsion thus obtained containing 1 g or 1 ml of the preparation being examined. Mix and incubate at 35^0 to 37^0 for 24 to 48 hours. Examine the medium for growth and if growth is present, streak a portion of the medium on the surface of cetrimide agar medium, each plated on Petri dishes. Cover and incubate at 35^0 to 37^0 for 18 to 24 hours.

If, upon examination, none of the plates contains colonies having the characteristics listed in Table 3 for the media used, the sample meets the requirement for freedom from *Pseudomonas aeruginosa*. If any colonies conforming to the description in Table 2.5 are produced, carry out the oxidase and pigent tests.

Streak representative suspect colonies from the agar surface of cetrimide agar on the surfaces of *Pseudomonas* agar medium for detection of fluorescein and *Pseudomonas* agar medium for detection of pyocyanin contained in Petri dishes. Cover and invert the inoculated media and incubate at 33^0 to 37^0 for not less than 3 days. Examine the streaked surfaces under ultra-violet light. Examine the plates to determine whether colonies conforming to the description in Table 2.5 are present.

If growth of suspect colonies occurs, place 2 or 3 drops of a freshly prepared 1per cent w/v solution of *N*,*N*,*N*^{1},*N*^{1}-tetramethyl-4-phenylenediamine dihydrochloride on filter paper and smear with the colony; if there is no development of a pink colour, changing to purple, the sample meets the requirements of the test for the absence of *Pseudomonas aeruginosa.*

Table 2.4 – Tests for *Pseudomonas aeruginosa*

Medium	**Characteristic colonial morphology**	**Fluorescence in UV light**	**Oxidase test**	**Gram stain**
Cetrimide agar	Generally greenish	Greenish	Positive	Negative rods
Pseudomonas agar medium for detection of fluorescein	Generally colourless to yellowish	Yellowish	Positive	Negative rods
Pseudomonas agar medium for detection of pyocyanin	Generally greenish	Blue	Positive	Negative rods

Staphylococcus aureus: Proceed as described under *Pseudomonas aeruginosa***.** If, upon examination of the incubated plates, none of them contains colonies having the characteristics listed in Table 4 for the media used, the sample meets the requirements for the absence of *Staphylococcus aureus*.

If growth occurs, carry out the coagulase test. Transfer representative suspect colonies from the agar surface of any of the media listed in Table 2.5 to individual tubes, each containing 0.5 ml of mammalian, preferably rabbit or horse, plasma with or without additives. Incubate in water-bath at 37^{0} examining the tubes at 3 hours and subsequently at suitable intervals up to 24 hours. If no coagulation in any degree is observed, the sample meets the requirements of the test for the absence of *Staphylococcus aureus*.

Table 2.5 – Tests for *Staphylococcus aureus*

Selective medium	**Characteristic colonial morphology**	**Gram stain**
Vogel-Johnson agar	Black surrounded by yellow zones	Positive cocci (in clusters)
Mannitol-salt agar	Yellow colonies with yellow zones	Positive cocci (in clusters)
Baird-Parker agar	Black, shiny, surrounded by clear zones of 2 to 5 mm	Positive cocci (in clusters)

Validity of the tests for total aerobic microbial count:

Grow the following test strains separately in tubes containing fluid soyabean-casein digest medium at 30^{0} to 35^{0} for 18 to 24 hours or, for *Candida albicans*, at 20^{0} for 48 hours.

Staphylococcus aureus (ATCC 6538; NCTC 10788)
Bacillus subtilis (ATCC 6633; NCIB 8054)
Escherichia coli (ATCC 8739; NCIB 8545)
Candida albicans (ATCC 2091; ATCC 10231)

Dilute portions of each of the cultures using buffered sodium chloride-peptone solution pH 7.0 to make test suspensions containing about 100 viable micro-organisms per ml. Use the suspension of each of the micro-organisms separately as a control of the counting methods, in the presence and absence of the preparation being examined, if necessary.

A count for any of the test organisms differing by not more than a factor of 10 from the calculated value for the inoculum should be obtained. To test the sterility of the medium and of the diluent and the aseptic performance of the test, carry out the total aerobic microbial count method using sterile buffered sodium chloride-peptone solution *p*H 7.0 as the test preparation. There should be no growth of micro-organisms.

Validity of the tests for specified micro-organisms: Grow separately the test strains of *Staphylococcus aureus* and *Pseudomonas aeruginosa* in fluid soyabean-casein digest medium and *Escherichia coli* and *Salmonella typhimurium* at 30^0 to 35^0 for 18 to 24 hours. Dilute portions of each of the cultures using buffered sodium chloride-peptone solution *p*H 7.0 to make test suspensions containing about 10^3 viable micro-organisms per ml. Mix equal volume of each suspension and use 0.4 ml (approximately 10^2 micro-organisms of each strain) as an inoculum in the test for *E. coli, Salmonella*, *P. aeruginosa* and *S. aureus*, in the presence and absence of the preparation being examined, if necessary. A positive result for the respective strain of micro-organism should be obtained.

Microbial Contamination Limits

S.No.	Parameters	Permissible limits
1.	*Staphylococcus aureus*/g.	Absent
2.	*Salmonella* sp./g .	Absent
3.	*Pseudomonas aeruginosa*/g	Absent
4.	*Escherichia coli*	Absent
5.	Total microbial plate count (TPC)	10^5/g*
6.	Total Yeast & Mould	10^3/g

*For topical use, the limit shall be 10^7/g.

2.5. - PESTICIDE RESIDUE

Definition: For the purposes of the Pharmacopoeia, a pesticide is any substance or mixture of substances intended for preventing, destroying or controlling any pest, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of vegetable drugs. The item includes substances intended for use as growth-regulators, defoliants or desiccants and any substance applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

Limits: Unless otherwise indicated in the monograph, the drug to be examined at least complies with the limits indicated in Table -1, The limits applying to pesticides that are not listed in the table and whose presence is suspected for any reason comply with the limits set by European Community directives 76/895 and 90/642, including their annexes and successive updates. Limits for pesticides that are not listed in Table.-1 nor in EC directives are calculated using the following expression:

$$ADI \times M$$

$$\frac{\textbf{MDD x } \textit{100}}{}$$

ADI = Acceptable Daily Intake, as published by FAO-WHO, in milligrams per kilogram of body mass,

M = body mass in kilograms (60 kg),

MDD = daily dose of the drug, in kilograms.

If the drug is intended for the preparation of extracts, tinctures or other pharmaceutical forms whose preparation method modifies the content of pesticides in the finished product, the limits are calculated using the following expression:

$$\frac{ADI \times M \times E}{\textbf{MDD x 100}}$$

E = Extraction factor of the method of preparation, determined experimentally.

Higher limits can also be authorised, in exceptional cases, especially when a plant requires a particular cultivation method or has a metabolism or a structure that gives rise to a higher than normal content of pesticides.

The competent authority may grant total or partial exemption from the test when the complete history (nature and quantity of the pesticides used, date of each treatment during cultivation and after the harvest) of the treatment of the batch is known and can be checked precisely.

Sampling

Method: For containers up to 1 kg, take one sample from the total content, thoroughly mixed, sufficient for the tests. For containers between 1 kg and 5 kg, take three samples, equal in volume, from the upper, middle and lower parts of the container, each being sufficient to carry out the tests. Thoroughly mix the samples and take from the mixture an amount sufficient to carry out the tests. For containers of more than 5 kg, take three samples, each of at least 250 g from the upper, middle and lower parts of the container. Thoroughly mix the samples and take from the mixture an amount sufficient to carry out the tests.

Size of sampling: If the number (n) of containers is three or fewer, take samples from each container as indicated above under Method. If the number of containers is more than three, take n+1 samples for containers as indicated under Method, rounding up to the nearest unit if necessary.

The samples are to be analysed immediately to avoid possible degradation of the residues. If this is not possible, the samples are stored in air-tight containers suitable for food contact, at a temperature below 0^0, protected from light.

Reagents: All reagents and solvents are free from any contaminants, especially pesticides, that might interfere with the analysis. It is often necessary to use special quality solvents or, if this is not possible, solvents that have recently been re-distilled in an apparatus made entirely of glass. In any case, suitable blank tests must be carried out.

Apparatus: Clean the apparatus and especially glassware to ensure that they are free from pesticides, for example, soak for at least 16 h in a solution of phosphate-free detergent, rinse with large quantities of *distilled water* and wash with *acetone* and *hexane* or *heptane*.

2.5.1. - Qualitative and Quantitative Analysis of Pesticide Residues

The analytical procedures used are validated according to the regulations in force. In particular, they satisfy the following criteria:

- the chosen method, especially the purification steps, are suitable for the combination pesticide residue/substance to be analysed and not susceptible to interference from co-extractives; the limits of detection and quantification are measured for each pesticide-matrix combination to be analysed.

- between 70 per cent to 110 per cent of each pesticide is recovered.

- the repeatability of the method is not less than the values indicated in Table 2.6.

- the reproducibility of the method is not less than the values indicated in Table 2.7.

- the concentration of test and reference solutions and the setting of the apparatus are such that a linear response is obtained from the analytical detector.

Table -2.6

Substance	**Limit (mg/kg)**
Alachlor	0.02
Aldrin and Dieldrin (sum of)	0.05
Azinphos-methyl	1.0
Bromopropylate	3.0
Chlordane (sum of cis-, trans – and Oxythlordane)	0.05
Chlorfenvinphos	0.5
Chlorpyrifos	0.2
Chlorpyrifos-methyl	0.1
Cypermethrin (and isomers)	1.0
DDT (sum of p,p-'DDT, o,p-'DDT, p,p-'DDE and p,p-'TDE	1.0
Deltamethrin	0.5
Diazinon	0.5
Dichlorvos	1.0
Dithiocarbamates (as CS2)	2.0
Endosulfan (sum of isomers and Endosulfan sulphate)	3.0
Endrin	0.05
Ethion	2.0
Fenitrothion	0.5
Fenvalerate	1.5
Fonofos	0.05
Heptachlor (sum of Heptachlor and Heptachlorepoxide)	0.05
Hexachlorobenzene	0.1
Hexachlorocyclohexane isomers (other than γ)	0.3
Lindane (γ-Hexachlorocyclohexane)	0.6
Malathion	1.0
Methidathion	0.2
Parathion	0.5
Parathion-methyl	0.2
Permethrin	1.0
Phosalone	0.1

Piperonyl butoxide	3.0
Pirimiphos-methyl	4.0
Pyrethrins (sum of)	3.0
Quintozene (sum of quintozene, pentachloroaniline and methyl pentachlorophenyl sulphide)	1.0

Table -2.7

Concentration of the pesticide (mg/kg)	Repeatability (difference, ± mg/kg)	Reproducibility (difference, ± mg/kg)
0.010	0.005	0.01
0.100	0.025	0.05
1.000	0.125	0.25

2.5.2. - Test for Pesticides

Organochlorine, Organophosphorus and Pyrethroid Insecticides

The following methods may be used, in connection with the general method above, depending on the substance being examined, it may be necessary to modify, sometimes extensively, the procedure described hereafter. In any case, it may be necessary to use, in addition, another column with a different polarity or another detection method (mass spectrometry) or a different method (immunochemical methods) to confirm the results obtained.

This procedure is valid only for the analysis of samples of vegetable drugs containing less than 15 per cent of water. Samples with a higher content of water may be dried, provided it has been shown that the drying procedure does not affect significantly the pesticide content.

1. Extraction

To 10 g of the substance being examined, coarsely powdered, add 100 ml of *acetone* and allow to stand for 20 min. Add 1 ml of a solution containing 1.8 µg/ml of *carbophenothion* in *toluene*.. Homogenise using a high-speed blender for 3 min. Filter and wash the filter cake with two quantities, each of 25 ml, of *acetone.* Combine the filtrate and the washings and heat using a rotary evaporator at a temperature not exceeding 40^0 C until the solvent has almost completely evaporated. To the residue add a few milliliters of *toluene* and heat again until the acetone is completely removed. Dissolve the residue in 8 ml of *toluene.* Filter through a membrane filter (45 µm), rinse the flask and the filter with *toluene* and dilute to 10.0 ml with the same solvent (solution A).

2. Purification

2.1 Organochlorine, organophosphorus and pyrethroid insecticides:

Examine by size-exclusion chromatography.
The chromatographic procedure may be carried out using:

- a stainless steel column 0.30 m long and 7.8 mm in internal diameter packed with styre:e-divinylbenzene copolymer (5 µm).

- as mobile phase *toluene* at a flow rate of 1 ml/min.

*Performance of the column***:** Inject 100 µl of a solution containing 0.5 g/l of *methyl red* and 0.5 g/l of *oracet blue* in *toluene* and proceed with the chromatography. The column is not suitable unless the colour of the eluate changes from orange to blue at an elution volume of about 10.3 ml. If necessary calibrate the column, using a solution containing, in *toluene,* at a suitable concentration, the insecticide to be analysed with the lowest molecular mass (for example, dichlorvos) and that with the highest molecular mass (for example, deltamethrin). Determine which fraction of the eluate contains both insecticides.

*Purification of the test solution***:** Inject a suitable volume of solution A (100 µl to 500 µl) and proceed with the chromatography. Collect the fraction as determined above (solution B). Organophosphorus insecticides are usually eluted between 8.8 ml and 10.9 ml. Organochlorine and pyrethroid insecticides are usually eluted between 8.5 ml and 10.3 ml.

2.2 Organochlorine and pyrethroid insecticides: In a chromatography column, 0.10 m long and 5 mm in internal diameter, introduce a piece of defatted cotton and 0.5 g of silica gel treated as follows: heat *silica gel for chromatography* in an oven at 150^0 for at least 4 h. Allow to cool and add dropwise a quantity of *water* corresponding to 1.5 per cent of the mass of silica gel used; shake vigorously until agglomerates have disappeared and continue shaking for 2 h using a mechanical shaker. Condition the column using 1.5 ml of *hexane.* Prepacked columns containing about 0.50 g of a suitable silica gel may also be used provided they are previously validated.

Concentrate solution B in a current of helium for chromatography or oxygen-free nitrogen almost to dryness and dilute to a suitable volume with *toluene* (200 µl to 1 ml according to the volume injected in the preparation of solution B). Transfer quantitatively onto the column and proceed with the chromatography using 1.8 ml of *toluene* as the mobile phase. Collect the eluate (solution C).

2.5.3. - Quantitative Analysis

A. Organophosphorus insecticides: Examine by gas chromatography, using *carbophenothion* as internal standard. It may be necessary to use a second internal standard to identify possible interference with the peak corresponding to carbophenothion.

Test solution: Concentrate solution B in a current of helium for chromatography almost to dryness and dilute to 100 µl with *toluene.*

Reference solution: Prepare at least three solutions in *toluene* containing the insecticides to be determined and *carbophenothion* at concentrations suitable for plotting a calibration curve.

The chromatographic procedure may be carried out using:

- a fused-silica column 30 m long and 0.32 mm in internal diameter the internal wall of which is covered with a layer 0.25 µm thick of poly (dimethyl) siloxane.

- hydrogen for chromatography as the carrier gas. Other gases such as helium for chromatography or nitrogen for chromatography may also be used provided the chromatography is suitably validated.

- a phosphorus-nitrogen flame-ionisation detector or a atomic emission spectrometry detector.

Maintaining the temperature of the column at 80^0 for 1 min, then raising it at a rate of 30^0 /min to 150^0, maintaining at 150^0 for 3 min, then raising the temperature at a rate of 4^0/min to 280^0 and maintaining at this

temperature for 1 min and maintaining the temperature of the injector port at 250^0 and that of the detector at 275^0. Inject the chosen volume of each solution. When the chromatograms are recorded in the prescribed conditions, the relative retention times are approximately those listed in Table 2.8 Calculate the content of each insecticide from the peak areas and the concentrations of the solutions.

B. Organochlorine and Pyrethroid Insecticides: Examine by gas chromatography, using *carbophenothion* as the internal standard. It may be necessary to use a second internal standard to identify possible interference with the peak corresponding to *carbophenothion*.

Test solution: Concentrate solution C in a current of helium for chromatography or oxygen-free nitrogen almost to dryness and dilute to 500 µl with *toluene.*

Reference solution: Prepare at least three solutions in *toluene* containing the insecticides to be determined and *carbophenothion* at concentrations suitable for plotting a calibration curve.

Table 2.8- Relative Retention Times of Pesticides

Substance	**Relative retention times**
Dichlorvos	0.20
Fonofos	0.50
Diazinon	0.52
Parathion-methyl	0.59
Chlorpyrifos-methyl	0.60
Pirimiphos-methyl	0.66
Malathion	0.67
Parathion	0.69
Chlorpyrifos	0.70
Methidathion	0.78
Ethion	0.96
Carbophenothion	1.00
Azinphos-methyl	1.17
Phosalon	1.18

The chromatographic procedure may be carried out using:

- a fused silica column 30 m long and 0.32 mm in internal diameter the internal wall of which is covered with a layer 0.25 µm thick of *poly (dimethyl diphenyl) siloxane.*
- hydrogen for chromatography as the carrier gas. Other gases such as helium for chromatography or nitrogen for chromatography may also be used, provided the chromatography is suitably validated.
- an electron-capture detector.
- a device allowing direct cold on-column injection.

maintaining the temperature of the column at 80^0 for 1 min, then raising it at a rate of 30^0/min to 150^0, maintaining at 150^0 for 3 min, then raising the temperature at a rate of 4^0/min to 280^0 and maintaining at this temperature for 1 min and maintaining the temperature of the injector port at 250^0 and that of the detector at 275^0. Inject the chosen volume of each solution. When the chromatograms are recorded in the prescribed conditions, the relative retention times are approximately those listed in Table 2.9. Calculate the content of each insecticide from the peak areas and the concentrations of the solutions.

Table 2.9- Relative Retention Times of Insecticides

Substance	**Relative retention times**
α-Hexachlorocyclohexane	0.44
Hexachlorobenzene	0.45

β-Hexachlorocyclohexane	0.49
Lindane	0.49
δ-Hexachlorocyclohexane	0.54
ε-Hexachlorocyclohexane	0.56
Heptachlor	0.61
Aldrin	0.68
cis-Heptachlor-epoxide	0.76
o,p-'DDE	0.81
α-Endosulfan	0.82
Dieldrin	0.87
p,p-'DDE	0.87
o,p-'DDD	0.89
Endrin	0.91
β-Endosulfan	0.92
o,p-'DDT	0.95
Carbophenothion	1.00
p,p-'DDT	1.02
cis-Permethrin	1.29
trans-Permethrin	1.31
Cypermethrin*	1.40
Fenvalerate*	1.47 and 1.49
Deltamethrin	1.54

*The substance shows several peaks.

2.6. - GAS CHROMATOGRAPHY

Gas chromatography (GC) is a chromatographic separation technique based on the difference in the distribution of species between two non-miscible phases in which the mobile phase is a carrier gas moving through or passing the stationary phase contained in a column. It is applicable to substances or their derivatives, which are volatilized under the temperatures employed.

GC is based on mechanisms of adsorption, mass distribution or size exclusion.

Apparatus

The apparatus consists of an injector, a chromatographic column contained in an oven, a detector and a data acquisition system (or an integrator or a chart recorder). The carrier gas flows through the column at a controlled rate or pressure and then through the detector.

The chromatography is carried out either at a constant temperature or according to a given temperature programme.

Injectors

Direct injections of solutions are the usual mode of injection, unless otherwise prescribed in the monograph. Injection may be carried out either directly at the head of the column using a syringe or an injection valve, or into a vaporization chamber which may be equipped with a stream splitter.

Injections of vapour phase may be effected by static or dynamic head-space injection systems.

Dynamic head-space (purge and trap) injection systems include a sparging device by which volatile substances in solution are swept into an absorbent column maintained at a low temperature. Retained substances are then desorbed into the mobile phase by rapid heating of the absorbent column.

Static head-space injection systems include a thermostatically controlled sample heating chamber in which closed vials containing solid or liquid samples are placed for a fixed period of time to allow the volatile components of the sample to reach equilibrium between the non-gaseous phase and the vapour phase. After equilibrium has been established, a predetermined amount of the head-space of the vial is flushed into the gas chromatograph.

Stationary Phases

Stationary phases are contained in columns, which may be:

- a capillary column of fused-silica close wall is coated with the stationary phase.
- a column packed with inert particles impregnated with the stationary phase.
- a column packed with solid stationary phase.

Capillary columns are 0.1 mm to 0.53 mm in internal diameter (Φ) and 5 to 6 m in length. The liquid or stationary phase, which may be chemically bonded to the inner surface, is a film 0.1 µm to 5.0 µm thick.

Packed columns, made of glass or metal, are usually 1 m to 3 m in length with an internal diameter (Φ) of 2 mm to 4 mm. Stationary phases usually consist of porous polymers or solid supports impregnated with liquid phase.

Supports for analysis of polar compounds on columns packed with low-capacity, low-polarity stationary phase must be inert to avoid peak tailing. The reactivity of support materials can be reduced by silanising prior to coating with liquid phase. Acid-washed, flux-calcinated diatomaceous earth is often used. Materials are available in various particle sizes, the most commonly used particles are in the ranges of 150 µm to 180 µm and 125 µm to 150 µm.

Mobile Phases

Retention time and peak efficiency depend on the carrier gas flow rate; retention time is directly proportional to column length and resolution is proportional to the square root of the column length. For packed columns, the carrier gas flow rate is usually expressed in milliliters per minute at atmospheric pressure and room temperature, flow rate is measured at the detector outlet, either with a calibrated mechanical device or with a bubble tube, while the column is at operating temperature. The linear velocity of the carrier gas through a packed column is inversely proportional to the square root of the internal diameter of the column for a given flow volume. Flow rates of 60 ml/min in a 4 mm internal diameter column and 15 ml/min in a 2 mm internal diameter column, give identical linear velocities and thus similar retention times.

Helium or nitrogen is usually employed as the carrier gas for packed columns, whereas commonly used carrier gases for capillary columns are nitrogen, helium and hydrogen.

Detectors

Flame-ionisation detectors are usually employed but additional detectors which may be used include: electron-capture, nitrogen-phosphorus, mass spectrometric, thermal conductivity, Fourier transform infrared spectrophotometric and others, depending on the purpose of the analysis.

Method

Equilibrate the column, the injector and the detector at the temperatures and the gas flow rates specified in the monograph until a stable baseline is achieved. Prepare the test solution (s) and the reference solutions (s) as prescribed. The solutions must be free from solid particles.

Criteria for assessing the suitability of the system are described in the chapter on *Chromatographic separation techniques.* The extent to which adjustments of parameters of the chromatographic system can be made to satisfy the criteria of system suitability are also given in this chapter.

2.7. - TEST FOR AFLATOXINS

Caution: Aflatoxins are highly dangerous and extreme care should be exercised in handling aflatoxin materials.

This test is provided to detect the possible presence of aflatoxins B_1, B_2, G_1 and G_2 in any material of plant origin. Unless otherwise specified in the individual monograph, use the following method.

Zinc Acetate – Aluminum Chloride Reagent: Dissolve 20 g of *zinc acetate* and 5 g of *aluminum chloride* in sufficient water to make 100 ml.

Sodium Chloride Solution: Dissolve 5 g of *sodium chloride* in 50 ml of purified water.

Test Solution 1: Grind about 200 g of plant material to a fine powder. Transfer about 50 g of the powdered material, accurately weighed, to a glass-stoppered flask. Add 200 ml of a mixture of *methanol* and *water* (17: 3). Shake vigorously by mechanical means for not less than 30 minutes and filter. [Note – If the solution has interfering plant pigments, proceed as directed for Test Solution 2.] Discard the first 50 ml of the filtrate and collect the next 40 ml portion. Transfer the filtrate to a separatory funnel. Add 40 ml of sodium chloride solution and 25 ml of *hexane* and shake for 1 minute. Allow the layers to separate and transfer the lower aqueous layer to a second separatory funnel. Extract the aqueous layer in the separatory funnel twice, each time with 25 ml of *methylene chloride*, by shaking for 1 minute. Allow the layers to separate each time, separate the lower organic layer and collect the combined organic layers in a 125 ml conical flask. Evaporate the organic solvent to dryness on a water bath. Cool the residue. If interferences exist in the residue, proceed as directed for *Cleanup Procedure;* otherwise, dissolve the residue obtained above in 0.2 ml of a mixture of *chloroform* and *acetonitrile* (9.8 : 0.2) and shake by mechanical means if necessary.

Test Solution 2: Collect 100 ml of the filtrate from the start of the flow and transfer to a 250 ml beaker. Add 20 ml of *Zinc Acetate-Aluminum Chloride Reagent* and 80 ml of water. Stir and allow to stand for 5 minutes. Add 5 g of a suitable filtering aid, such as diatomaceous earth, mix and filter. Discard the first 50 ml of the filtrate, and collect the next 80 ml portion. Proceed as directed for *Test Solution 1,* beginning with "Transfer the filtrate to a separatory funnel."

Cleanup Procedure: Place a medium-porosity sintered-glass disk or a glass wool plug at the bottom of a 10 mm x 300 mm chromatographic tube. Prepare slurry of 2 g of silica gel with a mixture of *ethyl ether* and *hexane* (3: 1), pour the slurry into the column and wash with 5 ml of the same solvent mixture. Allow the absorbent to settle and add to the top of the column a layer of 1.5 g of *anhydrous sodium sulfate*. Dissolve the residue obtained above in 3 ml of *methylene chloride* and transfer it to the column. Rinse the flask twice with 1 ml portions of *methylene chloride*, transfer the rinses to the column and elute at a rate not greater than 1 ml per minute. Add successively to the column 3 ml of *hexane*, 3 ml of *diethyl ether* and 3 ml of *methylene chloride*; elute at a rate not greater than 3 ml per minute; and discard the eluates. Add to the column 6 mL of a mixture of *methylene chloride* and *acetone* (9 : 1) and elute at a rate not greater than 1 ml per minute, preferably without the aid of vacuum. Collect this eluate in a small vial, add a boiling chip if necessary and evaporate to dryness on a water bath. Dissolve the residue in 0.2 ml of a mixture of *chloroform* and *acetonitrile* (9.8 : 0.2) and shake by mechanical means if necessary.

Aflatoxin Solution: Dissolve accurately weighed quantities of aflatoxin B_1, aflatoxin B_2, aflatoxin G_1 and aflatoxin G_2 in a mixture of *chloroform* and *acetonitrile* (9.8: 0.2) to obtain a solution having concentrations of 0.5 µg /per ml each for aflatoxin B_1 and G_1 and 0.1µg per ml each for aflatoxins for B2 and G_2.

Procedure: Separately apply 2.5 µl, 5 µl, 7.5 µl and 10 µl of the Aflatoxin Solution and three 10 µl applications of either *Test Solution 1* or *Test Solution 2* to a suitable thin-layer chromatographic plate coated with a 0.25-mm layer of chromatographic silica gel mixture. Superimpose 5 µl of the *Aflatoxin Solution* on one of the three 10 µl applications of the *Test Solution.* Allow the spots to dry and develop the chromatogram in an unsaturated chamber containing a solvent system consisting of a mixture of *chloroform*, *acetone* and *isopropyl alcohol* (85:10:5) until the solvent front has moved not less than 15 cm from the origin. Remove the plate from the developing chamber, mark the solvent front and allow the plate to air-dry. Locate the spots on the plate by examination under UV light at 365 nm: the four applications of the *Aflatoxin Solution* appear as four clearly separated blue fluorescent spots; the spot obtained from the *Test Solution* that was superimposed on the *Aflatoxin Solution* is no more intense than that of the corresponding *Aflatoxin Solution;* and no spot from any of the other *Test Solutions* corresponds to any of the spots obtained from the applications of the *Aflatoxin Solution.* If any spot of aflatoxins is obtained in the *Test Solution,* match the position of each fluorescent spot of the *Test Solution* with those of the *Aflatoxin Solution* to identify the type of aflatoxin present. The intensity of the aflatoxin spot, if present in the *Test Solution,* when compared with that of the corresponding aflatoxin in the *Aflatoxin Solution* will give an approximate concentration of aflatoxin in the *Test Solution.*

Permissible Limit of Aflatoxins*

S.No	Aflatoxins	Permissible Limit
1.	B_1	0.5 ppm
2.	G_1	0.5 ppm
3.	B_2	0.1 ppm
4.	G_2.	0.1 ppm

*For Domestic use only

APPENDIX - 3

3.1. PHYSICAL TESTS AND DETERMINATIONS

3.1.1. - REFRACTIVE INDEX

The refractive index (η) of a substance with reference to air is the ratio of the sine of the angle of incidence to the sine of the angle of refraction of a beam of light passing from air into the substance. It varies with the wavelength of the light used in its measurement.

Unless otherwise prescribed, the refractive index is measured at 25^0 (±0.5) with reference to the wavelength of the D line of sodium (λ 589.3 nm). The temperature should be carefully adjusted and maintained since the refractive index varies significantly with temperature.

The Abbe's refractometer is convenient for most measurements of refractive index but other refractometer of equal or greater accuracy may be used. Commercial refractometers are normally constructed for use with white light but are calibrated to give the refractive index in terms of the D line of sodium light.

To achieve accuracy, the apparatus should be calibrated against *distilled water* which has a refractive index of 1.3325 at 25^0 or against the reference liquids given in the Table 3.1.

Table 3.1

Reference Liquid	$\eta_D^{20^o}$	Temperature Co-efficient Δn/Δt
Carbon tetrachloride	1.4603	-0.00057
Toluene	1.4969	-0.00056
α-Methylnaphthalene	1.6176	-0.00048

* Reference index value for the D line of sodium, measured at 20^0

The cleanliness of the instrument should be checked frequently by determining the refractive index of distilled water, which at 25^0 is 1.3325.

3.1.2. - WEIGHT PER MILLILITRE AND SPECIFIC GRAVITY

A. Weight per millilitre: The weight per millilitre of a liquid is the weight in g of 1 ml of a liquid when weighed in air at 25^0, unless otherwise specified.

Method

Select a thoroughly clean and dry pycnometer. Calibrate the pycnometer by filling it with recently boiled and cooled *water* at 25^0 and weighing the contents. Assuming that the weight of 1 ml of *water* at 25^0 when weighed in air of density 0.0012 g per ml, is 0.99602 g. Calculate the capacity of the pycnometer. (Ordinary deviations in the density of air from the value given do not affect the result of a determination significantly). Adjust the

temperature of the substance to be examined, to about 20^0 and fill the pycnometer with it. Adjust the temperature of the filled pycnometer to 25^0, remove any excess of the substance and weigh. Substract the tare weight of the pycnometer from the filled weight of the pycnometer. Determine the weight per milliliter dividing the weight in air, expressed in g, of the quantity of liquid which fills the pycnometer at the specified temperature, by the capacity expressed in ml, of the pycnometer at the same temperature.

B. Specific gravity: The specific gravity of a liquid is the weight of a given volume of the liquid at 25^0 (unless otherwise specified) compared with the weight of an equal volume of water at the same temperature, all weighing being taken in air**.**

Method

Proceed as described under wt. per ml. Obtain the specific gravity of the liquid by dividing the weight of the liquid contained in the pycnometer by the weight of water contained, both determined at 25^0 unless otherwise directed in the individual monograph.

3.1.3. - DETERMINATION OF pH VALUES

The *p*H value of an aqueous liquid may be defined as the common logarithum of the reciprocal of the hydrogen ion concentration expressed in g per litre. Although this definition provides a useful practical means for the quantitative indication of the acidity or alkalinity of a solution, it is less satisfactory from a strictly theoretical point of view. No definition of pH as a measurable quantity can have a simple meaning, which is also fundamental and exact.

The pH value of a liquid can be determined potentiometrically by means of the glass electrode, a reference electrode and a pH meter either of the digital or analogue type.

3.2. - DETERMINATION OF MELTING RANGE AND CONGEALING RANGE

3.2.1. Determination of Melting Range

The melting-range of a substance is the range between the corrected temperature at which the substance begins to form droplets and the corrected temperature at which it completely melts, as shown by formation of a meniscus.

Apparatus

(a) A capillary tube of soft glass, closed at one end, and having the following dimensions:

(i) thickness of the wall, about 0.10 to 0.15 mm.
(ii) length about 10 cm or any length suitable for apparatus used.
(iii) internal diameter 0.9 to 1.1 mm for substances melting below 100^0 or 0.8 to 1.2 mm for substances melting above 100^0.

Thermometers

Accurately standardized thermometers covering the range 10^0 to 300^0 the length of two degrees on the scale being not less than 0.8 mm. These thermometers are of the mercury-in-glass, solid-stem type; the bulb is

cylindrical in shape, and made of approved thermometric glass suitable for the range of temperature covered; each thermometer is fitted with a safety chamber. The smallest division on the thermometer scale should vary between 0.1^0 to 1.5^0 according to the melting point of the substance under test.

The following form of heating apparatus is recommended.

A glass heating vessel of suitable, construction and capacity fitted with suitable stiring device, capable of rapidly mixing the liquids.

Suitable liquids for use in the heating vessel:

Glycerin	Upto 150^0
Sulphuric acid to which a small crystal of *potassium nitrate* or 4 Drops of *nitric acid* per 100 ml has been added	Upto 200^0
A liquid paraffin of sufficiently high boiling range	Upto 250^0
Seasame oil	Upto 300^0
30 parts of *potassium sulphate*, dissolved by heating in 70 parts of *sulphuric acid*	Upto 300^0

Any other apparatus or method, preferably, the electric method may be used subject to a check by means of pure substances having melting temperature covering the ranges from 0^0 to 300^0 and with suitable intervals.

The following substances are suitable for this purpose.

Substance	Melting range
Vanillin	81^0 to 83^0
Acetanilide	114^0 to 116^0
Phenacetin	134^0 to 136^0
Sulphanilamide	164^0 to 166.5^0
Sulphapyridine	191^0 to 193^0
Caffeine (Dried at 100^0)	234^0 to 237^0

Procedure

Method I: Transfer a suitable quantity of the powdered and thoroughly dried substance to a dry capillary tube and pack the powder by tapping the tube on a hard surface so as to form a tightly packed column of 2 to 4 mm in height. Attach the capillary tube and its contents to a standardized thermometer so that the closed end is at the level of the middle of the bulb; heat in a suitable apparatus (preferably a round-bottom flask) fitted with an auxiliary thermometer regulating the rise of temperature in the beginning to 3^0 per minute. When the temperature reached is below the lowest figure of the range for the substance under examination, the heating of the apparatus is adjusted as desired; if no other directions are given, the rate of rise of temperature should be kept at 1^0 to 2^0 per minute. The statement 'determined by rapid heating' means that the rate of rise of temperature is 5^0 per minute during the entire period of heating.

Unless otherwise directed, the temperature at which the substance forms droplets against the side of the tube and the one at which it is completely melted as indicated by the formation of a definite meniscus, are read.

The following emergent stem corrections should be applied to the temperature readings.

Before starting the determination of the melting temperature the auxiliary thermometer is attached so that the bulb touches the standard thermometer at a point midway between the graduation for the expected melting temperature and the surface of the heating material. When the substance has melted, the temperature is read on the auxiliary thermometer. The correction figure to be added to the temperature reading of the standardized thermometer is calculated from the following formula

$$0.00015\ N\ (T—t)$$

Where 'T' is the temperature reading of the standardized thermometer.

't' is the temperature reading of the auxiliary thermometer.

'N' is the number of degrees of the scale of the standardized thermometer between the surface of the heating material and level of mercury.

The statement "melting range, a^0 to b^0" means that the corrected temperature at which the material forms droplets must be at least a^0, and that the material must be completely melted at the corrected temperature, b^0.

Method II: The apparatus employed for this test is the same as described for method I except for such details as are mentioned in the procedure given below

Procedure: A capillary tube open at both ends is used for this test. Melt the material under test at as low a temperature as possible. Draw into the capillary a column of the material about 10 mm high. Cool the charged tube in contact with ice for at least 2 hours. Attach the tube to the thermometer by means of rubber band and adjust it in the heating vessel containing water so that the upper edge of the material is 10 mm below the water level. Heat in the manner as prescribed in Method I until the temperature is about 5^0 below the expected melting point and then regulate the rate of rise of temperature to between 0.5^0 to 1^0 per minute. The temperature at which the material is observed to rise in the capillary tube is the melting temperature of the substance.

3.2.2. - Determination of Congealing Range

The congealing temperature is that point at which there exists a mixture of the liquid (fused) phase of a substance and a small but increasing proportion of the solid phase. It is distinct from the freezing point which is the temperature at which the liquid and solid phase of a substance are in equilibrium. In certain cases, this may happen over a range of temperatures.

The temperature at which a substance solidifies upon cooling is a useful index of its purity if heat is liberated when solidification takes place.

The following method is applicable to substances that melt between -20^0 and 150^0.

Apparatus

A test-tube (About 150 mm × 25 mm) placed inside another test-tube (about 160 mm × 40 mm) the inner tube is closed by a stopper that carries a stirrer and a thermometer (About 175 mm long and with 0.2^0 graduations) fixed so that the bulb is about 15 mm above the bottom of the tube. The stirrer is made from a glass rod or other suitable material formed at one end into a loop of about 18 mm overall diameter at right angles to the rod. The inner tube with its jacket is supported centrally in a 1-litre baker containing a suitable cooling liquid to within 20 mm of the top. The thermometer is supported in the cooling bath.

Method

Melt the substance, if a solid, at a temperature not more than 20^0 above its expected congealing point, and pour it into the inner test-tube to a height of 50 to 57 mm. Assemble the apparatus with the bulb of the thermometer immersed half-way between the top and bottom of the sample in the test-tube. Fill the bath to almost 20 mm from the top of the tube with a suitable fluid at a temperature 4^0 to 5^0 below the expected congealing point. If the substance is a liquid at room temperature, carry out the determination using a bath temperature about 15^0 below the expected congealing point. When the sample has cooled to about 5^0 above its expected congealing point stir it continuously by moving the loop up and down between the top and bottom of the sample at a regular rate of 20 complete cycles per minute. If necessary, congelation may be induced by scratching the inner walls of the test-tube with the thermometer or by introducing a small amount of the previously congealed substance under examination. Pronounced supercooling may result in deviation from the normal pattern of temperature changes. If it happens, repeat the test introducing small fragments of the solid substance under examination at 1^0 intervals when the temperature approaches the expected congealing point.

Record the reading of the thermometer every 30 seconds and continue stirring only so long as the temperature is falling. Stop the stirring when the temperature is constant to starts to rise slightly. Continue recording the temperature for at least 3 minutes after the temperature again begins to fall after remaining constant.

The congealing point will be mean of not less than four consecutive readings that lie within a range of 0.2^0.

3.2.3. - DETERMINATION OF BOILING RANGE

The boiling-range of a substance is the range of temperature within which the whole or a specified portion of the substance distils.

Apparatus

The boiling-range is determined in a suitable apparatus, the salient features of which are described below:

(a) **Distillation flask:** The flask shall be made of colourless transparent heat-resistant glass and well annealed. It should have a spherical bulb having a capacity of about 130 ml. The side tube slopes downwards in the same plane as the axis of the neck at angle of between 72^0 to 78^0. Other important dimensional details are as under:

Internal diameter of neck	15 to 17 mm
Distance from top of neck to center of side tube	72 to 78 mm
Distance from the center of the side tube to surface of the Liquid when the flask contains 100 ml liquid	87 to 93 mm
Internal diameter of side tube	3.5 to 4.5 mm
Length of side tube	97 to 103 mm

(b) **Thermometer**: Standardised thermometers calibrated for 100 mm immersion and suitable for the purpose and covering the boiling range of the substance under examination shall be employed; the smallest division on the thermometer scale may vary between 0.2^0 to 1^0 according to requirement.

(c) **Draught Screen**: suitable draught screen, rectangular in cross section with a hard asbestos board about 6 mm thick closely fitting horizontally to the sides of the screen, should be used. The asbestos board shall have a centrally cut circular hole, 110 mm in diameter. The asbestos board is meant for ensuring that hot gases from the heat source do not come in contact with the sides or neck of the flask.

(d) **Asbestos Board:** A 150 mm square asbestos board 6 mm thick provided with a circular hole located centrally to hold the bottom of the flask, shall be used. For distillation of liquids boiling below 60^0 the hole shall be 30 mm in diameter; for other liquid it should be 50 mm in diameter. This board is to be placed on the hard asbestos board of the draught screen covering its 110 mm hole.

(e) **Condenser:** A straight water-cooled glass condenser about 50 cm long shall be used.

Procedure: 100 ml of the liquid to be examined is placed in the distillation flask, and a few glass beads or other suitable substance is added. The bulb of the flask is placed centrally over a circular hole varying from 3 to 5 cm in diameter (according to the boiling range of the substance under examination), in a suitable asbestos board. The thermometer is held concentrically in the neck of the flask by means of a well fitting cork in such a manner that the bulb of the thermometer remains just below the level of the opening of the side-tube. Heat the flask slowly in the beginning and when distillation starts, adjust heating in such a manner that the liquid distils at a constant rate of 4 to 5 ml per minute. The temperature is read when the first drop runs from the condenser, and again when the last quantity of liquid in the flask is evaporated.

The boiling ranges indicated, apply at a barometric pressure of 760 mm of mercury. If the determination is made at some other barometric pressure, the following correction is added to the temperatures read:

K- (760—p)

Where p is the barometric pressure (in mm) read on a mercury barometer, without taking into account the temperature of the air;

K is the boiling temperature constant for different liquids having different boiling ranges as indicated below:—

Observed Boiling range	'K'
Below 100^0	0.04
100^0 to 140^0	0.045
141^0 to 190^0	0.05
191^0 to 240^0	0.055
above 240^0	0.06

If the barometric pressure is below 760 mm of mercury the correction is added to the observed boiling-range; if above, the correction is subtracted.

The statement 'distils between a^0 and $b^{0,}$, means that temperature at which the first drop runs from the condenser is not less than a^0 and that the temperature at which the liquid is completely evaporated is not greater than b^0.

Micro-methods of equal accuracy may be used.

3.3. - DETERMINATION OF OPTICAL ROTATION AND SPECIFIC OPTICAL ROTATION

A. Optical Rotation: Certain substances, in a pure state, in solution and in tinctures posses the property of rotating the plane of polarized light, i.e., the incident light emerges in a plane forming an angle with the plane of the incident light. These substances are said to be optically active and the property of rotating the plane of polarized light is known as optical rotation. The optical rotation is defined as the angle through which the plane of polarized light is rotated when polarized light obtained from sodium or mercury vapour lamp passes through one decimeter thick layer of a liquid or a solution of a substance at a temperature of 25º unless as otherwise stated in the monograph. Substances are described as dextrorotatory or laevoretatory according to the clockwise or anticlockwise rotation respectively of the plane of polarized light. Dextrorotation is designated by a plus (+) sign and laevorotation by a minus (-) sign before the number indicating the degrees of rotation.

Apparatus: A polarimeter on which angular rotation accurate 0.05^0 can be read may be used.

Calibration: The apparatus may be checked by using a solution of previously dried *sucrose* and measuring the optical rotation in a 2-din tube at 25^0 and using the concentrations indicated in Table.

Concentration (g/100 ml)	Angle of Rotation (+) at 25^0
10.0	13.33
20.0	26.61
30.0	39.86
40.0	53.06
50.0	66.23

Procedure: For liquid substances, take a minimum of five readings of the rotation of the liquid and also for an empty tube at the specified temperature. For a solid dissolve in a suitable solvent and take five readings of the rotation of the solution and the solvent used. Calculate the average of each set of five readings and find out the corrected optical rotation from the observed rotation and the reading with the blank (average).

B. Specific Rotation : The apparatus and the procedure for this determination are the same as those specified for optical rotation.

Specific rotation is denoted by the expression

$$[\alpha]_x^t$$

't' denotes the temperature of rotation; 'α' denotes the wave length of light used or the characteristic spectral line. Specific rotations are expressed in terms of sodium light of wave length 589.3 mw (D line) and at a temperature of 25^0, unless otherwise specified.

Specific rotation of a substance may be calculated from the following formulae:
For liquid substances

$$[\alpha]^t = \frac{a}{ld}$$

For solutions of substances

$$[\alpha]^t \leftrightarrow = \frac{a \times 100}{lc.}$$

Where a is the corrected observed rotation in degrees
1 is the length of the polarimeter tube in decimeters.

D is the specific gravity of the liquid C is the concentration of solution expressed as the number of g of the substance in 100 ml of solution.

3.4. - DETERMINATION OF VISCOSITY

Viscosity is a property of a liquid, which is closely related to the resistance to flow.

In C.G.S. system, the dynamic viscosity (n) of a liquid is the tangential force in dryness per square centimeter exerted in either of the two parallel planes placed, 1 cm apart when the space between them is filled with the fluid and one of the plane is moving in its own plane with a velocity of 1 cm per second relatively to the other. The unit of dynamic viscosity is the poise (abbreviated p). The centi poise (abbreviated cp) is $1/100^{th}$ of one poise.

While on the absolute scale, viscosity is measured in poise or centi poise, it is mot convenient to use the kinematic scale in which the units are stokes (abbreviated S) and centi-stokes (abbreviated CS). The centistokes is $1/100^{th}$ of one stoke. The kinematic viscosity of a liquid is equal to the quotient of the dynamic viscosity and the density of the liquid at the same temperature, thus :

$$\text{Kinematic Viscosity} = \frac{\text{Dynamic Viscosity}}{\text{Density}}$$

Viscosity of liquid may be determined by any method that will measure the resistance to shear offered by the liquid.

Absolute viscosity can be measured directly if accurate dimensions of the measuring instruments are known but it is more common practice to calibrate the instrument with a liquid of known viscosity and to determine the viscosity of the unknown fluid by comparison with that of the known.

Procedure: The liquid under test is filled in a U tube viscometer in accordance with the expected viscosity of the liquid so that the fluid level stands within 0.2 mm of the filling mark of the viscometer when the capillary is vertical and the specified temperature is attained by the test liquid. The liquid is sucked or blown to the specified weight of the viscometer and the time taken for the meniscus to pass the two specified marks is measured. The kinematic viscosity in centistokes is calculated from the following equation:

$$\text{Kinematic viscosity} = kt$$

Where k = the constant of the viscometer tube determined by observation on liquids of known kinematic viscosity; t = time in seconds for meniscus to pass through the two specified marks.

3.5. - DETERMINATION OF TOTAL SOLIDS

Determination of total solids in Asava/ Aristha is generally required. Asava/ Aristha containing sugar or honey should be examined by method 1, sugar or honey free Asava/ Aristha and other material should be examined by method 2.

Method 1: Transfer accurately 50 ml of the clear Asava/ Aristha an evaporable dish and evaporate to a thick extract on a water bath. Unless specified otherwise, extract the residue with 4 quantities, each of 10 ml, of dehydrated ethanol with stirring and filter. Combine the filtrates to another evaporating dish which have been dried to a constant weight and evaporate nearly to dryness on a water bath, add accurately 1 g of diatomite (dry at 105^0 for 3 hours and cooled in a desiccator for 30 min), stir thoroughly, dry at 105^0 for 3 hours, cool the dish in a desiccator for 30 min, and weigh immediately. Deduct the weight of diatomite added, the weight of residue should comply with the requirements stated under the individual monograph.

Method 2: Transfer accurately 50 ml of the clear Asava/ Aristha to an evaporable dish, which has been dried to a constant weight and evaporate to dryness on a water bath, then dry at 105^0 for 3 hours. After cooling the dish containing the residue in a desiccator for 30 min, weigh it immediately. The weight of residue should comply with the requirements stated under the individual monograph.

3.6. - SOLUBILITY IN WATER

Take 100 ml of distil water in a *Nessler cylinder* and add air-dried and coarsely powdered drug up to saturation. Then stir the sample continuously by twirling the spatula (rounded end of a microspatula) rapidly. After 1 minute, filter the solution using Hirsch funnel, evaporate the filtrate to dryness in a tared flat bottomed shallow dish and dry at 105^0 to constant weight and calculate the solubility of the drug in water (wt. in mg/100ml).

3.7. - DETERMINATION OF SAPONIFICATION VALUE

The saponification value is the number of mg of potassium hydroxide required to neutralize the fatty acids, resulting from the complete hydrolysis of 1 g of the oil or fat, when determined by the following method:

Dissolve 35 to 40 g of potassium hydroxide in 20 ml water, and add sufficient alcohol to make 1,000 ml. Allow it to stand overnight, and pour off the clear liquor.

Weigh accurately about 2 g of the substance in a tared 250 ml flask, add 25 ml of the alcoholic solution of potassium hydroxide, attach a reflux condenser and boil on a water-bath for one hour, frequently rotating the contents of the flask cool and add 1 ml of solution of phenolphthalein and titrate the excess of alkali with 0.5 N hydrochloric acid. Note the number of ml required (a). Repeat the experiment with the same quantities of the same reagents in the manner omitting the substance. Note the number of ml required (b) Calculate the saponification value from the following formula:—

$$\text{Saponification Value} = \frac{(b-a) \times 0.02805 \times 1.000}{W}$$

Where 'W' is the weight in g of the substance taken.

3.8. - DETERMINATION OF IODINE VALUE

The Iodine value of a substance is the weight of iodine absorbed by 100 part by weight of the substance, when determined by one of the following methods:-

Iodine Flasks - The Iodine flasks have a nominal capacity of 250 ml.

A. Iodine Monochloride Method - Place the substance accurately weighed, in dry iodine flask, add 10 ml of *carbon tetrachloride*, and dissolve. Add 20 ml of iodine monochloride solution, insert the stopper, previously moistened with solution of potassium iodine and allow to stand in a dark place at a temperature of about 17^0 or thirty minutes. Add 15 ml of solution of potassium iodine and 100 ml water; shake, and titrate with 0.1 N sodium thiosulphate, using solution of starch as indicator. Note the number of ml required (a). At the same time carry out the operation in exactly the same manner, but without the substance being tested, and note the number of ml of *0.1 N sodium thiosulphate* required (b).

Calculate the iodine value from the formula:-

$$\text{Iodine value} = \frac{(b-a) \times 0.01269 \times 100}{W}$$

Where 'W' is the weight in g of the substance taken.

The approximate weight, in g, of the substance to be taken may be calculated by dividing 20 by the highest expected iodine value. If more than half the available halogen is absorbed, the test must be repeated, a smaller quantity of the substance being used.

Iodine Monochloride Solution: The solution may be prepared by either of the two following methods:

(1) Dissolve 13 g of iodine in a mixture of 300 ml of carbon tetrachloride and 700 ml of glacial acetic acid. To 20 ml of this solution, add 15 ml of *solution of potassium iodide* and 100 ml of *water*, and titrate the solution with *0.1 N sodium thiosulphate*. Pass chlorine, washed and dried, through the remainder of the iodine solution until the amount of 0.1 N sodium thiosulphate required for the titration is approximately, but more than, doubled.

(2)

Iodine trichloride	8 g
Iodine	9 g
Carbon tetrachloride	300 ml
Glacial acetic acid, sufficient to produce	1000 ml

Dissolve the iodine trichloride in about 200 ml of glacial acetic acid, dissolve the iodine in the carbon tetrachloride, mix the two solutions, and add sufficient glacial acetic acid to produce 1000 ml. Iodine Monochloride Solution should be kept in a stoppered bottle, protected from light and stored in a cool place.

B. Pyridine Bromide Method - Place the substance, accurately weighed, in a dry iodine flask, add 10 ml of *carbon tetrachloride* and dissolve. Add 25 ml of pyridine bromide solution, allow to stand for ten minutes in a dark place and complete the determination described under iodine monochloride method, beginning with the words. Add 15 ml.

The approximate weight in gram, of the substance to be taken may be calculated by dividing 12.5 by the highest expected iodine value. If more than half the available halogen is absorbed the test must be repeated, a small quantity of the substance being used.

Pyridine bromide Solution: Dissolve 8 g pyridine and 10 g of *sulphuric acid* in 20 ml of *glacial acetic acid*, keeping the mixture cool. Add 8 g of *bromine* dissolved in 20 ml of *glacial acetic acid* and dilute to 100 ml with *glacial acetic acid*.

Pyridine bromide Solution should be freshly prepared.

3.9. - DETERMINATION OF ACID VALUE

The acid value is the number of mg of *potassium hydroxide* required to neutralize the free acids in 1 g of the substance, when determined by the following method:

Weigh accurately about 10 g of the substance (1 to 5) in the case of a resin into a 250 ml flask and add 50 ml of a mixture of equal volumes of alcohol and solvent ether, which has been neutralized after the addition of 1 ml of solution of phenolphthalein. Heat gently on a water-bath, if necessary until the substance has completely melted, titrate with *0.1 N potassium hydroxide*, shaking constantly until a pink colour which persists for fifteen seconds is obtained. Note the number of ml required. Calculate the acid value from the following formula:

$$\text{Acid Value} = \frac{a \times 0.00561 \times 1000}{W}$$

Where 'a' is the number of ml of *0.1 N potassium hydroxide* required and 'W' is the weight in g of the substance taken.

3.10. - DETERMINATION OF PEROXIDE VALUE

The peroxide value is the number of milliequivalents of active oxygen that expresses the amount of peroxide contained in 1000 g of the substance.

Method

Unless otherwise specified in the individual monograph, weigh 5 g of the substance being examined, accurately weighed, into a 250-ml glass-stoppered conical flask, add 30 ml of a mixture of 3 volumes of *glacial acetic acid* and 2 volumes of *chloroform,* swirl until dissolved and add 0.5ml volumes of saturated *potassium iodide solution.* Allow to stand for exactly 1 minute, with occasional shaking, add 30 ml of *water* and titrate gradually, with continuous and vigorous shaking, with *0.01M sodium thiosulphate* until the yellow colour almost disappears. Add 0.5 ml of *starch solution* and continue the titration, shaking vigorously until the blue colour just disappears (a ml). Repeat the operation omitting the substance being examined (b ml). The volume of *0.01M sodium thiosulphate* in the blank determination must not exceed 0.1 ml.

Calculate the peroxide value from the expression

$$\text{Peroxide value} = 10\,(a - b)/W$$

Where W = weight, in g, of the substance.

3.11. - DETERMINATION OF UNSAPONIFIABLE MATTER

The unsaponifiable matter consists of substances present in oils and fats, which are not saponifiable by alkali hydroxides and are determined by extraction with an organic solvent of a solution of the saponified substance being examined.

Method

Unless otherwise specified in the individual monograph, introduce about 5 g of the substance being examined, accurately weighed, into a 250-ml flask fitted with a reflux condenser. Add a solution of 2 g of *potassium hydroxide* in 40 ml of *ethanol (95per cent)* and heat on a water-bath for 1 hour, shaking frequently. Transfer the contents of the flask to a separating funnel with the aid of 100 ml of hot water and, while the liquid is still warm, shake very carefully with three quantities, each of 100 ml, of *peroxide-free ether.* Combine the ether extracts in a second separating funnel containing 40 ml of water, swirl gently for a few minute, allow to separate and reject the lower layer. Wash the ether extract with two quantities, each of 40 ml, of water and with three quantities, each of 40 ml, of a 3 per cent w/v solution of *potassium hydroxide,* each treatment being followed by a washing with 40 ml of water. Finally, wash the ether layer with successive quantities, each of 40 ml, of water until the aqueous layer is not alkaline to *phenolphthalein solution.* Transfer the ether layer to a weighed flask, washing out the separating funnel with *peroxide-free ether.* Distil off the ether and add to the residue 6 ml of *acetone.* Remove the solvent completely from the flask with the aid of a gentle current of air. Dry at 100^0 to 105^0 for 30 minutes. Cool in a desiccator and weigh the residue. Calculate the unsaponifiable matter as per cent w/w.

Dissolve the residue in 20 ml of *ethanol (95per cent)*, previously neutralised to *phenolphthalein solution* and titrate with *0.1M ethanolic potassium hydroxide.* If the volume of *0.1M ethanolic potassium hydroxide* exceeds 0.2 ml, the amount weighed cannot be taken as the unsaponifiable matter and the test must be repeated.

3.12. - DETECTION OF MINERAL OIL (HOLDE'S TEST)

Take 22 ml of the alcoholic potassium hydroxide solution in a conical flask and add 1ml of the sample of the oil to be tested. Boil in a water bath using an air or water cooled condenser till the solution becomes clear and no oily drops are found on the sides of the flask. Take out the flask from the water bath, transfer the contents to a wide mouthed warm test tube and carefully add 25ml of boiling distilled water along the side of the test tube. Continue shaking the tube lightly from side to side during the addition. The turbidity indicates presence of mineral oil, the depth of turbidity depends on the percentage of mineral oil present.

3.13. - RANCIDITY TEST (KREIS TEST)

The test depends upon the formation of a red colour when oxidized fat is treated with conc. *hydrochloric acid* and a solution of phloroglucinol in ether. The compound in rancid fats responsible for the colour reaction is epihydrin aldehyde. All oxidized fats respond to the Kreis test and the intensity of the colour produced is roughly proportional to the degree of oxidative rancidity.

Procedure

Mix 1 ml of melted fat and 1 ml of conc. *hydrochloric acid* in a test tube. Add 1 ml of a 1 per cent solution of phloroglucinol in *diethyl ether* and mix thoroughly with the fat-acid mixture. A pink colour formation indicates that the fat is slightly oxidized while a red colour indicates that the fat is definitely oxidized.

3.14. Determination of Reichert-Meissl and Polenske Value

The Reichert-Meissl value is the number of millitres of 0.1N aqueous sodium hydroxide solution required to neutralize steam volatile water soluble fatty acids distilled from 5g of an oil/fat under the prescribed conditions. It is a measure of water soluble steam volatile fatty acids chiefly butric and caprole acids present in oil or fat.

The Polenske value is the number of millitres of 0.1N aqueous alkali solution required to neutralize steam volatile water insoluble fatty acids distilled from 5 g of the oil/fat under the prescribed conditions. It is a measure of the steam volatile and water insoluble fatty acids, chiefly caprylic, capric and lauric acids present in oil and fat.

Principle:

The material is saponified by heating with glycerol sodium hydroxide solution and then split by treatment with dilute sulfuric acid. The volatile acids are immediately steam distilled. The soluble volatile acids in the distillate are filtered out and estimated by titration with standard sodium hydroxide solution.

Reagents

a. Glycerine: Analytical reagent grade
b. Concentrated sodium hydroxide solution: 50 percent (w/w)
c. Pumice stone grains
d. Dilute sulfuric acid solution: Approximately 1.0 N
e. Sodium hydroxide solution: 0.1N solution in water, accurately standardized
f. Phenolphthalein indicator: Dissolve 0.1g of phenolphthalein in 100 ml of ethyl alcohol
g. Ethyl alcohol: 90% by volume and neutral to phenolphthalein

Procedure

Weigh accurately 5 ± 0.1 g of filtered oil or fat sample into a clean, dry, 300 ml distilling flask. Add 20 g of glycerine and 2 ml of concentrated sodium hydroxide solution, and heat with swirling over a flame until completely saponified, as shown by the mixture becoming perfectly clear. Cool the content slightly and add 90 ml of boiling distilled water, which has been vigorously boiled for about 15 min. After thorough mixing the solution should remain clear. If the solution is not clear (indicating incomplete saponification) or is darker than light yellow (indicating over-heating), repeat the saponification with a fresh sample of the oil or fat. If the sample is old , the solution may some times be dark and not clear.

Add about 0.1 g of pumic stone grains, and 50 ml of dilute sulfuric acid solution. Immediately connect the flask to the distillation apparatus. Heat very gently until the liberated fatty acids melt and separate. Then set the flame so that 110 ml of distillate shall be collected within 19 to 21 min. The beginning of the distillation is to be taken as the moment when the first drop forms in the still head. Collect the distallate in a graduated flask. The temperature of the issuing distillate should be between 18° to 21°C.

When the distillate exactly reaches the 110 ml mark on the flask, remove the flame and quickly replace the flask by a 25 ml measuring cylinder. Stopper the graduated flask and without mixing place it in a water bath maintain at 15°C for 10 min so that the 110 ml graduation mark is 1 cm below the water level in the bath. Remove the graduated flask from the cold water bath, dry the outside and mix the content gently by inverting the flask 4 or 5 times without shaking. Avoid wetting the stopper with the insoluble acids. Filter the liquid through a dry, 9 cm Whatman No.4 filter paper. The filtrate should be clear. Pipette 100 ml of the filtrate and add 5 drops of the phenolophthalein solution, and titrate against standard 0.1 N sodium hydroxide solution. Run a Blank Test without the fat, but using the same quantities of the reagents.

Calculation

Reichert-Meissl Value = (A-B) x N x 11
where,

A = Volume in ml of standard sodium hydroxide solution required for the test;
B = Volume in ml of standard sodium hydroxide solution required for the blank;
N = Normality of standard sodium hydroxide solution.

After titrating the soluble volatile acids, detach the still head and rinse the condenser with three successive 15 ml portions of cold distilled water passing each washing separately through the measuring cylinder, 110 ml graduated flask and the filter paper and allow all of it to pass through. Discard all the washings. Place the funnel on a clean conical flask. Dissolve the insoluble fatty acids by three similar washings of the condenser, the measuring cylinder, the 110 ml flask with stopper, and the filter paper with 15 ml portions of ethyl alcohol. Combine the alcoholic washings in a clean flask, add 5 drops of phenolphthalein indicator solution, and titrate with standard (0.1N) sodium hydroxide solution.

Polenske Value = 10 x V x N
where,

V = Volume in ml of standard sodium hydroxide solution required for the test;
N = Normality of the standard sodium hydroxide solution.

3.15. - DETERMINATION OF ALCOHOL CONTENT

The ethanol content of a liquid is expressed as the number of volumes of ethanol contained in 100 volumes of the liquid, the volumes being measured at 24.9^0 to 25.1^0. This is known as the "percentage of ethanol by volume". The content may also be expressed in g of ethanol per 100 g of the liquid. This is known as the 'percentage of ethanol by weight".

Use Method I or Method II, as appropriate, unless otherwise specified in the individual monograph.

Method I

Carry out the method for gas chromatography, using the following solutions. Solution (1) contains 5.0 per cent v/v of ethanol and 5.0 per cent v/v of 1-propanol (internal standard). For solution (2) dilute a volume of the preparation being examined with water to contain between 4.0 and 6.0 per cent v/v of ethanol. Prepare solution (3) in the same manner as solution (2) but adding sufficient of the internal standard to produce a final concentration of 5.0 per cent v/v.

The chromatographic procedure may be carried out using a column (1.5 m x 4 mm) packed with porous polymer beads (100 to 120 mesh) and maintained at 150^0, with both the inlet port and the detector at 170^0, and nitrogen as the carrier gas.

Calculate the percentage content of ethanol from the areas of the peaks due to ethanol in the chromatogram obtained with solutions (1) and (3).

Method II

For preparations where the use of Industrial Methylated Spirit is permitted in the monograph, determine the content of ethanol as described in Method I but using as solution (2) a volume of the preparation being examined diluted with water to contain between 4.0 and 6.0 per cent v/v of total ethanol and methanol.

Determine the concentration of methanol in the following manner. Carry out the chromatographic procedure described under Method I but using the following solutions. Solution (1) contains 0.25 per cent v/v of methanol and 0.25 per cent v/v of 1-propanol (internal standard). For solution (2) dilute a volume of the preparation being examined with water to contain between 0.2 per cent and 0.3 per cent v/v of methanol. Prepare solution (3) in the same manner as solution (2) but adding sufficient of the internal standard to produce a final concentration of 0.25 per cent v/v.

The sum of the contents of ethanol and methanol is within the range specified in the individual monograph and the ration of the content of methanol to that of ethanol is commensurate with Industrial Methylated Spirit having been used.

Method III

This method is intended only for certain liquid preparations containing ethanol. Where the preparation contains dissolved substances that may distil along with ethanol Method III B or III C must be followed.

Apparatus

The apparatus (see Fig. 3) consists of a round-bottomed flask (A) fitted with a distillation head (B) with a steam trap and attached to a vertical condenser (C). A tube is fitted to the lower part of the condenser and carries the distillate into the lower part of a 100-ml or 250-ml volumetric flask (D). The volumetric flask is immersed in a beaker (E) containing a mixture of ice and water during the distillation. A disc with a circular aperture, 6 cm in diameter, is placed under the distillation flask (A) to reduce the risk of charring of any dissolved substances.

Method III A

Transfer 25 ml of the preparation being examined, accurately measured at 24.9^0 to 25.1^0, to the distillation flask. Dilute with 150 ml of water and add a little pumice powder. Attach the distillation head and condenser. Distil and collect not less than 90 ml of the distillate into a 100-ml volumetric flask. Adjust the temperature to 24.9^0 to 25.1^0 and dilute to volume with distilled water at 24.9^0 to 25.1^0. Determine the relative density at 24.9^0 to 25.1^0. The values indicated in column 2 of Table 3.2 are multiplied by 4 in order to obtain the percentage of ethanol by volume contained in the preparation. If the specific gravity is found to be between two values, the percentage of ethanol should be obtained by interpolation. After calculation of the ethanol content, report the result to one decimal place.

NOTE – (1) If excessive frothing is encountered during distillation, render the solution strongly acid with phosphoric acid or treat with a small amount of liquid paraffin or silicone oil.

(2) The distillate should be clear or not more than slightly cloudy. If it is turbid or contains oily drops, follow Method IIIC. When steam-volatile acids are present, make the solution just alkaline with *1M sodium hydroxide* using solid *phenolphthalein* as indicator before distillation.

Method III B

Follow this method or the following one if the preparation being examined contains appreciable proportions of volatile materials other than ethanol and water.

Mix 25 ml of the preparation, accurately measured at 24^0 to 25.1^0, with about 100 ml of water in a separating funnel. Saturate this mixture with sodium chloride, add about 100 ml of *hexane* and shake vigorously for 2 to 3 minutes. Allow the mixture to stand for 15 to 20 minutes. Run the lower layer into the distillation flask, wash the *hexane* layer in the separating funnel by shaking vigorously with about 25 ml of *sodium chloride* solution, allow to separate and run the wash liquor into the first saline solution. Make the mixed solutions just alkaline with 1M sodium hydroxide using solid phenolphthalein as indicator, add a little pumice powder and 100 ml of water, distil 90 ml and determine the percentage v/v of ethanol by Method IIIA beginning at the words "Adjust the temperature…".

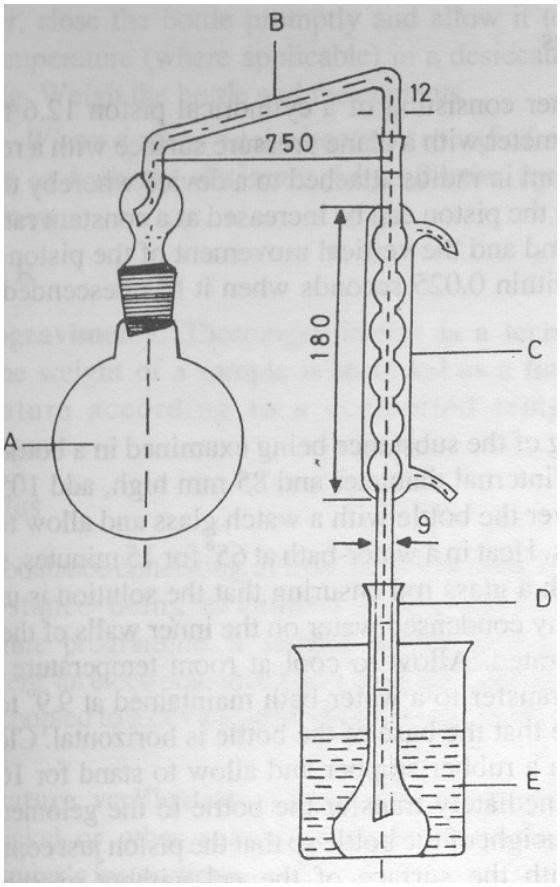


Fig.3. Apparatus for Determination of Ethanol by Distillation Method.

Table 3.2

Specific gravity at 25^0	Ethanol content*
1.0000	0
0.9985	1
0.9970	2
0.9956	3
0.9941	4
0.9927	5
0.9914	6
0.9901	7
0.9888	8
0.9875	9
0.9862	10
0.9850	11
0.9838	12
0.9826	13
0.9814	14
0.9802	15
0.9790	16
0.9778	17
0.9767	18
0.9756	19
0.9744	20
0.9733	21
0.9721	22
0.9710	23
0.9698	24
0.9685	25

* per cent v/v at 15.56^0.

Method III C

Transfer 25 ml of the preparation, accurately measured at 24.9^0 to 25.1^0, to the distillation flask. Dilute with 150 ml of water and add a little pumice powder. Attach the distillation head and condenser. Distil and collect about 100 ml. Transfer to a separating funnel and determine the percentage v/v of ethanol by Method III B beginning at the words “Saturate this mixture…”.

APPENDIX –4

4.1. REAGENTS AND SOLUTIONS

Acetate buffer 5.5 pH – Dissolve 21.5 g of *sodium acetate* (AR) in 300 ml *purified water* containing 2 ml *glacial acetic acid* and dilute to 1000 ml

Acetic Acid –Contains approximately 33 per cent w/v of $C_2H_4O_2$. Dilute 315 ml of glacial acetic acid to 1000 ml with *water*.

Acetic Acid, Glacial – CH_3COOH =60.05.

Contains not less than 99.0 per cent w/w of $C_2H_4O_2$. About 17.5 N in strength.

Description –At temperature above its freezing point a clear colourless liquid, odour, pungent and characteristic; crystallises when cooled to about 10^0 and does not completely re-melt until warmed to about 15^0.

Solubility – Miscible with *water,* with *glycerin* and most fixed and volatile oils.

Boiling range –Between 117^0 and 119^0.

Congealing temperature –Not lower than 14.8^0.

Wt. per ml –At 25^0about 1.047 g.

Heavy metals –Evaporate 5 ml to dryness in a porcelain dish on water-bath, warm the residue with 2 ml of 0.1 *N hydrochloric acid* and water to make 25 ml; the limit of heavy metals is 10 parts per million, Appendix 2.3.3.

Chloride –5 ml complies with the limit test for chlorides, Appendix 2.3.2.

Sulphate –5 ml complies with the limit test for sulphates,

Certain aldehydic substances –To 5 ml add 10 ml of *mercuric chloride solution* and make alkaline with *sodium hydroxide solution,* allow to stand for five minutes and acidify with dilute *sulphuric acid*; the solution does not show more than a faint turbidity.

Formic acid and oxidisable impurities –Dilute 5 ml with 10 ml of water, to 5 ml of this solution add 2.0 ml of 0.1 *N* potassium dichromate and 6 ml of sulphuric acid, and allow to stand for one minute, add 25 ml of water, cool to 15^0, and add 1 ml of freshly prepared potassium iodide solution and titrate the liberated iodine with 0.1 *N* sodium thiosulphate, using starch solution as indicator. Not less than 1 ml of 0.*N sodium thiosulphate* is required.

Odorous impurities –Neutralise 1.5 ml with *sodium hydroxide solution*; the solution has no odour other than a faint acetous odour.

Readily oxidisable impurities –To 5 ml of the solution prepared for the test for Formic Acid and Oxidisable Impurities, add 20 ml of water and 0.5 ml of 0.1 *N potassium permanganate;* the pink colour does not entirely disappear within half a minute.

Non-volatile matter –Leaves not more than 0.01 per cent w/w of residue when evaporated to dryness and dried to constant weight at 105^0.

Assay –Weigh accurately about 1 g into a stoppered flask containing 50 ml of *water* and titrate with *N sodium hydroxide,* using *phenolphthalein solution* as indicator. Each ml of *sodium hydroxide* is equivalent to 0.06005 g of $C_2H_4O_2$.

Acetic Acid, Lead-Free –Acetic acid which complies with following additional test, boil 25 ml until the volume is reduced to about 15 ml, cool make alkaline with lead-free ammonia solution, add 1 ml of lead free *potassium cyanide solution, dilute* to 50 ml with water, add 2 drops of *sodium sulphide solution;* no darkening is produced.

Acetone – Propan-2-one; $(CH_3)_2CO$ = 58.08

Description –Clear, colourless, mobile and volatile liquid; taste, pungent and sweetish; odour characteristic; flammable.

Solubility –Miscible with *water*, with alcohol, with *solvent ether,* and with *chloroform,* forming clear solutions.

Distillation range –Not less than 96.0 per cent distils between 55.5^0 and 57^0.

Acidity –10 ml diluted with 10 ml of freshly boiled and cooled water; does not require for neutralisation more than 0.2 ml of 0.1 *N sodium hydroxide*, using phenolphthalein solution as indicator.

Alkalinty –10 ml diluted with 10 ml of freshly boiled and cooled water, is not alkaline to litmus solution.

Methyl alcohol –Dilute 10 ml with water to 100 ml. To 1 ml of the solution add 1 ml of *water* and 2 ml of *potassium permanganate* and *phosphoric acid solution*. Allow to stand for ten minutes and add 2 ml of *oxalic acid* and *sulphuric acid solution;* to the colourless solution add 5 ml of *decolorised magenta solution* and set aside for thirty minutes between 15^0 and 30^0; no colour is produced.

Oxidisable substances –To 20 ml add 0.1 ml of 0.1 *N potassium permanganate,* and allow to stand for fifteen minutes; the solution is not completely decolorised.

Water –Shake 10 ml with 40 ml of *carbon disulphide*; a clear solution is produced.

Non-volatile matter –When evaporated on a water-bath and dried to constant weight at 105^0, leaves not more than 0.01 per cent w/v residue.

Acetone Solution, Standard – A 0.05 per cent v/v solution of acetone in water.

Alcohol –

Description –Clear, colourless, mobile, volatile liquid, odour, characteristic and spirituous; taste, burning, readily volatilised even at low temperature, and boils at about 78^0, flammable. Alcohol containing not less than 94.85 per cent v/v and not more than 95.2 per cent v/v of C_2H_5OH at 15.56^0.

Solubility –Miscible in all proportions with *water,* with *chloroform* and with *solvent ether.*

Acidity or alkalinity –To 20 ml add five drops of *phenolphthalein solution*; the solution remains colourless and requires not more than 2.0 ml of 0.1*N sodium hydroxide* to produce a pink colour.

Specific gravity –Between 0.8084 and 0.8104 at 25^0.

Clarity of solution –Dilute 5 ml to 100 ml with *water* in glass cylinder; the solution remains clear when examined against a black background. Cool to 10^0 for thirty minutes; the solution remains clear.

Methanol –To one drop add one of water, one drop of *dilute phosphoric acid,* and one drop of *potassium permanganate solution.* Mix, allow to stand for one minute and add sodium bisulphite solution dropwise, until the permanganate colour is discharged. If a brown colour remains, add one drop of *dilute phosphoric* acid. To the colourless solution add 5 ml of freshly prepared *chromotropic acid* solution and heat on a water-bath at 60^0 for ten minutes; no violet colour is produced.

Foreign organic substances –Clean a glass-stoppered cylinder thoroughly with *hydrochloric acid,* rinse with water and finally rinse with the alcohol under examination. Put 20 ml in the cylinder, cool to about 15^0 and then add from a carefully cleaned pipette 0.1 ml 0.1 *N potassium permanganate.* Mix at once by inverting the stoppered cylinder and allow to stand at 15^0 for five minutes; the pink colour does not entirely disappear.

Isopropyl alcohol and t-butyl alcohol –To 1 ml add 2 ml of water and 10 ml of *mercuric sulphate solution* and heat in a boiling water-bath; no precipitate is formed within three minutes.

Aldehydes and ketones –Heat 100 ml of *hydroxylamine hydrochloride solution* in a loosely stoppered flask on a water-bath for thirty minutes, cool, and if necessary, add sufficient 0.05 *N sodium hydroxide* to restore the green colour. To 50 ml of this solution add 25 ml of the alcohol and heat on a water bath for ten minutes in a loosely stoppered flask. Cool, transfer to a *Nesseler cylinder*, and titrate with 0.05 *N sodium hydroxide* until the colour matches that of the remainder of the *hydroxylamine hydrochloride solution* contained in a similar cylinder, both solutions being viewed down the axis of the cylinder. Not more than 0.9 ml of 0.05 *N sodium hydroxide* is required.

Fusel oil constituents –Mix 10 ml with 5 ml of *water* and 1 ml of *glycerin* and allow the mixture to evaporate spontaneously from clean, odourless absorbent paper; no foreign odour is perceptible at any stage of the evaporation.

Non-volatile matter –Evaporate 40 ml in a tared dish on a water-bath and dry the residue at 105º for one hour; the weight of the residue does not exceed 1 mg.

Storage –Store in tightly-closed containers, away from fire.

Labelling –The label on the container states "Flammable".

Alcohol, Aldehyde-free. –Alcohol which complies with the following additional test :

Aldehyde –To 25 ml, contained in 300 ml flask, add 75 ml of *dinitrophenyl hydrazine solution,* heat on a water bath under a reflux condenser for twenty four hours, remove the alcohol by distillation, dilute to 200 ml with a 2 per cent v/v solution of sulphuric acid, and set aside for twenty four hours; no crystals are produced.

Alcohol, Sulphate-free. –Shake alcohol with an excess of anion exchange resin for thirty minutes and filter.

. –Solutions of any normality xN may be prepared by diluting 75 x ml of strong ammonia solution to 1000 ml with water.

Ammonia Solution, Iron-free –Dilute ammonia solution which complies with the following additional test:

Evaporate 5 ml nearly to dryness on a water-bath add 40 ml of water, 2 ml of 20 per cent w/v *solution of iron free citric acid* and 2 drops of *thioglycollic acid*, mix, make alkaline with *iron-free ammonia solution and dilute* to 50 ml with *water*, no pink colour is produced.

Ammonia buffer solutions 9.5 pH – Dissolve 67.5 g *ammonium chloride* in 300 ml *purified water*, add 570 ml *ammonia solution* and dilute to 1000 ml.

Ammonium Chloride Solution –A 10.0 per cent w/v solution of *ammonium chloride* in water.

Ammonium molybdate - $NH_4Mo_7O_{24}.4H_2O$=1235.86
Analytical reagent grade of commerce.
White crystal or crystalline masses, sometimes with a yellowish or green tint.

Ammonium Thiocyanate – NH_4SCN = 76.12.

Description –Colourless crystals.

Solubility – Very soluble in water, forming a clear solution, readily soluble in alcohol.

Chloride –Dissolve 1 g in 30 ml of solution of hydrogen peroxide, add 1 g of *sodium hydroxide*, warm gently, rotate the flask until a vigorous reaction commences and allow to stand until the reaction is complete; add a further 30 ml of *hydrogen peroxide solution* boil for two minutes, cool, and add 10 ml of *dilute nitric acid* and 1 ml of *silver nitrate solution*; any opalescence produced is not greater than that obtained by treating 0.2 ml of 0.01 *N hydrochloric acid* in the same manner.

Sulphated ash –Moisten 1 g with *sulphuric acid* and ignite gently, again moisten with sulphuric acid and ignite; the residue weighs not more than 2.0 mg.

Ammonium Thiocyanate, 0.1N – NH_4SCN = 76.12; 7.612 in 1000 ml. Dissolve about 8 g of *ammonium thiocyanate* in 100o ml of water and standardise the solution as follows :

Pipette 30 ml of standardised 0.1 *N silver nitrate* into a glass stoppered flask, dilute with 50 ml of *water* then add 2 ml of *nitric acid* and 2 ml of *ferric ammonium sulphate solution* and titrate with the *ammonium thiocyanate solution* to the first appearance of a red brown colour. Each ml of 0.1N *silver nitrate* is equivalent to 0.007612 g of NH_4SCN.

Ammonium Thiocyanate Solution –A 10.0 per cent w/v solution of *ammonium thiocyanate solution*.

Aniline chloride solution – To 100 ml of aniline, add 30 ml of hydrochloric acid. (10:3).

Anisaldehyde-Sulphuric Acid Reagent –0.5 ml *anisaldehyde* is mixed with 10 ml *glacial acetic acid*, followed by 85 ml methanol and 5 ml concentrated *sulphuric acid* in that order.

The reagent has only limited stability and is no longer usable when the colour has turned to redviolet.

Arsenomolybdic Acid Reagent -250 mg of ammonium molybdate was dissolved in 45 ml of distilled water. To this, 2.1 ml of concentrated H_2SO_4 was added and mixed well. To this solution, 3mg of $Na_2ASO_4.7\ H_2O$ dissolved in 25 ml of distilled water, mixed well and placed in incubator maintained at 37^0 C for 24 h.

Borax - Sodium Tetraborate, $Na_2B_4O_7.\ 10H_2O$ = 381.37.
Contains not less than 99.0 per cent and not more than the equivalent of 103.0 per cent of $Na_2B_4O_7.\ 10H_2O$.

Description –Transparent, colourless crystals, or a white, crystalline powder; odourless, taste, saline and alkaline. Effloresces in dry air, and on ignition, loses all its water of crystallisation.

Solubility –Soluble in water, practically insoluble in alcohol.

Alkalinity –A solution is alkaline to litmus solution.

Heavy metals – Dissolve 1 g in 16 ml of water and 6 ml of *N hydrochloric acid* and add *water* to make 25 ml; the limit of heavy metals is 20 parts per million, Appendix 2.3.3.

Iron –0.5 g complies with the *limit test for iron*, Appendix 2.3.4.

Chlorides –1 g complies with the *limit test for chlorides,* Appendix 2.3.2.

Sulphates –1g complies with the *limit test for sulphates,* Appendix 2.3.6.

Assay –Weigh accurately about 3 g and dissolve in 75 ml of *water* and titrate with 0.5 *N hydrochloric acid*, using *methyl red solution* as indicator. Each ml of 0.5 *N* hydrochloric acid is equivalent to 0.09534 g of $Na_2B_4O_7.10H_2O$.

Storage – Preserve Borax in well-closed container.

Bromine – Br_2 =159.80.

Description –Reddish-brown, fuming, corrosive liquid.

Solubility –Slightly soluble in *water*, soluble in most organic solvents.

Iodine –Boil 0.2 ml with 20 ml of *water*, 0.2 ml of *N sulphuric acid* and a small piece of marble until the liquid is almost colourless. Cool, add one drop of *liquefied phenol*, allow to stand for two minutes, and then add 0.2 g of *potassium iodide* and 1 ml of *starch solution*; no blue colour is produced.

Sulphate –Shake 3 ml with 30 ml of *dilute ammonia solution* and evaporate to dryness on a water bath, the residue complies with the *limit test for sulphates*, Appendix 2.3.6.

Bromine Solution – Dissolve 9.6 ml of *bromine* and 30 g of *potassium bromide* in sufficient *water* to produce 100 ml.

Bromophenol Blue Indicator – Dissolve 0.1 g of bromophenol blue in 3.0 ml of 0.05 N sodium hydroxide solution and 5 ml of ethyl alcohol (90 percent by volume) by gently warming. Make up the volume of the solution with ethyl alcohol (20 percent v/v) to 250 ml in a volumetric flask.

Canada Balsam Reagent –General reagent grade of commerce.

Carbon Tetrachloride – CCl_4 = 153.82

Description –Clear, colourless, volatile, liquid; odour, characteristic.

Solubility –Practically insoluble in water; miscible with ethyl alcohol, and with solvent ether.

Distillation range –Not less than 95 per cent distils between 76^0 and 77^0.

Wt. per ml – At 20^0, 1.592 to 1.595 g.

Chloride, free acid –Shake 20 ml with 20 ml of freshly boiled and cooled water for three minutes and allow separation to take place; the aqueous layer complies with the following test :

Chloride – To 10 ml add one drop of nitric acid and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Free acid –To 10 ml add a few drops of *bromocresol purple solution;* the colour produced does not indicate more acidity than that indicated by the addition of the same quantity of the indicator to 10 ml of freshly boiled and cooled *water.*

Free chlorine –Shake 10 ml with 5 ml of *cadmium iodide solution* and 1 ml *of starch solution*, no blue colour is produced.

Oxidisable impurities –Shake 20 ml for five minutes with a cold mixture of 10 ml of *sulphuric acid* and 10 ml of 0.1 *N potassium dichromate*, dilute with 100 ml of water and add 3 g of *potassium iodide* : the liberated iodine requires for decolourisation not less than 9 ml of 0.1 *N sodium thiosulphate*.

Non-volatile matter –Leaves on evaporation on a water-bath and drying to constant weight at 105^0 not more than 0.002 per cent w/v of residue.

Caustic Alkali Solution, 5 per cent – Dissolve 5 g of *potassium or sodium hydroxide* in *water* and dilute to 100 ml.

Charcoal, Decolourising –General purpose grade complying with the following test.

Decolourising powder –Add 0.10 g to 50 ml of 0.006 per cent w/v solution of *bromophenol blue* in ethanol (20 per cent) contained in a 250 ml flask, and mix. Allow to stand for five minutes, and filter; the colour of the filtrate is not deeper than that of a solution prepared by diluting 1 ml of the *bromophenol blue solution* with *ethanol* (20 per cent) to 50 ml.

Chloral Hydrate –$CCl_3.CH(OH)_2$ = 165.40.

Description –Colourless, transparent crystals, odour, pungent but not acrid; taste, pungent and slightly bitter, volatilises slowly on exposure to air.

Solubility –Very soluble in *water,* freely soluble in *alcohol*, in chloroform and in *solvent ether*.

Chloral alcoholate – Warm 1 g with 6 ml of *water* and 0.5 ml of *sodium hydroxide solution* : filter, add sufficient 0*.1 N iodine* to impart a deep brown colour, and set aside for one hour; no yellow crystalline precipitate is produced and no smell of iodoform is perceptible.

Chloride – 3 g complies with the limit test for chlorides, Appendix 2.3.2.

Assay – Weigh accurately about 4 g and dissolve in 10 ml of *water* and add 30 ml of *N sodium hydroxide.* Allow the mixture to stand for two minutes, and then titrate with *N sulphuric acid* using *phenolphthalein solution* as indicator. Titrate the neutralised liquid with 0.1 *N silver nitrate* using solution of *potassium chromate* as indicator. Add two-fifteenth of the amount of 0.1 *N silver nitrate* used to the amount of *N sulphuric acid* used in the first titration and deduct the figure so obtained from the amount of *N sodium hydroxide* added. Each ml of *N sodium hydroxide,* obtained as difference; is equivalent to 0.1654 g of $C_2H_3Cl_3O_2$.

Storage – Store in tightly closed, light resistant containers in a cool place.

Chloral Hydrate Solution –Dissolve 20 g of *chloral hydrate* in 5 ml of water with warming and add 5 ml of *glycerin*.

Chloral Iodine Solution –Add an excess of crystalline *iodine with* shaking to the *chloral hydrate solution*, so that crystals of undissolved iodine remain on the bottom of bottle. Shake before use as the

iodine dissolves, and crystals of the iodine to the solution. Store in a bottle of amber glass in a place protected from light.

Chloroform – $CHCl_3$ = 119.38

Description –Colourles, volatile liquid; odour, characteristic. Taste, sweet and burning.

Solubility –Slightly soluble in water; freely miscible with ethyl alcohol and with solvent ether.

Wt. per ml. : Between 1.474 and 1.478 g.

Boiling range – A variable fraction, not exceeding 5 per cent v/v, distils below 60^0 and the remainder distils between 50^0 to 62^0.

Acidity –Shake 10 ml with 20 ml of freshly boiled and cooled water for three minutes, and allow to separate. To a 5 ml portion of the aqueous layer add 0.1 ml of *litmus solution*; the colour produced is not different from that produced on adding 0.1 ml of *litmus solution* to 5 ml of freshly boiled and cooled water.

Chloride –To another 5 ml portion of the aqueous layer obtained in the test for Acidity, add 5 ml of water and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Free chlorine –To another 10 ml portion of the aqueous layer, obtained in the test for Acidity, add 1 ml of *cadmium iodide solution* and two drops of starch solution; no blue colour is produced.

Aldehyde –Shake 5 ml with 5 ml of water and 0.2 ml of *alkaline potassium mercuri-iodide solution* in a stoppered bottle and set aside in the dark for fifteen minutes; not more than a pale yellow colour is produced.

Decomposition products – Place 20 ml of the *chloroform* in a glass-stoppered flask, previously rinsed with *sulphuric acid,* add 15 ml of *sulphuric acid* and four drops of *formaldehyde solution*, and shake the mixture frequently during half an hour and set aside for further half an hour, the flask being protected from light during the test; the acid layer is not more than slightly coloured.

Foreign organic matter – Shake 20 ml with 10 ml of *sulphuric* acid in a stoppered vessel previously rinsed with *sulphuric acid* for five minutes and set aside in the dark for thirty minutes, both the acid and chloroform layers remain colourless. To 2 ml of the acid layer add 5 ml of water; the liquid remains colourless and clear, and has no unpleasent odour. Add a further 10 ml of water and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Foreign odour –Allow 10 ml to evaporate from a large piece of filter paper placed on a warm plate; no foreign odour is detectable at any stage of the evaporation.

Non volatile matter – Not more than 0.004 per cent w/v determined on 25 ml by evaporation and drying at 105^0.

Storage - Store in tightly-closed, glass-stoppered, light-resistant bottles.

Copper Sulphate – $CuSO_4.5H_2O$ = 249.68

Contains not less than 98.5 per cent and not more than the equivalent of 101.0 per cent of $CuSO_4.5H_2O$.

Description – Blue triclinic prisms or a blue, crystalline powder.

Solubility –Soluble in *water*, very solube in boiling water, almost insoluble in *alcohol*; very slowly soluble in glycerin.

Acidity and clarity of solution – 1 g, dissolved in 20 ml of water, forms a clear blue solution, which becomes green on the addition of 0.1 ml of *methyl orange solution*.

Iron – To 5 g, add 25 ml of water, and 2 ml of nitric acid, boil and cool. Add excess of *strong ammonia solution*, filter, and wash the residue with *dilute ammonia solution* mixed with four times its volumes of water. Dissolve the residue, if any, on the filter with 2 ml of *hydrochloric acid*, diluted with 10 ml of water; to the acid solutions add *dilute ammonia solution* till the precipitation is complete; filter and wash; the residue after ignition weighs not more than 7 mg.

Copper Sulphate, Anhydrous – $CuSO_4$ =159.6

Prepared by heating copper sulphate to constant weight at about 230^0.

Copper Sulphate Solution –A10.0 per cent w/v solution of *copper sulphate* in *water*.

Cresol Red – 4,4/, –(3H-2, 1-Benzoxathiol-3 ylidene) di-O-cresol SS-dioxide; $C_{12}H_8O_5S$ = 382.4.

Gives a red colour in very strongly acid solutions, a yellow colour in less strongly acid and neutral solutions, and a red colour in moderately alkaline solutions (*p*H ranges, 0.2 to 1.8, and 7.2 to 8.8).

Cresol Red Solution ***–Warm 50 ml of cresol red with 2.65 ml of 0.05 M sodium hydroxide and 5 ml of ethanol (90 per cent); after solution is effected, add sufficient ethanol (20 per cent) to produce 250 ml.***

Sensitivity –A mixitue of 0.1 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.15 ml of 0.02 M s*odium hydroxide* has been added is purplish-red. Not more than 0.15 ml of 0.02 *M hydrochloric acid* is required to change the colour to yellow.

Diphenylamine barium sulphonate – Dissolve 0.25 g in 100 ml water.
Disodium Ethylenediamine tetraacetate ***– (Disodium Acetate) $C_{10}H_{14}N_2Na_2O_8.2H_2O$ = 372.2, Analytical reagent grade.***

Dragendorff ′s Reagent –

Solution 1 –Dissolve 0.85 g of *bismuth oxy nitrate* in 40 ml of water and 10 ml of acetic acid.

Solution 2 –Dissolve 8 g of *potassium iodide* in 20 ml of water.

Mix equal volumes of solution 1 and 2, and to 10 ml of the resultant mixture add 100 ml of water and 20 ml of acetic acid.

Dithizone-1,5-Diphenylthiocarbazone;Diphenylthiocarbazone; $C_6H_5N:NCSNHNHC_6H_5$= 56.32
Analytical Reagent grade of commerce.
Almost black powder; mp, about 168^0, with decomposition.
Store in light-resistant containers.

Eosin – Acid Red 87; Tetrabromofluorescein disodium salt; $C_{20}H_6O_5Br_4Na_2$ =691.86.

Description – Red powder, dissolves in water to yield a yellow to *purplish-red* solution with a greenish-yellow fluorescence.

Solubility –Soluble in *water* and in alcohol.

Chloride –Dissolve 50 mg in 25 ml of *water*, add 1 ml of *nitric acid*, and filter; the filtrate complies with *the limit test for chlorides*, Appendix 2.3.2.

Sulphated ash –Not more than 24.0 per cent, calculated with reference to the substance dried at 110^0 for two hours, Appendix 2.2.6.

EDTA solution 0.05 M – Dissolve 18.6120 g of sodium salt of EDTA in purified water and make up to 1000 ml.

Eosin Solution – A 0.5 per cent w/v solution of eosin in water.

Eriochrome Black T –Mordant Black 11; Sodium 2(1-hydroxy-2-naphthylazo) 5-nitro-2-naphtol-4-sulphonate; $C_{20}H_{12}N_3NaO_7S$ = 461.38.

Brownish black powder having a faint, metallic sheen, soluble in alcohol, in *methyl alcohol* and in hot water.

Eriochrome Black T indicator 0.1per cent solution – Dissolve 0.10 g indicator in 100 ml of Methanol.

Ethyl Acetate – $CH_3.CO_2C_2H_5$ = 88.11.

Analytical reagent grade.

A colourless liquid with a fruity odour; boiling point, about 77^0; weight per ml about 0.90g.

Ethyl Alcohol – C_2H_5OH = 46.07.

Absolute Alcohol; Dehydrated Alcohol.

Description – Clear, colourless, mobile, volatile liquid; odour, characteristic and spirituous; taste, burning; hygroscopic. Readily volatilisable even at low temperature and boils at 78^0 and is flammable.

Solubility – Miscible with water, with solvent ether and with chloroform.

Contains not less than 99.5 per cent w/w or 99.7 per cent v/v of C_2H_5OH.

Identification – Acidity or Alkalinity: Clarity of Solution; Methanol; Foreign organic substances; Isopropyl alcohol and butyl alcohol; Aldehydes and ketones; fusel oil constituents; Non-volatile matter; complies with the requirements described under Alcohol.

Specific gravity –Between 0.7871 and 0.7902, at 25^0.

Storage –Store in tightly closed containers in a cool place away from fire and protected from moisture.

Labelling –The label on the container states "Flammable".

Fehling's Solution –

A. Dissolve 69.278 g of CuSO4. $5H_2O$ in water and make the volume up to 1 litre
B. Dissolve 100 g of sodium hydroxide and 340 g of Sodium potassium tartarate in water and make the volume to 1 litre.

Mix equal volumes of A and B before the experiment.

Formaldehyde Solution – Formalin; HCHO =30.03

Formaldehyde Solution is a solution of formaldehyde in water with *methyl alcohol* added to prevent polymerisation. It contains not less than 34.0 per cent w/w and not more than 38.0 per cent w/w of CH_2O.

Description – Colourless liquid; odour, characteristic, pungent and irritating; taste, burning. A slight white cloudy deposit is formed on long standing, especially in the cold, due to the separation of paraformaldehyde. This white deposit disappears on warming the solution.
Solubility –Miscible with *water*, and with *alcohol*.

Acidity –To 10 ml add 10 ml of *carbon dioxide free water* and titrate with 0.1 *N sodium hydroxide* using *bromothymol blue solutions* as indicator; not more than 5 ml of 0.1 *N sodium hydroxide* is required.

Wt. per ml – At 20^0, 1.079 to 1.094 g.

Assay –Weigh accurately about 3 g and add to a mixture of 50 ml of *hydrogen peroxide solution* and 50 ml of *N sodium hydroxide*, warm on a water-bath until effervescence ceases and titrate the excess of alkali with *N sulphuric acid* using *phenolphthalein solution* as indicator. Repeat the experiment with the same quantities of the same reagents in the same manner omitting the formaldehyde solution. The difference between the titrations represents the sodium hydroxide required to neutralise the formic acid produced by the oxidation of the formaldehyde. Each ml of N sodium hydroxide is equivalent to 0.03003 g of CH_2O.

Storage–Preserve Formaldehyde Solution in well-closed container preferably at a temperature not below 15^0.

Formaldehyde Solution, Dilute – Dilute 34 ml of *formaldehyde solution* with sufficient water to produce 100 ml.

Folin Ciocalteu Reagent- Dilute commercially available Folin-Ciocalteu reagent (2N) with an equal volume of distilled water. Transfer it in a brown bottle and store in a refrigerator (4^0). It should be goldern in colour. Do not use it if it turns olive green.

Formic acid- HCOOH = 46.03

Description -Colourless liquid, odour, very pungent, highly corrosive; wt per ml. about 1.20 g, contains about 90.0 per cent of HCOOH and is about 23.6 M in strength.

Assay - Weigh accurately, a conical flask containing 10ml of water, quickly add about 1ml of the reagent being examined and weigh again. Add 50ml of water and titrate with *1M sodium hydroxide* using 0.5 ml of *phenolphthalein solution* as indicator. Each ml of 1*M sodium hydroxide* is equivalent to 0.04603 g of HCOOH.

Glycerine – $C_3H_8O_3$ = 82.09.

Description – Clear, colorless, liquid of syrupy consistency; odourless, taste sweet followed by a sensation of warmth. It is hygroscopic.

Solubility –Miscible with water and with *alcohol*; practically insoluble in chloroform, in solvent ether and in fixed oils.

Acidity –To 50 ml of a 50 per cent w/v solution add 0.2 ml of *dilute phenolphthalein solution*; not more than 0.2 ml of 0.1 *N sodium hydroxide* is required to produce a pink colour.

Wt. per ml –Between 1.252 g and 1.257 g, corresponding to between 98.0 per cent and 100.0 per cent w/w of $C_3H_8O_3$.

Refractive index –Between 1.470 and 1.475 determined at 20^0.

Arsenic –Not more than 2 parts per million, Appendix 2.3.1.

Copper –To 10 ml add 30 ml of *water*, and 1 ml of *dilute hydrochloric acid*, and 10 ml of *hydrogen sulphide solution*; no colour is produced.

Iron – 10 g complies with the *limit test* for iron, Appendix 2.3.4.

Heavy metals – Not more than 5 parts per million, determined by Method A on a solution of 4 g in 2 ml of 0.1 *N hydrochloric acid* and sufficient water to produce 25 ml, Appendix 2.3.3.

Sulphate –1 ml complies with the *limit test* for sulphates, Appendix 2.3.6.

Chloride –1 ml complies with the *limit test* for chloride, Appendix 2.3.2.

Acraldehyde and glucose –Heat strongly; it assumes not more than a faint yellow, and not a pink colour. Heat further; it burns with little or no charring and with no odour of burnt sugar.

Aldehydes and related substances – To 12.5 ml of a 50 per cent w/v solution in a glass-stoppered flask add 2.5 ml of *water* and 1 ml of *decolorised magenta solution*. Close the flask and allow to stand for one hour. Any violet colour produced is not more intense than that produced by mixing 1.6 ml of 0.1 *N potassium permanganate* and 250 ml of *water*.

Sugar – Heat 5 g with 1 ml of *dilute sulphuric acid* for five minutes on a water-bath. Add 2 ml of *dilute sodium hydroxide solution* and 1 ml of *copper sulphate solution*. A clear, blue coloured solution is produced. Continue heating on the water-bath for five minutes. The solution remains blue and no precipitate is formed.

Fatty acids and esters –Mix 50 ml with 50 ml of freshly boiled *water* and 50.0 ml of 0.5N *sodium hydroxide,* boil the mixture for five minutes. Cool, add a few drops of *phenolphthalein solution* and titrate the excess alkali with 0.5 *N hydrochloric acid*. Perform a blank determination, not more than 1 ml of 0.5 *N sodium hydroxide* is consumed.

Sulphated ash –Not more than 0.01 per cent, Appendix 2.2.6.

Storage – Store in tightly-closed containers.

Glycerin Solution – Dilute 33 ml of *glycerin* to 100 ml with water and add a small piece of camphor or liquid phenol.

***n*- Hexane -** C_6H_{14},= 86.18
Analytical reagent grade of commerce containing not less than 90.05 of *n*-Hexane.

Colourless, mobile, highly flammable liquid, bp 68^0; wt per ml, about 0.674 g.

Hydrochloric Acid – HCl = 36.46

Concentrated Hydrochloric Acid

Description – Clear, colourless, fuming liquid; odour, pungent.

Arsenic – Not more than 1 part per million, Appendix 2.3.1.

Heavy metals – Not more than 5 parts per million, determined by Method A on a solution prepared in the following manner : Evaporate 3.5 ml to dryness on a water-bath, add 2 ml of *dilute acetic acid* to the residue, and add water to make 25 ml, Appendix 2.3.3.

Bromide and iodide – Dilute 5 ml with 10 ml of *water*, add 1 ml of *chloroform*, and add drop by drop, with constant shaking, *chlorinated lime solution*; the chloroform layer does not become brown or violet.

Sulphite – Dilute 1 ml with 10 ml of water, and add 5 drops of *barium chloride solution* and 0.5 ml of 0.001 *N iodine*; the colour of the iodine is not completely discharged.

Sulphate – To 5 ml add 10 mg of sodium bicarbonate and evaporate to dryness on a water bath; the residue, dissolved in *water*; complies with the *limit test for sulphates*, Appendix. 2.3.7.

Free chlorine – Dilute 5 ml with 10 ml of freshly boiled and cooled *water*, add 1 ml of cadmium *iodide solution*, and shake with 1 ml of *chloroform*; the chloroform layer does not become violet within one minute.

Sulphated ash –Not more than 0.01 per cent, Appendix 2.2.6.

Assay –Weigh accurately about 4 g into a stoppered flask containing 40 ml of water, and titrare with *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.03646 g of HCl.

Storage – Store in glass-stoppered containers at a temperature not exceeding 30^0.

Hydrochloric Acid, x N –Solution of any normality x N may be prepared by diluting 84 x ml of *hydrochloric acid* to 1000 ml with *water*.

Hydrochloric Acid – (1 per cent w/v) Dilute 1 g of hydrochloric *acid* to 100 ml with *water.*

Dilute Hydrochloric Acid –

Description –Colourless liquid.

Arsenic, Heavy metals bromoide and iodide, Sulphate, free chlorine –Complies with the tests described under Hydrochloric Acid, when three times the quantity is taken for each test.

Assay –Weigh accurately about 10 g and carry out the Assay described under Hydrochloric Acid.

Storage –Store in stoppered containers of glass or other inert material, at temperature below 30^0.

Hydrochloric Acid, N – HCl = 36.460

36.46 g in 1000 ml

Dilute 85 ml of hydrochloric acid with water to 1000 ml and standardise the solution as follows:

Weigh accurately about 1.5 g of anhydrous sodium carbonate, previously heated at about 270^0 for one hour. Dissolve it in 100 ml of *water* and add two drops of *methyl red solution*. Add the acid slowly from a burette with constant stirring, until the solution becomes faintly pink. Heat again to boiling and titrate

further as necessary until the faint pink colour no longer affected by continued boiling. Each 0.5299 g of *anhydrous* sodium carbonate is equivalent to 1 ml of N hydrochloric acid.

Hydrochloric Acid, Iron-Free – Hydrochloric acid, which complies with the following additional test. Evaporate 5 ml on a water-bath nearly to dryness, add 40 ml of water, 2 ml of a 20 per cent w/v solution of citric acid and two drops of thioglycollic acid, mix, make alkaline with *dilute ammonia solution*, and dilute to 50 ml with water; no pink colour is produced.

Hydrogen Peroxide Solution – (20 Vol.) H_2O_2 = 34.02

Analytical reagent grade of commerce or *hydrogen peroxide solution* (100 Vol.) diluted with 4 volumes of water.

A colourless liquid containing about 6 per cent w/v of H_2O_2; weight per ml, about 1.02 g.

Hydroxylamine Hydrochloride; Hydroxylammonium Chloride – $NH_2OH.HCl$ = 69.49.

Contains not less than 97.0 per cent w/w of NH_2OH. HCI.

Description –Colourless crystals, or a white, crystalline powder.

Solubility –Very soluble in water; soluble in alcohol.

Free acid –Dissolve 1.0 g in 50 ml of *alcohol*, add 3 drops of *dimethyl yellow solution* and titrate to the full yellow colour with *N sodium hydroxide*; not more than 0.5 ml of *N sodium hydroxide* is required.

Sulphated ash –Not more than 0.2 per cent, Appendix 2.2.6.

Assay –Weigh accurately about 0.1 g and dissolve in 20 ml of water, add 5 g of ferric ammonium sulphate dissolve in 20 ml of water, and 15 ml of *dilute sulphuric acid*, boil for five minutes, dilute with 200 ml of water, and titrate with 0.1 *N potassium permanganate*. Each ml of 0.1 *N potassium permanganate* is equivalent to 0.003475 g of NH_2OH. HCl.

Hydroxylamine Hydrochloride Solution – Dissolve 1 g of *hydroxylamine hydrochloride* in 50 ml of *water* and add 50 ml of *alcohol,* 1 ml of *bromophenol blue solution* and 0.1 *N sodium hydroxide* until the solution becomes green.

Mercuric Chloride –$HgCl_2$ =271.50.

Contains not less than 99.5 per cent of $HgCl_2$;

Description –Heavy, colourless or white, crystalline masses, or a white crystalline powder.

Solubility –Soluble in *water*; freely soluble in *alcohol*.

Non-volatile matter –When volatilised, leaves not more than 0.1 per cent of residue.

Assay –Weigh accurately about 0.3 g and dissolve in 85 ml of *water* in a stoppered-flask, add 10 ml of *calcium chloride solution*, 10 ml of *potassium iodide solution*, 3 ml of *formaldehyde solution and* 15 ml of *sodium hydroxide solution*, and shake continuously for two minutes. Add 20 ml of acetic acid and 35 ml of 0.1 *N iodine.* Shake continuously for about ten minutes, or until the precipitated mercury is completely redissolved, and titrate the excess of iodine with 0.1 *N sodium thiosulphate*. Each ml of 0.1 *N iodine is* equivalent to 0.01357 g of $HgCl_2$.

Mercuric Chloride, 0.2 M – Dissolve 54.30 g of *mercuric chloride* in sufficient water to produce 1000 ml.

Mercuric Chloride Solution –A 5.0 per cent w/v solution of *mercuric chloride* in water.

Mercuric Potassium Iodide Solution – See Potassium - Mercuric Iodide solution.

Methyl Alcohol : Methanol : CH_3OH = 32.04.

Description –Clear, Colourless liquid with a characteristic odour.

Solubility –Miscible with water, forming a clear colourless liquid.

Specific Gravity – At 25^0, not more than 0.791.

Distillation range – Not less than 95 per cent distils between 64.5^0 and 65.5^0.

Refractive Index –At 20^0, 1.328 to 1.329.

Acetone –Place 1 ml in a *Nessler cylinder*, add 19 ml of water, 2 ml of a 1 per cent w/v solution of *2-nitrobenzaldehyde* in *alcohol (50 per cent)*, 1 ml of 30 per cent w/v *solution of sodium hydroxide* and allow to stand in the dark for fifteen minutes. The colour developed does not exceed that produced by mixing 1 ml of standard acetone solution, 19 ml of water, 2 ml of the solution of *2-nitrobenzaldehyde* and 1 ml of the *solution of sodium hydroxide* and allowing to stand in the dark for fifteen minutes.

Acidity –To 5 ml add 5 ml of *carbon dioxide-free water*, and titrate with 0.1 *N sodium hydroxide*, using *bromothymol blue solution* as indicator; not more than 0.1 ml is required.

Non-volatile matter – When evaporated on a water-bath and dried to constant weight at 105º, leaves not more than 0.005 per cent w/v of residue.

Methyl Alcohol, Dehydrated –Methyl alcohol, which complies with the following additional requirement.

Water –Not more than 0.1 per cent w/w.

Methyl Orange – Sodium-*p*-di methylamineazobenzene sulphate, $C_{14}H_{14}O_3N_3SNa$.

An orange-yellow powder or crystalline scales, slightly soluble in cold water; insoluble in alcohol; readily soluble in hot water.

Methyl Orange Solution –Dissolve 0.1 g of methyl orange in 80 ml of water and dilute to 100 ml with alcohol.

Test for sensitivity –A mixture of 0.1 ml of the methyl orange solution and 100 ml freshly boiled and cooled water is yellow. Not more than 0.1 ml of 0.1 N hydrochloric acid is required to change the colour to red.

Colour change – *p*H 3.0 (red) to pH 4.4 (yellow).

Methyl Red – *p*-Dimethylaminoazobenzene-O-carboxylic acid, $C_{15}H_{15}O_2N_3$.

A dark red powder or violet crystals, sparingly soluble in *water*; soluble in alcohol.

Methyl red solution –Dissolve 100 mg in 1.86 ml of 0.1 *N sodium hydroxide* and 50 ml of *alcohol* and dilute to 100 ml with water.

Test for sensitivity –A mixture of 0.1 ml of the *methyl red solution* and 100 ml of freshly boiled and cooled *water* to which 0.05 ml of 0.02 *N hydrochloric acid* has been added is red. Not more than 0.01 ml of 0.02 *N sodium hydroxide* is required to change the colour to yellow.

Colour change – *p*H 4.4 (red) to *p*H 6.0 (yellow).

Molish's Reagent –Prepare two solutions in separate bottles, with ground glass stoppers:

(a) Dissolve 2 g of α-naphthol in 95 per cent alcohol and make upto 10 ml with alcohol (*α*-naphthol can be replaced by thymol or resorcinol). Store in a place protected from light. The solution can be used for only a short period.

(b) *Concentrated sulphuric acid*.

Nitric Acid –Contains 70.0 per cent w/w of HNO_3 (limits, 69.0 to 71.0). About 16 N in strength.

Description –Clear, colourless, fuming liquid.

Wt. per ml. – At 20^0, 1.41 to 1.42 g.

Copper and Zinc –Dilute 1 ml with 20 ml of water, and add a slight excess of dilute ammonia solution; the mixture does not become blue. Pass hydrogen sulphide; a precipitate is not produced.

Iron –0.5 ml of complies with the limit test for iron, Appendix 2.3.4.

Lead –Not more than 2 parts per million, Appendix 2.3.5.

Chloride –5 ml neutralised with dilute ammonia solution, complies with the limit test for chlorides, Appendix 2.3.2.

Sulphates –To 2.5 ml add 10 mg of sodium bicarbonate and evaporate to dryness on a water-bath, the residue dissolved in water, complies with the limit test for sulphates, Appendix 2.3.7.

Sulphated ash – Not more than 0.01 per cent w/w, Appendix 2.2.6.

Assay –Weigh accurately about 4 g into a stoppered flask containing 40 ml of water, and titrate with N Sodium hydroxide, using methyl orange solution as indicator. Each ml of N sodium hydroxide is equivalent to 0.06301 g of HNO_3.

Nitric Acid, x N –Solutions of any normality XN may be prepared by diluting 63x ml of nitric acid to 1000 ml with water.

Nitric Acid, Dilute –Contains approximately 10 per cent w/w of HNO_3. Dilute 106 ml of nitric acid to 1000 ml with water.

Petroleum Light – Petroleum Spirit.

Description – Colourless, very volatile, highly flammable liquid obtained from petroleum, consisting of a mixture of the lower members of the paraffin series of hydrocarbons and complying with one or other of the following definitions :

Light Petroleum –(Boiling range, 30^0 to 40^0).

Wt. per ml. –At 20^0, 0.620 to 0.630 g.

Light Petroleum –(Boiling range, 40^0 to 60^0).

Wt. per ml –At 20^0, 0.630 to 0.650 g.

Light Petroleum –(Boiling range, 60^0 to 80^0).

Wt. per ml. –At 20^0, 0.670 to 0.690.

Light Petroleum –(Boiling range, 80^0 to 100^0).

Wt. per ml. –At 20^0, 0.700 to 0.720

Light Petroleum –(Boiling range, 100^0 to 120^0).

Wt. per ml –At 20^0, 0.720 to 0.740 g.

Light Petroleum –(Boiling range, 120^0 to 160^0).

Wt. per ml –At 20^0, about 0.75 g.

Non-volatile matter –When evaporated on a water-bath and dried at 105^0, leaves not more than 0.002 per cent w/v of residue.

Patterns & Reeders indicators 0.1per cent solution – Dissolve 0.01g indicator in 100 ml of Methanol.

Phenolphthalein –$C_{20}H_{14}O_4$.

A white to yellowish-white powder, practically insoluble in water, soluble in alcohol.

Phenolpthalein indicator – Dissolve 0.5 gm Phenolpthalein in 100 ml of
50% ethyl alcohol (v/v).

Phenolphthalein Solution –Dissolve 0.10 g in 80 ml of *alcohol* and dilute to 100 ml with water.

Test for sensitivity –To 0.1 ml of the *phenolphthalein solution* add 100 ml of freshly boiled and cooled water, the solution is colourless. Not more than 0.2 ml of 0.02 *N sodium hydroxide* is required to change the colour to pink.

Colour change – *p*H 8.2 (colourless) to pH 10.0 (red)

Phloroglucinol – 1 , 3 , 5 – Trihydroxybenzene , $C_6H_3(OH)_3 . 2H_2O$.

Description – White or yellowish crystals or a crystalline powder.

Solubility –Slightly soluble in water; soluble in *alcohol*, and in *solvent ether*.

Melting range –After drying at 110^0 for one hour, 215^0 to 219^0.

Sulphated ash – Not more than 0.1 per cent, Appendix 2.2.6.

Phloroglucinol should be kept protected from light.

Phosphoric Acid – H_3PO_4 = 98.00.

(Orthophosphoric Acid; Concentrated Phosphoric Acid).

Description –Clear and colourless syrupy liquid, corrosive.

Solubility –Miscible with water and with alcohol.

Phosphoric Acid, x N –

Solutions of any normality, x N may be prepared by diluting 49 x g of *phosphoric acid* with water to 1000 ml.

Phosphoric Acid, Dilute –

Contains approximately 10 per cent w/v of H_3PO_4.

Dilute 69 ml of *phosphoric acid* to 1000 ml with water.

Potassium Chloride –KCl = 74.55

Analytical reagent grade

Potassium Chromate – K_2CrO_4 = 194.2

Analytical reagent grade

Potassium Chromate Solution –A 5.0 per cent w/v solution of potassium chromate.

Gives a red precipitate with *silver nitrate* in neutral solutions.

Potassium Cupric-Tartrate Solution –Cupric Tatrate Alkaline Solution: Fehling's Solution.

(1) Copper Solution – Dissolve 34.66 g of carefully selected small crystals of *copper sulphate,* showing no trace of efflorescence or of adhering moisture, in sufficient water to make 500 ml. Keep this solution in small, well-stoppered bottles.

(2) Alkaline Tartrate Solution – Dissolve 176 g of sodium *potassium tartrate* and 77 g of *sodium hydroxide* in sufficient *water* to produce 500 ml.

Mix equal volumes of the solutions No. 1 and No. 2 at the time of using.

Potassium Dichromate – $K_2Cr_2O_7$ =294.18.

Contains not less than 99.8 per cent of $K_2Cr_2O_7$.

Description – Orange-red crystals or a crystalline powder.

Solubility – Soluble in *water*

Chloride –To 20 ml of a 5 per cent w/v solution in *water* and 10 ml *nitric acid,* warm to about $50^0$and add a few drops of *silver nitrate solution*; not more than a faint opalescence is produced.

Assay –Carry out the assay described under Potassium Chromate, using 2 g. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.004904 g of $K_2Cr_2O_7$.

Potassium Dichromate Solution – A 7.0 per cent w/v solution of *potassium dichromate* in *water.*

Potassium Dichromate, Solution 0.1N – $K_2Cr_2O_7$ = 294.18, 4.903 g in 1000 ml.

Weigh accurately 4.903 g of *potassium dichromate* and dissolve in sufficient *water* to produce 1000 ml.

Potassium Dihydrogen Phosphate - KH_2PO_4 = 136.1

Analytical reagent grade of commerce.

Potassium Ferrocyanide – $K_4Fe(CN)_6.3H_2O$ =422.39.

Contains not less than 99.0 per cent of $K_4Fe(CN)_6.3H_2O$.

Description –Yellow, crystalline powder.

Solubility –Soluble in water.

Acidity or Alkalinity –A 10 per cent w/v solution in water is neutral to litmus paper.

Assay –Weigh accurately about 1g and dissolve in 200 ml of *water,* add 10 ml of *sulphuric acid and* titrate with 0.1 *N potassium permanganate.* Each ml of 0.1 *N potassium permanganate* is equivalent to 0.04224 g of $K_4Fe(CN)_6.3H_2O$.

Potassium Ferrocyanide Solution –A 5.0 per cent w/v solution of *potassium ferrocyanide in water.*

Potassium Hydrogen Phthalate –$CO_2H.C_6H_4.CO_2K$ =204.22.

Contains not less than 99.9 per cent and not more than the equivalent of 100.1 per cent of $C_8H_5O_4K$ calculated with reference to the substance dried at 110^0 for one hour.

Description –White, crystalline powder.

Solubility –Slowly soluble in *water,* forming clear, colourless solution.

Acidity –A 2.0 per cent w/v solution in carbon dioxide free water gives with *bromophenol blue solution* the grey colour indicative of *p*H 4.0.

Assay –Weigh accurately about 9 g, dissolve in 100 ml of *water* and titrate with *N sodium hydroxide* using *phenolphthalein solution* as indicator. Each ml of *N Sodium hydroxide* is equivalent to 0.2042 g of $C_8H_5O_4K$.

Potassium Hydrogen Phthalate, 0.02 M – Dissolve 4.084 g of *Potassium hydrogen phthalate* in sufficient *water* to produce 1000 ml.

Potassium Hydrogen Phthalate, 0.2 M – Dissolve 40.84 g of *potassium hydrogen phthalate* in sufficient *water* to produce 1000 ml.

Potassium Hydroxide –Caustic Potash : KOH = 56.11

Contains not less than 85.0 per cent of total alkali, calculated as KOH and not more than 4.0 per cent of K_2CO_3.

Description – Dry white sticks, pellets or fused mass; hard, brittle and showing a crystalline fracture; very deliquescent; strongly alkaline and corrosive.

Solubility –Freely soluble in water, in alcohol and in glycerin; very soluble in boiling *ethyl alcohol*.

Aluminium, iron and matter insoluble in hydrochloric acid –Boil 5 g with 40 ml of dilute *hydrochloric acid*, cool, make alkaline with dilute ammonia solution, boil, filter and wash the residue with a 2.5 per cent w/v solution of ammonium nitrate; the insoluble residue, after ignition to constant weight, weighs not more than 5 mg.

Chloride –0.5 g dissolved in water with the additon of 1.6 ml of nitric acid, complies with the limit test for chlorides, Appendix 2.3.2.

Heavy metals –Dissolve 1 g in a mixture of 5 ml of water and 7 ml of dilute hydrochloric acid. Heat to boiling, add 1 drop of phenolphthalein solution and dilute ammonia solution dropwise to produce a faint pink colour. Add 2 ml of acetic acid and water to make 25 ml; the limit of heavy metals is 30 parts per million, Appendix 2.3.3.

Sulphate –Dissolve 1 g in water with the addition of 4.5 ml of hydrochloric acid; the solution complies with the limit test for sulphates, Appendix 2.3.6.

Sodium –To 3 ml of a 10 per cent w/v solution add 1 ml of water, 1.5 ml of alcohol, and 3 ml of potassium antimonate solution and allow to stand; no white crystalline precipitate or sediment is visible to the naked eye within fifteen minutes.

Assay –Weigh accurately about 2 g, and dissolve in 25 ml of water, add 5 ml of barium chloride solution, and titrate with N hydrochloric acid, using phenolphthalein solution as indicator. To the solution in the flask add bromophenol blue solution, and continue the titration with N hydrochloric acid. Each ml of N hydrochloric acid, used in the second titration in equivalent to 0.06911 g of K_2CO_3 . Each ml of N hydrochloric acid, used in the combined titration is equivalent to 0.05611 g of total alkali, calculated as KOH.

Storage –Potassium Hydroxide should be kept in a well-closed container.

Potassium Hydroxide, x N *– Solution of any normality, x N, may be prepared by dissolving 56.11x g of potassium hydroxide in water and diluting to 1000 ml.*

Potassium Hydroxide Solution *–Solution of Potash.*

An aqueous solution of potassium hydroxide containing 5.0 per cent w/v of total alkali, calculated as KOH (limits, 4.75 to 5.25).

Assay –Titrate 20 ml with N sulphuric acid, using solution of methyl orange as indicator. Each ml of N sulphuric acid is equivalent to 0.05611 g of total alkali, calculated as KOH.

Storage –Potassium hydroxide solution should be kept in a well-closed container of lead-free glass or of a suitable plastic.

Potassium Iodide –KI = 166.00

Description – Colourless crystals or white powder; odourless, taste, saline and slightly bitter.

Solubility –Very soluble in water and in glycerin; soluble in alcohol.

Arsenic –Not more than 2 parts per million, Appendix 2.3.1.

Heavy metals -Not more than 10 parts per million, determined on 2.0 g by Method A, Appendix 2.3.3.

Barium –Dissolve 0.5 g in 10 ml of water and add 1 ml of dilute sulphuric acid; no turbidity develops within one minute.

Cyanides –Dissolve 0.5 g in 5 ml of warm water, add one drop of ferrous sulphate solution and 0.5 ml of sodium hydroxide solution and acidify with hydrochloric acid; no blue colour is produced.

Iodates –Dissolve 0.5 g in 10 ml of freshly boiled and cooled water, and add 2 drops of dilute sulphuric acid and a drop of starch solution; no blue colour is produced within two minutes.

Assay –Weigh accurately about 0.5 g, dissolve in about 10 ml of water and add 35 ml of hydrochloric acid and 5 ml of chloroform. Titrate with 0.05 M potassium iodate until the purple colour of iodine disappears from the chloroform. Add the last portion of the iodate solution drop-wise and agitate vigorously and continuously. Allow to stand for five minutes. If any colour develops in the chloroform layer continue the titration. Each ml of 0.05 M potassium iodate is equivalent to 0.0166 mg of KI.

Storage –Store in well-closed containers.

Potassium Iodide, M –Dissolve 166.00 g of potassium iodide in sufficient water to produce 1000 ml.

Potassium Iodide and Starch Solution –Dissolve 10 g of potassium iodide in sufficient water to produce 95 ml and add 5 ml of starch solution.

Potassium Iodide and Starch solution must be recently prepared.

Potassium Iodide Solution –A 10 per cent w/v solution of potassium iodide in water.

Potassium Iodobismuthate Solution –Dissolve 100 g of tartaric acid in 400 ml of water and 8.5 g of bismuth oxynitrate. Shake during one hour, add 200 ml of a 40 per cent w/v

Potassium Iodobismuthate Solution, Dilute –Dissolve 100 g of tartaric acid in 500 ml of water and add 50 ml of potassium iodobismuthate solution.

Potassium Mercuric-Iodide Solution –Mayer's Reagent.

Add 1.36 g of mercuric chloride dissolved in 60 ml of water to a solution of 5 g of potassium iodide in 20 ml of water, mix and add sufficient water to produce 100 ml.

Potassium Mercuric-Iodide Solution, Alkaline (Nessler's Reagent)

To 3.5 g of potassium iodide add 1.25 g of mercuric chloride dissolved in 80 ml of water, add a cold saturated solution of mercuric chloride in water, with constant stirring until a slight red precipitate remains. Dissolve 12 g of sodium hydroxide in the solution, add a little more of the cold saturated solution of mercuric chloride and sufficient water to produce 100 ml. Allow to stand and decant the clear liquid.

Potassium Permanganate – $KMnO_4$ = 158.03

Description –Dark purple, slender, prismatic crystals, having a metallic lustre, odourless; taste, sweet and astringent.

Solubility –Soluble in *water*; freely soluble in *boiling water.*

Chloride and Sulphate –Dissolve 1 g in 50 ml of boiling *water*, heat on a water-bath, and add gradually 4 ml or a sufficient quantity of *alcohol* until the meniscus is colour-less; filter. A 20 ml portion of the filtrate complies with the limit test for *chloride,* Appendix 2.3.2., and another 20 ml portion of the filtrate complies with the limit test for *sulphates,* Appendix 2.3.7.

Assay –Weigh accurately about 0.8 g, dissolve in water and dilute to 250 ml. Titrate with this solution 25.0 ml of 0.1 *N oxalic acid* mixed with 25 ml of *water* and 5 ml of *sulphuric acid.* Keep the temperature at about 70^0 throughout the entire titration. Each ml of 0.1 *N oxalic acid* is equivalent to 0.00316 g of $KMnO_4$.

Storage –Store in well-closed containers.

Caution –Great care should be observed in handling *potassium permanganate*, as dangerous explosions are liable to occur if it is brought into contact with organic or other readily oxidisable substance, either in solution or in the dry condition.

Potassium Permanganate Solution – A 1.0 per cent w/v solution of *potassium permanganate* in water.

Potassium Permanganate, 0.1 N Solution –158.03. 3.161 g in 1000 ml

Dissolve about 3.3. g of *potassium permanganate* in 1000 ml of *water*, heat on a water-bath for one hour and allow to stand for two days. Filter through glass wool and standardise the solution as follows :

To an accurately measured volume of about 25 ml of the solution in a glass stoppered flask add 2 g of *potassium iodide* followed by 10 ml of *N sulphuric acid.* Titrate the liberated *iodine* with standardised 0.1 *N sodium thiosulphate,* adding 3 ml of *starch solution* as the end point is approached. Correct for a blank run on the same quantities of the same reagents. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.003161 g of $KMnO_4$.

Potassium Tellurite: $K_2 TeO_3$ (approx)
General reagent grade of commerce.

Purified Water –H_2O = 18.02.

Description –Clear, colourless liquid, odourless, tasteless.

Purified water is prepareed from potable water by distillation, ion-exchange treatment, reverse osmosis or any other suitable process. It contains no added substances.

pH – Between 4.5 and 7.0 determined in a solution prepared by adding 0.3 ml of a saturated solution of *potassium chloride* to 100 ml of the liquid being examined.

Carbon dioxide –To 25 ml add 25 ml of *calcium hydroxide solution*, no turbidity is produced.

Chloride –To 10 ml add 1 ml of *dilute nitric acid* and 0.2 ml of *silver nitrate solution;* no opalescence is produced, Appendix 2.3.2.

Sulphate –To 10 ml add 0.1 ml of *dilute hydrochloric acid* and 0.1 ml of *barium chloride,* the solution remains clear for an hour, Appendix 2.3.6.

Nitrates and Nitrites –To 50 ml add 18 ml of *acetic acid* and 2 ml of *naphthylamine-sulphanilic acid* reagent. Add 0.12 g of *zinc reducing mixture* and shake several times. No pink colour develops within fifteen minutes.

Ammonium – To 20 ml add 1 ml of *alkaline potassium mercuric-iodide solution* and after five minutes view in a Nessler cylinder placed on a white tile; the colour is not more intense than that given on adding 1 ml of *alkaline potassium mercuric-iodide solution* to a solution containing 2.5 ml of *dilute ammonium chloride solution (Nessler's)* 7.5 ml of the liquid being examined.

Calcium –To 10 ml add 0.2 ml of *dilute ammonia solution* and 0.2 ml of *ammonium oxalate solution;* the solution remains clear for an hour.

Heavy metals –Adjust the *p*H of 40 ml to between 3.0 and 4.0 with *dilute acetic acid,* add 10 ml of freshly prepared *hydrogen sulphide solution* and allow to stand for ten minutes; the colour of the solution is not more than that of a mixture of 50 ml of the liquid being examined and the same amount of *dilute acetic acid* added to the sample, Appendix 2.3.3.

Oxidisable matter –To 100 ml add 10 ml of *dilute sulphuric acid* and 0.1 ml of 0.1 *N potassium permanganate* and boil for five minutes. The solution remains faintly pink.

Total Solids –Not more than 0.001 per cent w/v determined on 100 ml by evaporating on a water bath and drying in an oven at 105^0 for one hour.

Storage –Store in tightly closed containers.

Resorcinol solution – Dissolve 1 g resublimed resorcinol in 100 ml hydrochloric acid (sp gr 1.18 to 1.19).

Silver Nitrate Solution – A freshly prepared 5.0 per cent w/v solution of silver nitrate in water.

Silver Nitrate, 0.1 N – $AgNO_3$ = 169. 87; 16.99 g in 1000 ml. Dissolve about 17 g in sufficient *water* to produce 1000 ml and standardise the solution as follows:

Weigh accurately about 0.1 g of *sodium chloride* previously dried at 110^0 for two hours and dissolve in 5 ml of *water*. Add 5 ml of *acetic acid*, 50 ml of *methyl alcohol* and three drops of *eosin solution is* equivalent to 1 ml of 0.1 *N silver nitrate.*

Sodium Bicarbonate – $NaHCO_3$ =84.01

Description –White, crystalline powder or small, opaque, monoclinic crystals; odourless; taste, saline.

Solubility –Freely soluble in *water*; practically insoluble in *alcohol.*
*Carbonate –p*H of a freshly prepared 5.0 per cent w/v solution in *carbon dioxide-free water,* not more than 8.6.

Aluminium, calcium and insoluble matter –Boil 10 g with 50 ml of *water* and 20 ml of *dilute ammonia solution,* filter, and wash the residue with water; the residue, after ignition to constant weight, not more than 1 mg.

Arsenic –Not more than 2 parts per million, Appendix 2.3.1.

Iron –Dissolve 2.5 g in 20 ml of *water* and 4 ml of *iron-free hydrochloric acid,* and *dilute* to 40 ml with *water*; the solution complies with the *limit test for iron,* Appendix 2.3.4.

Heavy metals –Not more than 5 parts per million, determined by Method A on a solution prepared in the following manner:

Mix 4.0 g with 5 ml of *water* and 10 ml of *dilute hydrochloric acid,* heat to boiling, and maintain the temperature for one minute. Add one drop of *phenolphthalein solution* and sufficient *ammonia solution* drop wise to give the solution a faint pink colour. Cool and dilute to 25 ml with *water,* Appendix 2.3.3.

Chlorides –Dissolve 1.0 g in *water* with the addition of 2 ml of *nitric acid;* the solution complies with the *limit test for chlorides,* Appendix 2.3.2.

Sulphates –Dissolve 2 g in *water* with the addition of 2 ml of *hydrochloric acid;* the solution complies with the limit test for *sulphates,* Appendix 2.3.6.

Ammonium compounds –1 g warmed with 10 ml of *sodium hydroxide solution* does not evolve ammonia.

Assay –Weigh accurately about 1 g, dissolve in 20 ml of *water,* and titrate with 0.5 *N sulphuric acid* using *methyl orange solutions* as indicator. Each ml of 0.5 *N sulphuric acid* is equivalent to 0.042 g of $NaHCO_3$.

Storage –Store in well-closed containers.

Sodium Bicarbonate Solution –A 5 per cnet w/v solution of *sodium bicarbonate* in *water.*

Sodium Carbonate – Na_2CO_3. $10H_2O$ =286.2.

Analytical reagent grade.

Sodium Chloride – NaCl = 58.44

Analytical reagent grade.

Sodium Chloride Solution: Dissolve 5 g of *sodium chloride* in 50 ml of purified water.

Sodium Hydroxide –NaOH = 40.00

Description –White sticks, pellets, fused masses, or scales; dry, hard brittle and showing a crystalline fracture, very deliquescent; strongly alkaline and corrosive.

Solubility –Freely soluble in *water* and in *alcohol.*

Aluminium, iron and matter insoluble in hydrochloric acid –Boil 5 g with 50 ml of dilute hydrochloric acid, cool, make alkaline with *dilute ammonia solution,* boil, filter, and wash with a 2.5 per cent w/v solution of *ammonium nitrate;* the insoluble residue after ignition to constant weight weighs not more than 5 mg.

Arsenic –Not more than 4 parts per million, Appendix 2.3.1.

Heavy metals –Not more than 30 parts per million, determined by Method A, Appendix 2.3.3. in a solution prepared by dissolving 0.67 g in 5 ml of water and 7 ml of 3 *N hydrochloric acid.* Heat to boiling, cool and dilute to 25 ml with water.

Potassium –Acidify 5 ml of a 5 per cent w/v solution with *acetic acid* and add 3 drops of *sodium cobaltnitrite solution;* no preciptitate is formed.

Chloride – 0.5 g dissolved in *water* with the addition of 1.8 ml of *nitric acid,* complies with the limit test for *chlorides,* Appendix 2.3.2.

Sulphates –1 g dissolved in *water* with the addition of 3.5 ml of *hydrochloric acid* complies with the limit test for *sulphates,* Appendix 2.3.6.

Assay –Weigh accurately about 1.5 g and dissolve in about 40 ml of *carbon dioxide-free water.* Cool and titrate with *N sulphuric acid* using *phenolphthalein solution* as indicator. When the pink colour of the solution is discharged, record the volume of acid solution required, add *methyl orange solution* and continue the titration until a persistent pink colour is produced. Each ml of *N sulphuric acid* is equivalent to 0.040 g of total alkali calculated as NaOH and each ml of acid consumed in the titration with *methyl orange* is equivalent to 0.106 g of Na_2CO_3.

Storage –Store in tightly closed containers.

Sodium Hydroxide, x N – Solutions of any normality, xN may be prepared by dissolving 40 x g of *sodium hydroxide* in *water* and diluting to 1000 ml.

Sodium Hydroxide Solution – A 20.0 per cent w/v solution of *sodium hydroxide* in *water.*

Sodium Hydroxide Solution, Dilute –

A 5.0 per cent w/v solution of *sodium hydroxide* in water.

Sodium Potassium Tartrate –Rochelle Salt COONa.CH(OH). CH(OH), COOK. $4H_2O$ = 282.17

Contains not less than 99.0 per cent and not more than the equivalent of 104.0 per cent of $C_4H_4O_6KNa.4H_2O$.

Description –Colourless crystals or a white, crystalline powder; odourless; taste saline and cooling. It effloresces slightly in warm, dry air, the crystals are often coated with a white powder.

Solubility –Soluble in *water;* practically insoluble in alcohol.

Acidity or Alkalinity –Dissolve 1 g in 10 ml of recently boiled and cooled *water,* the solution requires for neutralisation not more than 0.1 ml of 0.1 *N sodium hydroxide* or of 0.1 *N hydrochloric acid,* using *phenolphthalein solution* as indicator.

Iron –0.5 g complies with the *limit test for iron,* Appendix 2.3.4.

Chloride –0.5 g complies with the *limit test for chlorides,* Appendix 2.3.2.

Sulphate –0.5 g complies with the *limit test for sulphate,* Appendix 2.3.6.

Assay –Weigh accurately about 2 g and heat until carbonised, cool, and boil the residue with 50 ml of *water* and 50 ml of 0.5 *N sulphuric acid;* filter, and wash the filter with *water;* titrate the excess of acid in the filtrate and washings with 0.5 N *sodium hydroxide,* using *methyl orange solution* as indicator. Each ml of 0.5 *N sulphuric acid* is equivalent to 0.07056 g of $C_4H_4O_6KNa.4H_2O$.

Sodium Sulphate (anhydrous) – Na_2SO_4 = 142.04

Analytical reagent grade of commerce.
White, crystalline powder of granules; hygroscopic.

Sodium Thiosulphate – $Na_2S_2O_3.5H_2O$ =248.17.

Description – Large colourless crystals or coarse, crystalline powder; odourless; taste, saline, deliquescent in moist air and effloresces in dry air at temperature above 33^0.

Solubility – Very soluble in *water*; insoluble in *alcohol.*

pH –Between 6.0 and 8.4, determined in a 10 per cent w/v solution.

Arsenic –Not more than 2 parts per million, Appendix 2.3.1.

Heavy metals –Not more than 20 parts per million, determined by Method A, Appendix 2.3.3. in a solution prepared in the following manner : Dissolve 1 g in 10 ml of *water,* slowly add 5 ml of *dilute hydrochloric acid* and evaporate the mixture to dryness on a water-bath. Gently boil the residue with 15 ml of *water* for two minutes, and filter. Heat the filtrate to boiling, and add sufficient *bromine solution* to the hot filtrate to produce a clear solution and add a slight excess of *bromine solution.* Boil the solution to expel the *bromine* completely, cool to room temperature, then add a drop of *phenolphthalein solution* and *sodium*

hydroxide solution until a slight pink colour is produced. Add 2 ml of *dilute acetic acid* and dilute with *water* to 25 ml.

Calcium –Dissolve 1 g in 20 ml of *water,* and add a few ml of *ammonium oxalate solution;* no turbidity is produced.

Chloride –Dissolve 0.25 g in 15 ml of *2N nitric acid* and boil gently for three to four minutes, cool and filter; the filtrate complies with the *limit test for chlorides,* Appendix 2.3.2.

Sulphate and Sulphite –Dissolve 0.25 g in 10 ml of *water*, to 3 ml of this solution add 2 ml of *iodine solution,* and gradually add more *iodine solution*, dropwise until a very faint-persistant yellow colour is procduced; the resulting solution complies with the limit test for sulphates, Appendix 2.3.7.

Sulphide –Dissolve 1 g in 10 ml of *water* and 10.00 ml of a freshly prepared 5 per cent w/v solution of *sodium nitroprusside;* the solution does not become violet.

Assay –Weigh accurately about 0.8 g and dissolve in 30 ml of *water.* Titrate with 0.1 *N iodine,* using 3 ml of *starch solution* as indicator as the end-point is approached. Each ml of 0.1 iodine is equivalent to 0.02482 g of $Na_2S_2O_3.5H_2O$.

Storage –Store in tightly-closed containers.

Sodium Thiosulphate, 0.1 N – $Na_2S_2O_3.5H_2O$. = 248.17, 24.82 g in 1000 ml.

Dissolve about 26 g of *sodium thiosulphate* and 0.2 g of *sodium carbonate* in *carbon dioxide-free water* and dilute to 1000 ml with the same solvent. Standardise the solution as follows :

Dissolve 0.300 g of *potassium bromate* in sufficient *water* to produce 250 ml. To 50 ml of this solution, add 2 g of *potassium iodide* and 3 ml of 2 *N hydrochloric acid* and titrate with the *sodium-thiosulphate solution* using *starch solution,* added towards the end of the titration, as indicator until the blue colour is discharged. Each 0.002784 g of *potassium bromate* is equivalent to 1 ml of 0.1*N sodium thiosulphate.* Note: –Re-standardise 0.1 *N sodium thiosulphate* frequently.

Soxhlet Modification of Fehling's solution – Prepare by mixing equal volumes of Solution A and Solution B immediately before using.

Copper Sulphate Solution (Solution A) – Dissolve 34.639 g of copper sulphate crystals ($CuSO_4.5H_2O$)in water, dilute to 500ml and filter through glass wool or filter paper.

Potassium Sodium Tartrate (Rochelle Salt) Solution (Solution B) – Dissolve 173 g of potassium sodium tartrate and 50 g of sodium hydroxide in water, dilute to 500 ml. Let the solution stand for a day and filter.

Standard Invert Sugar Solution – Weigh accurately 0.95 g sucrose and dissolve it in 500 ml water. Add 2 ml of concentrated hydrochloric acid, boil gently for 30 minutes and keep aside for 24 hours. Neutralize with sodium carbonate and make the final volume to 1000 ml; 50 ml of this solution contains 0.05 g invert sugar.

Stannous Chloride – $SnCl_2. 2H_2O$ =225.63.

Contains not less than 97.0 per cent of $SnCl_2.\ 2H_2O$.

Description –Colourless crystals.

Solubility –Soluble in *dilute hydrochloric acid.*

Arsenic- Dissolve 5.0 g in 10 ml of *hydrochloric acid,* heat to boiling and allow to stand for one hour; the solution shows no darkening when compared with a freshly prepared solution of 5.0 g in 10 ml of *hydrochloric acid.*

Sulphate –5.0 g with the addition of 2 ml of *dilute hydrochloric acid*, complies with the *limit test for sulphates,* Appendix 2.3.7.

Assay –Weigh accurately about 1.0 g and dissolve in 30 ml of *hydrochloric acid* in a stoppered flask. Add 20 ml of *water* and 5 ml of *chloroform* and titrate rapidly with 0.05 *M potassium iodate until* the *chloroform* layer is colourless. Each ml of 0.05 M potassium iodate is equivalent to 0.02256 g of $SnCl_2.\ 2H_2O$.

Stannous Chloride Solution – May be prepared by either of the two methods given below :
Dissolve 330 g of stannous *chloride* in 100 ml of *hydrochloric acid* and add sufficient *water* to produce 1000 ml.

Dilute 60 ml of *hydrochloric acid* with 20 ml of *water*, add 20 g of tin and heat gently until gas ceases to be evolved; add sufficient *water* to produce 100 ml, allowing the undissolved tin to remain in the solution.

Starch Soluble – Starch, which has been treated with *hydrochloric acid* until after being washed, it forms an almost clear liquid solution in hot water.

Description –Fine, white powder.

Solubility –Soluble in hot *water,* usually forming a slightly turbid solution.

Acidity or Alkalinity –Shake 2 g with 20 ml of *water* for three minutes and filter; the filtrate is not alkaline or more than fainthy acid to litmus paper.

Sensitivity –Mix 1 g with a little cold *water* and add 200 ml *boiling water.* Add 5 ml of this solution to 100 ml of *water* and add 0.05 ml of 0.1 N *iodine.* The deep blue colour is discharged by 0.05 ml of 0.1 N *sodium thiosulphate.*

Ash – Not more than 0.3 per cent, Appendix 2.3.

Starch Solution –Triturate 0.5 g of *soluble starch,* with 5 ml of *water,* and add this, with constant stirring, to sufficient water to produce about 100 ml. Boil for a few minutes, cool, and filter.

Solution of *starch* must be recently prepared.

Sulphamic Acid –NH_2SO_3H =97.09.

Contains not less than 98.0 per cent of H_3NO_3S.

Description -White crystals or a white crystalline powder.

Solubility –Readily soluble in water. Melting Range –203^0 to 205^0, with decomposition.

Sulphuric Acid – H_2SO_4 = 98.08.

When no molarity is indicated use analytical reagent grade of commerce containing about 98 per cent w/w of *sulphuric acid.* An oily, corrosive liquid weighing about 1.84 g per ml and about 18 M in strength.

When solutions of molarity xM are required, they should be prepared by carefully adding 54 ml of sulphuric acid to an equal volume of water and diluting with water to 1000 ml.

Solutions of sulphuric acid contain about 10 per cent w/v of H_2SO_4 per g mol.

Sulphuric Acid, Dilute –Contains approximately 10 per cent w/w of H_2SO_4.

Dilute 57 ml of sulphuric acid to 1000 ml with water.

Sulphuric Acid, Chlorine-free –Sulphuric acid which complies with the following additional test:

Chloride –Mix 2 ml with 50 ml of water and add 1 ml of solution of *silver nitrate,* no opalescence is produced.

Sulphuric Acid, Nitrogen-free-Sulphuric acid which contains not less than 98.0 per cent w/w of H_2SO_4 and complies with the following additional test :

Nitrate –Mix 45 ml with 5 ml of *water*, cool and add 8 mg of *diphenyl benezidine;* the solution is colourless or not more than very pale blue.

Sulphuric acid + orthophosphoric acid mixture – take 60 ml water, add 15 ml conc. *sulphuric acid* and 15 ml H_3PO_4 cool and dilute to 1000ml.

Tartaric Acid –$(CHOH.\ COOH)_2$ =150.1

Analytical reagent grade.

Thioglycollic Acid – Mercapto acetic acid, – HS. CH_2COOH =92.11.

Contains not less than 89.0 per cent w/w of $C_2H_4O_2S$, as determined by both parts of the Assay described below :

Description –Colourless or nearly colourless liquid; odour strong and upleasant.

Iron –Mix 0.1 ml with 50 ml of water and render alkaline with *strong ammonia solution;* no pink colour is produced.

Assay – Weigh accurately about 0.4 g and dissolve in 20 ml of *water* and titrate with 0.1 *N sodium hydroxide* using *cresol red solution* as indicator. Each ml of 0.1 *N sodium hydroxide is equivalent to* 0.009212 g of $C_2H_4O_2S$.

To the above neutralised solution and 2 g of *sodium bicarbonate* and titrate with 0.1 *N iodine.* Each ml of 0.1 N iodine is equivalent to 0.009212 g of $C_2H_4O_2S$.

Triethanolamine 20per cent Solution – 200 ml of triethanolamine, adds 800 ml water and make up to 1000 ml.

Toluene -Methyl benzene,$C_6H_5.CH_3$ =102.14.

Analytical grade reagent of commerce.
Clear, colourless liquid, odour, characteristic; bp about 110^0, wt per ml, about 0.870 g.

Water –See purified water.

Water, Ammonia-free –Water, which has been boiled vigorously for a few minutes and protected from the atomosphere during cooling and storage.

Xylenol Orange – [3H-2,1-Benzoxathiol–3-ylidene bis – (6-hydroxy-5-methyl-m-phenylene) methylenenitrilo] tetra acetic acid SS-dioxide or its tetra sodium salt.

Gives a reddish-purple colour with mercury, lead, zinc and contain other metal ions in acid solution. When metal ions are absent, for example, in the presence of an excess of *disodium ethylenediamine tetraacetate*, this solution is yellow.

Xylenol Orange Solution –Dissolve 0.1 g of *xylenol orange* with 100 ml of *water* and filter, if necessary.

Zinc Acetate – analytical grade reagent of commerce.

Zinc Acetate – Aluminum Chloride Reagent: Dissolve 20 g of *zinc acetate* and 5 g of *aluminum chloride* in sufficient water to make 100 ml.

Zinc acetate solution 0.05M - Dissolve 10.9690 g of z*inc acetate* in 50 ml *purified water* and few drops of *glacial acetic acid* and dilute to 1000 ml.

APPENDIX- 5

5.1. CHEMICAL TESTS AND ASSAYS

5.1.1. - ESTIMATION OF TOTAL PHENOLICS

Prepare a stock solution (1 mg/ml) of the extract in *methanol*. From the stock solution, take suitable quantity of the extract into 25-ml volumetric flask and add 10 ml of water and 1.5 ml of *Folin Ciocalteau reagent*. Keep the mixture for 5 min, and then add 4 ml of 20 per cent *sodium carbonate solution* and make up to 25 ml with *double distilled water.*

Keep the mixture for 30 min and record absorbance at 765 nm. Calculate percentage of total phenolics from calibration curve of gallic acid prepared by using the above procedure and express total phenolics as percentage of gallic acid.

5.1.2. - ESTIMATION OF TOTAL TANNINS

Defat 2 g of sample with 25 ml *petroleum ether* for 12 h. Boil the marc for 2 h with 300 ml of *double distilled water*. Cool, dilute up to 500 ml and filter. Measure 25 ml of this infusion into 2-litre porcelain dish; add 20 ml *Indigo solution* and 750 ml *double distilled water*. Titrate it with *0.1N potassium permanganate solution,* 1 ml at a time, until blue solution changes to green. Thereafter add drops wise until solution becomes golden yellow in colour.

Similarly, titrate mixture of 20-ml *Indigo solution* and 750 ml of *double distilled water*. Calculate the difference between two titrations in ml.

Each ml of 0.1*N potassium permanganate solution* is equivalent to 0.004157 g of total tannins.

5.1.3. - ESTIMATION OF SUGARS

Method A:

Estimate total soluble and reducing sugars according to Nelson – Somogyi photometric method for the determination of glucose.

Preparation of calibration curve for *d*-glucose (Dextrose)

Dissolve accurately weighed 500 mg of dextrose in a 100-ml volumetric flask (5 mg / ml). From the above stock solution pipette out aliquots of 0.05 ml to 0.3 ml in to 10- ml volumetric flask and makeup the volume with *double distilled water*. Add 1 ml of alkaline reagent to each tube (25 parts of Reagent I + 1 part of Reagent II).

Reagent I: Dissolve 25 g of anhydrous *sodium carbonate* 25 g of Rochelle salt or sodium potassium tartrate, 20 g of *sodium bicarbonate* and 200 g of anhydrous *sodium sulphate* in about 800 ml of water and dilute to 1 L.

Reagent II : Add 15 per cent *copper sulphate* containing concentrated *sulphuric acid* per 100 ml to the tube. Mix the contents and heat for 20 min in a boiling water-bath. Then cool the tubes and add the solution 1 ml of *arsenomolybdic acid reagent* (dissolve 250 mg of *ammonium molybdate* in 45 ml of *purified water*. To this, add 2.1 ml of *concentrated sulphuric acid* and mix well. To this solution, dissolve 3 g of *sodium arsenate* in 25 ml of *purified water*, mix well and place in incubator maintained at 37 ° C for 24 hr). Dilute the contents of the test tube to 10 ml by adding *purified water* mix well and then read color intensity at 520 nm using a *ultra violet* visible spectrophotometer. Record the absorbance and plot a standard curve of absorbance *vs.* concentration.

5.1.3.1. - Reducing sugars

For reducing sugars, weigh accurately 500 mg of the sample, dissolve in 100 ml of *double distilled water* and make up the volume to 100 ml in a volumetric flask. Then follow method as mentioned for the preparation of calibration curve.

5.1.3.2. - Total sugars

Place 25 ml of the solution from the 100 ml stock solution prepared for the reducing sugars in a 100 ml beaker. To this, add 5 ml of hydrochloric acid: *purified water* (1:1 v/v), mix well and allow to stand at room temperature for 24 hr for inversion. Neutralize the sample with 5 N *sodium hydroxide* and make up to 50 ml with *purified water*. From this diluted sample, use 1 ml of aliquot for the estimation of total soluble sugars using the method described in preparation of calibration curve for dextrose.

5.1.3.3. - Non -reducing sugars

Non-reducing sugars are determined by subtracting the content of reducing sugars from the amount of total sugars.

Preparation of reagent:

Fehling's solution:

A) Dissolve 69.278 g of *copper sulphate* in water and make the volume up to 1 liter.

B) Dissolve 100 g of *sodium hydroxide* and 340 g *sodium potassium tartarate* in purified water and make the volume to 1 liter.

Mix equal volumes of A and B before the experiment.

Clarifying reagent:

Solution 1: Dissolve 21.9 g of *zinc acetate* and 3 ml of *glacial acetic acid* in *purified water* and make the volume to 100 ml.

Solution II: Dissolve 10.6 g of *potassium ferrocyanide* in water and make up to 100 ml.

Reducing sugars: Take suitable amount of the sample and neutralize with *sodium hydroxide solution* (10per cent in water). Evaporate the neutralized solution to half the volume on a water bath at 50^0 to remove the alcohol. Cool the solution add 10 ml of the clarifying solution I followed by 10 ml of the clarifying solution II. Mix, filter through a dry filter paper and make up the volume to 100 ml. Take 10 ml of the *Fehling's solution* and from a burette and add sugar solution (above prepared sample) in a drop wise manner and heat to boiling over the hot plate (maintained at 80^0) until the mixture of Copper (*Fehling's solution*) appears to be nearly reduced. Add 3-5 drops of 1per cent *methylene blue* and continue the titration till the blue colour is discharged. Note down the readings and calculate the percentage of glucose.

Non-reducing sugars*:* Take suitable amount of the sample and neutralize with *sodium hydroxide solution* (10per cent in water). Evaporate the neutralized solution to half the volume on a water bath at 50^0C to remove the alcohol. Cool the solution add 10 ml of the clarifying solution I followed by 10 ml of the clarifying solution II. Mix, filter through a dry filter paper. To the Filter add 15 ml of 0.1 N *hydrochloric acid*. Cover with stopper and heat to

boiling for two minutes. Add *phenolpthlein* and neutralize with *sodium hydroxide* solution (10per cent). Transfer to 100 ml volumetric flask and make the volume to 100 ml and perform the titration as done for the reducing sugars. Calculate the percentage of the total sugars. Subtract the percentage of the reducing sugars from the sugars to obtain non reducing sugars.

5.1.4. FIEHE'S TEST

Reagents
Resorcinol solution – Dissolve 1 g resublimed resorcinol in 100 ml hydrochloric acid (sp gr 1.18 to 1.19).
Ether – sulphuric ether.

Procedure – Transfer about 5 g of the honey sample into a mortar, using a pastle, mix the honey with 10 ml of ether. Decant the ether extract into a porcelain dish. Repeat the extraction twice in the same manner and collect the extract in the same dish. Allow the extracts to evaporate to dryness at room temperature and add a large drop of freshly prepared resorcinol solution. The production of cherry red colour appearing instantly indicates a positive reaction. Faint pink colour disappearing after a short time or yellow to salmon pink colours indicate a negative reaction.

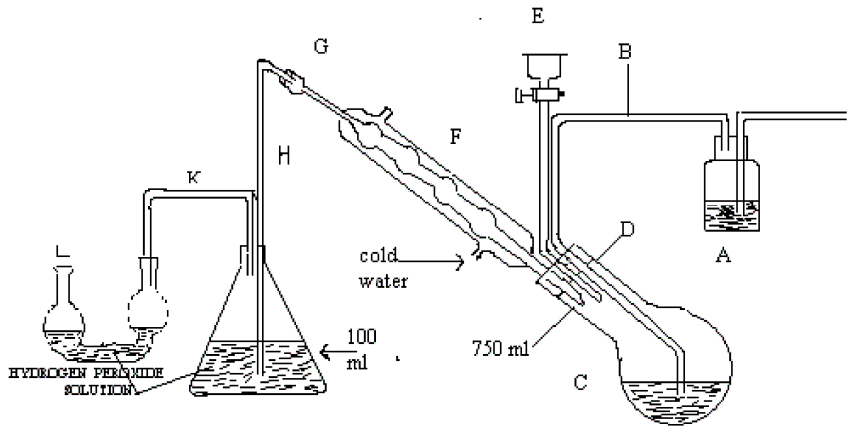
5.1.5. ANILINE CHLORIDE TEST

Reagent
Aniline chloride solution – To 100 ml of aniline, add 30 ml of hydrochloric acid. (10:3).

Procedure – Place 5 g of the sample in a porcelain dish and add, while stirring, 2.5 ml of recently prepared aniline chloride solution. In the presence of commercial invert sugar within one minute, the reagent assumes orange red colour turning dark red. Yellow to salmon shades have no significance.

5.1.6. DETERMINATION OF SULPHUR DIOXIDE

Sulphur dioxide is determined by the modified Monier-William's Method –
The apparatus as assembled is shown below



Assembly for determination of Sulphur dioxide

Reagents

(a) **Sodium Carbonate Solution**- 10 percent (m/v). aqueous
(b) **Bromophenol Blue Indicator** – Dissolve 0.1 g of bromophenol blue in 3.0 ml of 0.05 N sodium hydroxide solution and 5 ml of ethyl alcohol (90 percent by volume) by gently warming. Make up the volume of the solution with ethyl alcohol (20 percent v/v) to 250 ml in a volumetric flask.
(c) **Hydrogen peroxide solution** - Dilute a 30 percent (m/v) hydrogen peroxide solution with about twice its volume of water and neutralize the free sulphuric acid that may be present in the hydrogen peroxide solution with barium hydroxide solution, using bromophenol blue indicator solution. Allow the precipitate of barium sulphate to settle, and filter. Determine the concentration of hydrogen peroxide in the filtrate by titrating with standard potassium permanganate solution. Dilute the filtrate with cold water so as to obtain a 3 percent (m/v) solution of hydrogen peroxide.
(d) **Concentrated Hydrochloric acid** - sp.gr. 1.16

(e) **Carbon dioxide gas** - from a cylinder.

(f) **Standard sodium hydroxide solution** -0.1 N, standardized at the time of the experiment using bromophenol blue indicator solution.

Procedure
Assemble the apparatus as shown above. Introduce into the flask C, 300 ml of water and 20 ml of concentrated hydrochloric acid through the dropping funnel E. Run a steady current of cold water through the condenser F. Boil the mixture contained in the flask G for a short time to expel the air from the system in current of carbon dioxide gas previously passed through the wash bottle A. Weigh accurately about 100 g of the material and mix with the minimum quantity of water so as to make the diluted material easily flow down to the dropping funnel. Introduce the diluted material into the flask C through the dropping funnel E. Wash the dropping funnel with a small quantity of water and run the washing into the flask C. Again boil the mixture contained in the flask C in a slow current of carbon dioxide gas (passed previously through the wash bottle A) for one hour. Just before the end of the distillation, stop the flow of water in the condenser. (This causes the condenser to become hot and drives over residual traces of sulphur dioxide retained in the condenser.) When the delivery tube H, just above the Erlenmeyer flask j, becomes hot to touch, remove the stopper J immediately. Wash the delivery tube H and the contents of the Peligot tube L with water into Erlenmeyer flask. Cool the contents of the Erlenmeyer flask to room temperature, add a few drops of bromophenol blue indicator and titrate with standard sodium hydroxide solution. (Bromophenol blue is unaffected by carbon dioxide and gives a distinct change of color in cold hydrogen peroxide solution).

Carry out a blank determination using 20 ml of Conc,. *Hydrochloric acid* diluted with 300 ml of water.

Calculation

$$\text{Sulphur dioxide, mg/kg} = \frac{0.032000\,(V-v) \times 1000 \times 1000 \times N}{W}$$

Where
V = volume in ml of standard sodium hydroxide solution required for the test with the material
v = volume in ml of standard sodium hydroxide solution required for the blank determination;
N = normality of standard sodium hydroxide solution; and
W = weight in g of the material taken for the test

5.1.7. DETERMINATION OF TOTAL REDUCING SUGARS, SUCROSE AND FRUCTOSE – GLUCOSE RATIO

TOTAL REDUCING SUGARS

Reagents

Soxhlet Modification of Fehling's solution – Prepare by mixing equal volumes of Solution A and Solution B immediately before using.

Copper sulphate solution (Solution A) – Dissolve 34.639 g of copper sulphate crystals ($CuSO_4.5H_2O$)in water, dilute to 500ml and filter through glass wool or filter paper.

Standardization of copper sulphate solution – Using separate pipettes, pipette accurately 5 ml of Solution A and 5 ml of Solution B into a conical flask of 250 ml capacity. Heat this mixture to boiling on an asbestos gauze and add standard invert sugar solution from a burette, about one millilitre less than the expected volume which will reduce the Fehling's solution completely 48 ml. Add one ml of methylene blue indicator while keeping the solution boiling. Complete the titration within three minute, the end point being indicated by change of colour from blue to red. From the volume of invert sugar solution used, calculate the strength(s) of the copper sulphate solution by multiplying the titre value by 0.001 (mg/ml of the standard invert sugar solution). This would give the quantity of invert sugar required to reduce the copper in 5 ml copper sulphate solution.

Potassium Sodium Tartrate (Rochelle Salt)Solution (Solution B) – Dissolve 173 g of potassium sodium tartrate and 50 g of sodium hydroxide in water, dilute to 500 ml. Let the solution stand for a day and filter.

Hydrochloric acid – Sp gr 1.18 at 20 ^{0}C (approximately 12 N).

Standard Invert Sugar Solution – Weigh accurately 0.95 g sucrose and dissolve it in 500 ml water. Add 2 ml of concentrated hydrochloric acid, boil gently for 30 minutes and keep aside for 24 hours. Neutralize with sodium carbonate and make the final volume to 1000 ml; 50 ml of this solution contains 0.05 g invert sugar.

Methylene Blue Indicator – 0.02 per cent in water.

Procedure – Place accurately weighed about one gram (*W*) of the prepared sample of honey into a 250 ml volumetric flask and dilute with about 150 ml of water. Mix thoroughly the contents of the flask and make the volume to 250 ml with water. Using separate pipettes, take accurately 5 ml of each of Solution A and Solution B, in a porcelain dish. Add about 12 ml of honey solution from a burette and heat to boiling over an asbestos gauze. Add 1 ml of methylene blue indicator and while keeping the solution boiling complete the titration, within three minutes, the end point being indicated by change of colour from blue to red. Note the volume (H) in ml of honey solution required for the titration.

Calculation

$$\text{Toatl reducing sugars, per cent by mass} = \frac{250 \times 100 \times S}{H \times M}$$

Where
S = strength of copper sulphate solution,
H = volume in ml of honey solution required for titration, and
M = mass in g of honey.

SUCROSE

Procedure – To 100 ml of the stock honey solution, add one ml of concentrated hydrochloric acid and heat the solution to near boiling. Keep aside overnight. Neutralize this inverted honey solution with sodium carbonate and determine the total reducing sugars as described as above.

Calculation

Sucrose, per cent by mass = [(reducing sugars after inversion, per cent by mass) – (reducing sugars before inversion, per cent by mass)] x 0.95

FRUCTOSE – GLUCOSE RATIO

Reagents

Iodine Solution – 0.05 N.

Sodium hydroxide solution – 0.1 N.

Sulphuric Acid – concentrated.

Standard Sodium Thiosulphate Solution – 0.05 N.

Procedure – Pipette 50 ml of honey solution in a 250 ml stoppered flask. Add 40 ml of iodine solution and 25 ml of sodium hydroxide solution. Stopper the flask and keep in dark for 20 minutes. Acidify with 5 ml of sulphuric acid and titrate quickly the excess of iodine against standard *sodium thiosuphate* solution. Conduct a blank using 50 ml of water instead of honey solution.

Calculations

Approximately glucose,

$$\text{Per cent by mass } (w) = \frac{(B - S) \times 0.004502 \times 100}{a}$$

where

B = volume of sodium thiosulphate solution required for the blank,
S = volume of sodium thiosulphate solution required for the sample, and
a = mass of honey taken for test.

$$\text{Approximate Fructose, per cent By mass } (x) = \frac{\text{Approximate total reducing sugars, per cent} - w}{0.925}$$

True glucose, per cent by mass (y) = w – 0.012 x

$$\text{True fructose, Per cent by mass } (z) = \frac{\text{Approximate reducing sugars, per cent} - y}{0.925}$$

True reducing sugars, per cent by mass = $y+z$

$$\text{Fructose – glucose ratio} = \frac{\text{True fructose, per cent by mass } (z)}{\text{True glucose, per cent by mass } (y)}$$

5.2.- ESTIMATION OF CURCUMIN BY TLC DENSITOMETER

Sample solution - Extract 5 g of avaleha with *methanol* (25 ml x 4), filter, pool, concentrate and make up the volume to 25 ml with *methanol.*

Standard solution - Prepare a s0tock solution of *curcumin* (160 µg/ml) by dissolving 4 mg of accurately weighed curcumin in methanol and making up the volume to 25 ml with methanol. Transfer the aliquots (0.4 – 1.4 ml) of stock solution to 10 ml volumetric flasks and make up the volume with methanol to obtain standard solutions containing 6.4 to 22.4 µg/ml curcumin, respectively.

Calibration curve - Apply 10 µl of the standard solutions (64 to 224 ng) on a precoated TLC plate of uniform thickness. Develop the plate in the solvent system *toluene: ethyl acetate: methanol* (5 : 0.5 : 1) to a distance of 10 cm. Scan the plate densitometrically at 429 nm. Record the peak area and prepare the calibration curve by plotting peak area *vs* concentration of *curcumin* applied.

Estimation of curcumin in the drug - Apply 5 µl of the test solution on a precoated silica gel 60 F_{254} TLC plate. Develop the plate in the solvent system *toluene: ethyl acetate: methanol* (5: 0.5: 1) and record the chromatogram as described above for the calibration curve. Calculate the amount of curcumin present in the sample from the calibration curve of curcumin.

5.2.1. -Determination of Aluminium

Solutions

10 per cent sodium hydroxide solution – Dissolve 10 g *sodium hydroxide* in 100 ml purified water.

EDTA solution 0.05 M – Dissolve 18.6120 g of sodium salt of EDTA in purified water and make up to 1000 ml.

Zinc acetate solution 0.05M - Dissolve 10.9690 g of z*inc acetate* in 50 ml *purified water* and few drops of *glacial acetic acid* and dilute to 1000 ml.

Acetate buffer 5.5 pH – Dissolve 21.5 g of *sodium acetate* (AR) in 300 ml *purified water* containing 2 ml *glacial acetic acid* and dilute to 1000 ml

Xylenol orange indicator –Dissolve 0.2 g of *xylenol orange indicator* in 100 ml *purified water* with 2 ml *acetic acid*.

Procedure

Take suitable aliquot from the stock solution in 250 ml beaker. Take 50 ml of 10 per cent *sodium hydroxide solution* in another beaker. Neutralize the aliquot with *sodium hydroxide solution*. Transfer the 10 per cent *sodium hydroxide solution* to aliquot with constant stirring. Add a pinch of *sodium carbonate* into the solution. Boil the content on burner. Cool and filter through Whatman 40 No. filter paper with pulp in 600 ml beaker. Wash the precipitate with hot water 6-8 times. Acidify the filtrate with *dil. hydrochloric acid* and adjust pH 5.5. Add, in excess normally 25 ml 0.05M EDTA solution. Add 25 ml *acetate buffer solution*. Boil the solution; cool and again adjust pH 5 – 5.5. Add 5-6 drops of *xylenol orange indicator*. The colour changes from golden yellow to orange red at the end point. Take 25 m l0.05 M EDTA solution and run a blank. Each of 1M EDTA is equivalent to 0.05098 g of Al_2O_3.

5.2.2. - Determination of Borax

Powder 5-6 g of drug and incinerated at 450^{O} for 3 hours to get it ash. Dissolve the ash in 20 ml. of *purified water* and left for 15 minutes, filter, wash the residue with 80 ml of *purified* water for 4-5 washings. If necessary, shake the contents and titrate with *0.5N hydrochloric acid* using solution of m*ethyl orange* as an indicator. Each ml of *0.5N hydrochloric acid* is equivalent to 0.09536 g of $Na_2 B_4O_7.10H_2O$.

5.2.3. - Determination of Calcium

Solutions

20 per cent Potassium hydroxide solution – Dissolve 200 g *potassium hydroxide* in *purified water* and make up to 1000 ml.
Ammonia buffer solutions 9.5 pH – Dissolve 67.5 g *ammonium chloride* in 300 ml *purified water*, add 570 ml *ammonia solution* and dilute to 1000 ml.

EDTA (Ethylene Diethyl Tetra Acetic acid) solution 0.05 M – Dissolve 18.6120 g of solution salt of EDTA and in water and make up to 1000 ml.

Triethanolamine 20per cent Solution – 200 ml of triethanolamine, adds 800 ml water and make up to 1000 ml.

Eriochrome Black T indicator 0.1per cent solution – Dissolve 0.10 g indicator in 100 ml of Methanol.

Patterns & Reeders indicators 0.1per cent solution – Dissolve 0.01g indicator in 100 ml of Methanol.

Procedure

Take one part of filtrate reserved from Iron (Fe) estimation. Add 5 ml Triethanolamine 20 per cent solution. Add a pinch of *Hydroxylamine hydrochloride*. Add 25-30 ml *potassium hydroxide* 20 per cent solution. Add 4-5 drops of Patterns and Reeders indicator, which imparts rose red colour. Titrate the solution against standard EDTA solution. The colour changes from rose red to Prussian blue mark end point.

Each ml of 1M EDTA solution is equivalent to 0.04008 g Calcium.

5.2.4. - Determination of Copper(Cu)

Solutions

Standard 0.1 N sodium thiosulphate solutions

Potassium iodide.

Starch 1per cent solution – Dissolve 1 g in water, boil and make up 100ml.

Procedure

Take suitable aliquot from the stock solution in a beaker. Add approx. 1.0 g sodium fluoride. Add *ammonia solution* and precipitate solution. Add *acetic acid* to dissolve the precipitate. Boil and cool in water bath. Add approx 1.0 g *potassium iodide*. Titrate the liberated iodine against *0.1 N sodium thoisulphate* (hypo) solutions by adding *starch solution* as indicator. The liberated iodine colour blackish brown changes to white at the end point. Calculate copper value against 1 ml of hypo solution titrating against standard 1000 ppm copper solution.

Each ml of 1N $Na_2S_2O_3$ solution is equivalent to 0.06357 g of Copper

5.2.5. - Determination of Iron (Fe)

Preparation of sample solution

Ignite a suitable quantity of the sample (in the presence of organic matter) in a crucible in a muffle furnace at 500-550^0 until the residue is free from organic matter. Moisten with 5-10 ml of hydrochloric acid, boil for two min, add 30 ml of water, heat on the water bath for few min, filter and wash thoroughly the residue with water and make up to volume in a volumentric flask.

Solutions

Stannous chloride solution – Dissolve 5 g *stannous chloride* (A.R) in 25 ml Conc. *hydrochloric acid* and dilute to 100 ml (5 per cent solution).

Mercuric chloride – saturated solution in water.

Sulphuric acid + orthophosphoric acid mixture – take 60 ml water, add 15 ml conc. *sulphuric acid* and 15 ml H_3PO_4 cool and dilute to 1000ml.

Diphenylamine barium sulphonate – Dissolve 0.25 g in 100 ml water.

0.1 N Standard potassium dichromate solution - Dissolve 4.9035 g AR grade in water and dilute to 1000 ml.

Procedure

Take /withdraw a suitable aliquot from the stock solution in 250 ml in duplicate. Dilute to about 100 ml with distilled water. Add 1-2 drops of *methyl red* indicator. Add 1-2 g *ammonium chloride*. Add dil. Ammonium solution till brown precipitate appears. Boil the solution with ppt. for 4-5 minutes. Cool the content and filter through Whatman 41 no. filter paper. Wash the residue with hot water 4-6 times. Dissolve the residue in dil. HCl in 250 ml beaker. Wash with hot water and make the volume to 100 ml approx. Boil the solution on burner. Reduce the Fe^{3+} to Fe^{2+} by adding *stannous chloride solution* drop wise till solution becomes colourless.

Add 1-2 drops of *stannous chloride solution* in excess. Cool the content in water. Add 10-15 ml 10per cent solution of *mercuric chloride*. Add 25 ml acid mixture. Add 2-3 drops of *diphenylamine barium sulphonate indicator*. Add distilled water, if required. Titrate against standard *potassium dichromate solution*. Appearance of violet colour show end point.

Each ml of 1N $K_2Cr_2O_7$ solution is equivalent to 0.05585 g Iron

Each ml of 1N $K_2Cr_2O_7$ solution is equivalent to 0.7985 g Fe_2O_3

5.2.6. - Determination of Magnesium

Take another part of filtrate reserved from Fe estimation. Add 5 ml *triethanolamine 20 per cent solution*. Add a pinch of *hydroxylamine hydrochloride*. Add 25-30 ml *ammonia buffer 9.5 pH*. Add 4-5 drops of *eriochrome black* T indicator. The colour changes from rose red to blue marks the end point.

Each ml of 1M EDTA solution is equivalent to 0.0409 g of MgO.

5.2.7. - Determination of Mercury

Powder 0.5 g drug and treat with 7 ml of conc. *nitric acid* and 15 ml of conc. *sulphuric acid* in a kjeldahl flask; heat under reflux gently at first then strongly for 30 minutes. Cool and add 50 ml conc. *nitric acid* boil so as to remove the brown fumes. Continue the addition of *nitric acid* and boiling until the liquid is colourless; cool, wash the condenser with 100 ml of water, remove the flask and add 1.0 per cent *potassium permangnate* solution drop wise until pink colour persists. Decolourize it by adding 6.0 per cent *hydrogen peroxide* drop wise to remove excess of *potassium permangnate* followed by 3.0 ml of conc. *nitric acid* and titrate with *0.1N ammonium thiocyanate solutions* using *ferric alum* as indicator.

Each ml. of 0.1N NH_4SCN solution is equivalent to 0.01003 g Mercury.

5.2.8. - Determination of Silica (SiO_2)

Weigh 0.5 g (in case of high silica) or 1.0 g (low silica) finely powdered and dried sample in a platinum crucible (W_1). Add 4-5 g *anhydrous sodium carbonate* into the crucible. Mix thoroughly and cover the crucible with lid, if necessary. Place the crucible in muffle furnace. Allow the temperature to rise gradually to reach 900-950^0 and keep on this temp. for about ½ hour to complete the fusion. Take out the crucible and allow cool at room temperature. Extract the cooled mass in 25-30 ml dil *hydrochloric acid* in 250 ml beaker. Heat on hot plate/burner to dissolve the contents. Wash the crucible with distilled water. Keep the beaker on water bath and allow dry the mass. Dehydrate back and powder the mass. Take out the beaker and allow cooling at room temperature. Add 25-30 ml *hydrochloric acid* dilute to 100 ml distilled water. Boil the content and allow cool. Filter through Whatman no 40. filter paper. Wash the residue with hot water 6-8 times. Place the residue along with filter paper in platinum crucible. Ignite at 900-950^0 for 2-3 min. Allow to cool and weigh as SiO_2.

5.2.9. - Estimation of Sodium and Potassium by Flame Photometer

Preparation of Standard Solutions

Weigh 2.542 g of AR *sodium chloride* and dissolve in *purified water* and make upto 1000 ml in a volumetric flask. Dilute 1 ml of the stock solution to 100 ml. This gives standard of 1mg of sodium per 100 ml (10 ppm). Prepare 20, 30, 40 and 50 ppm standard solution.

Weigh 1.9115g of AR *potassium chloride* and dissolve in *purified water* and make up to 1000 ml in a volumetric flask. Dilute 1ml of the stock solution to 100ml. This gives standard of 1mg of sodium per 100 ml (10 ppm). Prepare 20, 30, 40 and 50 ppm standard solution.

Preparation of Sample Solution

Weigh 10 g of sample in a preweighed silica dish and heat in a muffle furnace for 1hr at 600º. Cool and dissolve the ash in purified water and make up to 100 ml in a volumetric flask.

Switch on the instrument first and then the pump. Keep distilled water for aspiration and allow it to stand for 15 min (warming time). Open the glass cylinder and ignite the flame. Adjust the instrument to zero.

Introduce the maximum concentration solution and adjust it to 100. Again introduce the purified water so that instrument shows zero. Then introduce the standard solution in ascending concentration. Note down the reading each time. Introduce the purified water for aspiration in between the standard solutions. Introduce the sample solution and if it is within the range take the reading. If it exceeds limit 100 then dilute the solution till the reading is within the range. Plot the curve with concentration in ppm against reading obtained. Find out the concentration of the sample solution. Take two or three readings and find out the average. Find out the concentration of sodium and potassium.

5.2.10. - Determination of Sodium Chloride

Dissolve about 2-3g accurately weighed drug in 25 ml of *purified water* and left for 30 minutes, filter. Wash the filter paper completely with *purified water* and the filtrate is made 100 ml in volumetric flask, make the solution homogeneous, titrate 25 ml of this solution with 0.1 *N silver nitrate solution* using *potassium chromate* as indicator. The end point shows the light brick red colour.

Each ml. of 0.1 *N* Ag NO_3 solution is equivalent to 0.005845 g of NaCl.

5.2.11. - Determination of Sulphur

Solution

Carbon tetrachloride saturated with Bromine

Barium chloride – 10 per cent solution in water.

Procedure

Take 0.5 – 1 g powdered sample in 250 ml beaker. Add 10 ml *carbon tetrachloride* saturated with bromine. Keep in cold condition in fume chamber over night. Add 10 – 15 ml conc. *nitric acid*. Digest on water bath. Add 10 ml conc. *hydrochloric acid*, digest it to expel nitrate fumes till syrupy mass. Cool and extract with *hydrochloric acid*, make volume to 100 ml. Boil and filter through Whatman No 40. filter paper. Wash the residue with hot water. Filter through Whatman 41 No. paper in 600 ml beaker. Acidify the filtrate with *hydrochloric acid*. Add 20 ml of 10 per cent *Barium chloride* solution. Stir the solution and digest on burner. Allow to settle $BaSO_4$ precipitate over night. Filter the precipitate through Whatman No. 42 filter paper. Wash the precipitate with water. Ignite the precipitate in muffle furnace in pre weighed platinum crucible up to 850^0. Allow to cool and weigh.

Each g of weight of precipitate is equivalent to 0.13734 g of Sulphur.

5.2.12. - Qualitative Reactions of Some Radicals

Sodium

Sodium compounds, moistened with hydrochloric acid and introduced on a platinum wire into the flame of a Bunsen burner, give a yellow colour to the flame.

Solutions of sodium salts yield, with solution of uranyl zinc acetate, a yellow crystalline precipitate.

Potassium

Potassium compounds moistened with hydrochloric acid and introduced on platinum wire into the flame of a Bunsen burner, give a violde colour to the flame.

Moderately strong solutions of potassium salts, which have been previously ignited to remove ammonium salts, give a white, crystalline precipitate with perchloric acid.

Solutions of potassium salts, which have been previously ignited to free them from ammonium salts and from which iodine has been removed, give a yellow precipitate with solution os sodium cobaltinitrte and acetic acid.

Magnesium

Solution of magnesium salts yield a white precipitate with solution of ammonium carbonate, especially on boiling, but yield no precipitate in the presence of solution of ammonium chloride.

Solution of magnesium salts yield a white crystalline precipitate with solution of sodium phosphate in the presence of ammonium salts and dilute ammonia solution.

Solution of magnesium salts yield with solution of sodium hydroxide a white precipitate insoluble in excess of the reagent, but soluble in solution of ammonium chloride.

Carbonates and Bicarbonates

Carbonates and bicarbonates effervesce with dilute acids, liberating carbon doxide; the gas is colourless and produces a wihte precipitate in solution of calcium hydroxide.

Solutions of carbonates produce a brownish-red precipitate with solution of mercuric chloride; Solutions of bicarbonates produce a white precipitate.

Solutions of carbonates yield, with solution of silver nitrate, a with precipitate which becomes yellow on the addition of an excess of the reagent and brown on boiling the mixture. The precipitate is soluble in dilute ammonia solution and in dilute nitric acid.

Solutions of carbonates produce, at room temperature, a white precipitate with solution of magnesium sulphate. Solutions of bicarbonates yield no precipitate with the reagent at room temperature, but on boiling the mixture a white precipitate is formed.

Solutions of bicarbonates, on boiling, liberate carbon dioxide which produces a white precipitate in solution of calcium hydroxide.

Sulphates

Solutions of sulphates yield, with solution of barium chloride, a white precipitate insoluble in hydrochloric acid.

Solutions of sulphates yield, with solution of lead acetate, a white precipitate soluble in solution of ammonium acetate and in solution of sodium hydroxide.

Chlorides

Chlorides, heated with manganese dioxide and sulphuric acid, yield chlorine, recognisable by its odour and by giving a blue colour with potassium iodide and solution of starch.

Calcium

Solutions of calcium salts yield, with solution of ammonium carbonate, a white precipitate which after boiling and cooling the mixture, is insoluble in solution of ammonium chloride.

APPENDIX-6

6.1. WEIGHTS AND MEASURES

6.1.1. - METRIC EQUIVALENTS OF CLASSICAL WEIGHTS AND MEASURES

Weights and measures described in Ayurvedic classics and their metric equivalents adopted by the Ayurvedic Pharmacopoeia Committee

The following table of metric equivalents of weights and measures, linear measures and measurement of time used in the Ayurvedic classics have been approved by the Ayurvedic Pharmacopoeia committee in consultation with Indian Standards Institution.

I. WEIGHTS AND MEASURES

Classical Unit			Metric Equivalent
1 Ratti or Guñjā			= 125 mg
8 Ratti or Guñjās	=1 Māṣa		= 1 g
12 Māṣas		=1 Karṣa (Tola)	= 12 g
2 Karṣas (Tolas)	=1 Śukti		= 24 g
2 Śuktis (4 Karṣas or Tolas)		=1 Palam	= 48 g
2 Palams		=1 Prasrti	= 96 g
2 Prasṛtis		=1 Kuḍava	= 192 g
2 Kuḍavas		=1 Mānika	= 384 g
2 Mānikas		=1 Prastha	= 768 g
4 Prasthas		=1 Āḍhaka	= 3 kg 73 g
4 Āḍhakas		=1 Dṛoṇa	= 12kg 228 g
2 Dṛoṇas		=1 Śūrpa	= 24kg 576 g
2 Śūrpas	=1 Dṛoṇi	(Vahi)	= 49kg 152 g
4 Dṛoṇis	=1 Khāri		= 196kg 608g
1 Palam			= 48 g
100 Palams		=1 Tula	= 4 kg 800 g
20 Tulas	=1 Bhāra		= 96 kg

In case of liquids, the metric equivalents would be the corresponding litre and milliliter.

II. LINEAR MEASURES

Classical Unit	Inches	Metric Equivalents
1. Yavodara	1/8 of ¾"	0.24 cm
2. Aṅgula	¾"	1.95 cm
3. Bitahasti	9"	22.86 cm
4. Aratni	10 ½"	41.91 cm
5. Hasta	18"	45.72 cm
6. Nṛpahasta (Rājahasta)	22"	55.88 cm
7. Vyama	72"	182.88 cm

III. MEASUREMENT OF TIME

Unit		Equivalent (in hours, minutes & seconds)
2 Kṣaṅa	=1 Lava	
2 Lavas	=1 Nimeṣa	
3 Nimeṣas	=1 Kaṣṭha	= 4.66 seconds
1 Ghati		= 24 Minutes
30 Kasṭhas	=1 Kalā	= 2 Minutes 20 seconds
20 Kalā + 3 Kaṣṭhas	=1 Muhūrta	= 48 Minutes
30 Muhūrtas	=1 Ahorātra	= 24 Hrs.
15 Ahorātras	=1 Pakṣa	= 15 Days
2 Pakṣas	=1 Māsa	= 30 Days/ One Month
2 Māsa	=1 Ṛtu	= 60 Days/ Two Months
3 Ṛtus	=1 Ayana	= 6 Months
2 Ayanas	=1 Samvatsara	= 12 Months/ One Year
5 Samvatsara	=1Yuga	= 5 Years
1 Ahorātra of Devas		= 1 Year
1 Ahorātra of Pitaras		= 1 Month

6.2. - METRIC SYSTEM

Measure of Mass (Weights)

1 Kilogram (Kg) – is the mass of the International Prototype Kilogram.
1 Gramme (g) – the 1000^{th} part of 1 Kilogram.
1Milligram (mg) – the 1000^{th} part of 1 gramme.
1 Microgram (µg) – the 1000^{th} part of 1 milligram.

Measures of capacity (Volumes)

1 Litre (1) is the volume occupied at its temperature of maximum density by a quantity of water having a mass of 1 Kilogram.
1 Millilitre (ml) the 1000^{th} part of 1 litre.

The accepted relation between the litre and the cubic centimetre is 1 litre –1000.027 cubic centimeters.

Relation of capacity of Weight (Metric)

One litre of water at 20º weighs 997.18 grammes when weighed in air of density 0.0012 gramme per millilitre against brass weights of density 84 grammes per millilitre.

Measures of Length

1 Metre (m) is the length of the International Prototype Metre at 0.
1 Centimetre (cm) – the 100^{th} part of 1 metre.
1 Millimetre (mm) – the 1000^{th} part of 1 metre.
1 Micron (µ) – the 1000^{th} part of 1 millimetre
1 Milliimicron (mµ) – the 1000^{th} part of micron.

APPENDIX-7

7.1. CLASSICAL AYURVEDIC REFERENCES

INDEX

ENGLISH EQUIVALENTS OF AYURVEDIC CLINICAL CONDITIONS AND DISEASES

DEFINITIONS

MONOGRAPHS PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL.-I

81.	Ajagandha (Sd.)	*Cleome gynandra* Linn.
82.	Ajamoda (Frt.)	*Apium leptophyllum* (Pers.) F.V.M. ex Benth.
83.	Amalaki (Fr. Frt. Pulp)	*Emblica officinalis* Gaertn.
84.	Amalaki (Drd. Frt.)	*Emblica officinalis* Gaertn.
85.	Aragvadha (Frt. Pulp.)	*Cassia fistula* Linn.
86.	Arka (Rt.)	*Calotropis procera* (Ait.) R. Br.
87.	Arka (Lf.)	*Calotropis procera* (Ait.) R. Br.
88.	Asana (Ht.Wd.)	*Pterocarpus marsupium* Roxb.
89.	Ashoka (St. Bk.)	*Saraca asoca* (Rosc.) DC. Willd.
90.	Asvagandha (Rt.)	*Withania somnifera* Dunal.
91.	Asvattha (Bk.)	*Ficus religiosa* Linn.
92.	Atasi (Sd.)	*Linum usitatissimum* Linn.
93.	Atibala (Rt.)	*Abutilon indicum* (Linn.) Sw.
94.	Ativisa (Rt.)	*Aconitum heterophyllum* Wall. ex Royle
95.	Babbula (St.Bk.)	*Acacia nilotica* (Linn.) Willd. ex Del. sp. *indica* (Benth.) Brenan
96.	Bakuci (Frt.)	*Psoralea corylifolia* Linn.
97.	Bibhitaka (Frt.)	*Terminalia belerica* Roxb.
98.	Bilva (Frt. Pulp)	*Aegle marmelos* Corr.
99.	Candrasura (Sd.)	*Lepidium sativum* Linn.
100.	Citraka (Rt.)	*Plumbago zeylanica* Linn.
101.	Dhanyaka (Frt.)	*Coriandrum sativum* Linn.
102.	Dhataki (Fl.)	*Woodfordia fruticosa* (Linn.) Kurz.
103.	Eranda (Rt.)	*Ricinus communis* Linn.
104.	Gambhari (Rt. Bk.)	*Gmelina arborea* Roxb
105.	Goksura (Rt.)	*Tribulus terrestris* Linn.
106.	Goksura (Frt.)	*Tribulus terrestris* Linn.
107.	Guduci (St.)	*Tinospora cordifolia* (Willd.) Miers.
108.	Guggulu (Exudate)	*Commiphora wightii* (Arn.) Bhand.
109.	Gunja (Sd.)	*Abrus precatorius* Linn.
110.	Haridra (Rz.)	*Curcuma longa* Linn.
111.	Haritaki (Frt.)	*Terminalia chebula* Retz.

112.	Hingu (Oleo-Gum-Resin)	*Ferula foetida* Regel.
113.	Jatamansi (Rz.)	*Nardostachys jatamansi* DC.
114.	Jatiphala (Sd.)	*Myristica fragrans* Houtt.
115.	Kampilla (Frt.)	*Mallotus philippinensis* Muell.-Arg.
116.	Kancanara (St. Bk.)	*Bauhinia variegata* Blume
117.	Kankola (Frt.)	*Piper cubeba* Linn. f.
118.	Kantakari (W.P.)	*Solanum surattense* Burm. f.
119.	Kanyasara (Lf.)	*Aloe barbadensis* Mill.
120.	Karanja (Sd.)	*Pongamia pinnata* (Linn.) Merr.
121.	Karavira (Lf.)	*Nerium indicum* Mill.
122.	Karkatasrngi (Gall)	*Pistacia chinensis* Burgo
123.	Karpasa (Sd.)	G*ossypium herbaceum* Linn.
124.	Kaseru (Rz.)	*Scirpus kysoor* Roxb.
125.	Ketaki (Rt.)	*Pandanus tectorius* Soland. ex Parkinson
126.	Khadira (Ht.Wd.)	*Acacia catechu* (Linn. f.) Willd.
127.	Kiratatikta (W.P.)	*Swertia chirata* Buch.-Ham.
128.	Krsnajiraka (Frt.)	*Carum carvi* Linn.
129.	Kulattha (Sd.)	*Vigna unquiculata* (Linn.) Walp.
130.	Kustha (Rt.)	*Saussurea lappa* C.B. Clarke
131.	Kutaja (St. Bk.)	*Holarrhena antidysenterica* (Roth) A. DC.
132.	Lavanga (Fl. Bud)	*Syzygium aromaticum* (Linn.) Merr. & M.Perry
133.	Lodhra (St. Bk.)	*Symplocos racemosa* Roxb.
134.	Madana (Frt.)	*Xeromphis spinosa* (Thunb.) Keay
135.	Misreya (Frt.)	*Foeniculum vulgare* Mill.
136.	Nyagrodha (St. Bk.)	*Ficus bengalensis* Linn.
137.	Pasanabheda (Rz.)	*Bergenia ciliata* (Haw.) Sternb.
138.	Patha (Rt.)	*Cissampelos pareira* Linn.
139.	Puga (Sd.)	*Areca catechu* Linn.
140.	Punarnava (Rakta) (W.P.)	*Boerhaavia diffusa* Linn.
141.	Saptaparna (St. Bk.)	*Alstonia scholaris* (Linn.) R. Br.
142.	Sati (Rz.)	*Hedychium spicatum* Ham. ex Smith
143.	Snuhi (St.)	*Euphorbia neriifolia* Linn.
144.	Suksmaila (Frt.)	*Elettaria cardamomum* (Linn.) Maton
145.	Sunthi (Rz.)	*Zingiber officinale* Roxb.

146.	Svarnapatri (Lf.)	*Cassia angustifolia* Vahl.
147.	Svetajiraka (Frt.)	*Cuminum cyminum* Linn.
148.	Sveta Sariva (Rt.)	*Hemidesmus indicus* (Linn.) R. Br.
149.	Tagara (Rz.)	*Valeriana wallichii* DC.
150.	Tamalaki (Rt., St. & Lf.)	*Phyllanthus fraternus* Webst.
151.	Tvak (Bk.)	*Cinnamomum zeylanicum* Blume
152.	Tvakapatra (Lf.)	*Cinnamomum tamala* (Buch.-Ham.) Nees & Eberm.
153.	Udumbara (Bk.)	*Ficus racemosa* Linn.
154.	Upakuncika (Sd.)	*Nigella sativa* Linn.
155.	Varuna (St. Bk.)	*Crataeva nurvala* Buch.-Ham.
156.	Vasa (Lf.)	*Adhatoda vasica* Nees
157.	Vidanga (Frt.)	*Embelia ribes* Burm.f.
158.	Vijaya (Lf.)	*Cannabis sativa* Linn.
159.	Yasti (St. & Rt.)	*Glycyrrhiza glabra* Linn.
160.	Yavani (Frt.)	*Trachyspermum ammi* (Linn.) Sprague ex Turril

MONOGRAPHS PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL. II

1. Akarakarabha (Rt.) *Anacyclus pyrethrum* DC.
79. Aksoda (Cotldn.) *Juglans regia* Linn.
80. Amrata (St. Bk.) *Spondias pinnata* (Linn. f.) Kurz.
81. Apamarga (W.P.) *Achyranthes aspera* Linn.
82. Aparajita (Rt.) *Clitoria ternatea* Linn.
83. Ardraka (Rz.) *Zingiber officinale* Rosc.
84. Arimeda (St.Bk.) *Acacia leucophloea* Willd.
85. Arjuna (St.Bk.) *Terminalia arjuna* W.& A.
86. Bhallataka (Frt.) *Semecarpus anacardium* Linn.
87. Bhrngaraja (W.P.) *Eclipta alba* Hassk.
88. Brahmi (W.P.) *Bacopa monnieri* (Linn.) Wettst.
89. Brhati (Rt.) *Solanum indicum* Linn.
90. Cavya (St.) *Piper retrofractum* Vahl.
91. Dadima (Sd.) *Punica granatum* Linn.
92. Daruharidra (St.) *Berberis aristata* DC.
93. Dronapuspi (W.P.) *Leucas cephalotes* Spreng.
94. Ervaru (Sd.) *Cucumis melo* var. *utilissimus* Duthie & Fuller
95. Gajapippali (Frt.) *Scindapsus officinalis* Schoott.
96. Gambhari (Frt.) *Gmelina arborea* Roxb.
97. Gangeru (St.Bk.) *Grewia tenax* (Forsk.) Aschers & Schwf.
98. Gunja (Rt.) *Abrus precatorius* Linn.
99. Iksu (St.) *Saccharum officinarum* Linn.
100. Indravaruni (Rt.) *Citrullus colocynthis* Schrad.
101. Indravaruni (Lf.) *Citrullus colocynthis* Schrad.
102. Jambu (Sd.) *Syzygium cuminii* (Linn.) Skeels
103. Jambu (St.Bk.) *Syzygium cuminii* (Linn.) Skeels
104. Jayapala (Sd.) *Croton tiglium* Linn.
105. Jayanti (Lf.) *Sesbania sesban* (Linn.) Merr.
106. Jyotismati (Sd.) *Celastrus paniculatus* Willd.
107. Kadamba (St.Bk.) *Anthocephalus cadamba* Miq.
108. Kakamaci (W.P.) *Solanum nigrum* Linn.

109.	Kamala (Fl.)	*Nelumbo nucifera* Gaertn.
110.	Kapittha (Frt.Pulp)	*Feronia limonia* (Linn.) Swingle
111.	Karamarda (St.Bk.)	*Carissa carandas* Linn.
112.	Karanja (Rt.Bk.)	*Pongamia pinnata* (Linn.) Merr.
113.	Karanja (Rt.)	*Pongamia pinnata* (Linn.) Merr.
114.	Karanja (St.Bk.)	*Pongamia pinnata* (Linn.) Merr.
115.	Karanja (Lf.)	*Pongamia pinnata* (Linn.) Merr.
116.	Karavallaka (Fr. Frt.)	*Momordica charantia* Linn.
117.	Katuka (Rz.)	*Picrorhiza kurroa* Royle ex Benth.
118.	Kokilaksa (W.P.)	*Asteracantha longifolia* Nees
119.	Kokilaksa (Rt.)	*Asteracantha longifolia* Nees
120.	Kokilaksa (Sd.)	*Asteracantha longifolia* Nees
121.	Kozuppa (W.P.)	*Portulaca oleracea* Linn.
122.	Lajjalu (W.P.)	*Mimosa pudica* Linn.
123.	Madhuka (Fl.)	*Madhuca indica* J.F. Gmel.
124.	Matsyaksi (W.P.)	*Alternanthera sessilis* (Linn.) R. Br.
125.	Methi (Sd.)	*Trigonella foenum-graecum* Linn.
126.	Mulaka (W.P.)	*Raphanus sativus* Linn.
127.	Mulaka (Rt.)	*Raphanus sativus* Linn.
128.	Mura (Rt.)	*Selinium candollei* DC.
129.	Murva (Rt.)	*Marsdenia tenacissima* Wight. & Arn.
130.	Nagakesar (Stmn.)	*Mesua ferrea* Linn.
131.	Nili (Lf.)	*Indigofera tinctoria* Linn.
132.	Nili (Rt.)	*Indigofera tinctoria* Linn.
133.	Nimba (Lf.)	*Azadirachta indica* A. Juss.
134.	Nimba (St.Bk.)	*Azadirachta indica* A. Juss.
135.	Palasa (St.Bk.)	*Butea monosperma* (Lam.) Kuntze
136.	Paribhadra (St.Bk.)	*Erythrina indica* Lam.
137.	Pippalimula (St.)	*Piper longum* Linn.
138.	Plaksa (St.Bk.)	*Ficus lacor* Buch.-Ham.
139.	Prasarini (W.P.)	*Paederia foetida* Linn.
140.	Priyala (Sd.)	*Buchanania lanzan* Spreng.
141.	Priyangu (Infl.)	*Callicarpa macrophylla* Vahl.
142.	Sali (Rt.)	*Oryza sativa* Linn.

143.	Sankhapuspi (W.P.)	*Convolvulus pluricaulis* Choisy
144.	Saptala (W.P.)	*Euphorbia dracunculoides* Lam.
145.	Satahva (Frt.)	*Anethum sowa* Roxb. ex Flem.
146.	Sigru (Lf.)	*Moringa oleifera* Lam.
147.	Sthulaela (Sd.)	*Amomum subulatum* Roxb.
148.	Tejovati (St.Bk.)	*Zanthoxylum armatum* DC.
149.	Tulasi (W.P.)	*Ocimum sanctum* Linn.
150.	Tulasi (Lf.)	*Ocimum sanctum* Linn.
151.	Vaca (Rz.)	*Acorus calamus* Linn.
152.	Vatsanabha (Rt.)	*Aconitum chasmanthum* Stapf ex Holmes
153.	Vidari (Tub.Rt.)	*Pueraria tuberosa* DC.
154.	Yava (Frt.)	*Hordeum vulgare* Linn.
155.	Yavasaka (W.P)	*Alhagi pseudalhagi* (Bieb.) Desv.

PHARMACOPOEIAL MONOGRAPHS TO BE PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL.-III

101.	Adhaki (Rt.)	*Cajanus cajan* (Linn.) Millsp.
102.	Agnimantha (Rt.)	*Clerodendrum phlomidis* Linn. f.
103.	Ambasthaki (Rt.)	*Hibiscus sabdariffa* Linn.
104.	Amra (Sd.)	*Mangifera indica* Linn.
105.	Amra (St. Bk.)	*Mangifera indica* Linn.
106.	Amrata (St.)	*Spondias pinnata* (Linn.f.) Kurz.
107.	Apamarga (Rt.)	*Achyranthes aspera* Linn.
108.	Araluka (St. Bk.)	*Ailanthus excelsa* Roxb.
109.	Arka (St. Bk.)	*Calotropis procera* (Ait.) R. Br.
110.	Asana (St. Bk.)	*Pterocarpus marsupium* Roxb.
111.	Asthisamhrta (St.)	*Cissus quadrangularis* Linn.
112.	Atmagupta (Sd.)	*Mucuna prurita* Hook.
113.	Bharangi (Rt.)	*Clerodendrum serratum* Linn.
114.	Bijapura (Frt.)	*Citrus medica* Linn.
115.	Bilva (Rt.)	*Aegle marmelos* Corr.
116.	Bimbi (W.P.)	*Coccinia indica* W. & A.
117.	Cangeri (W.P.)	*Oxalis corniculata* Linn.
118.	Cirabilva (Frt.)	*Holoptelea integrifolia* Planch
119.	Danti (Rt.)	*Baliospermum montanum* Muell-Arg.
120.	Dhattura (Sd.)	*Datura metel* Linn.
121.	Draksa (Frt.)	*Vitis vinifera* Linn.
122.	Durva (Rt.)	*Cynodon dactylon* (Linn.) Pers.
123.	Eranda (Lf.)	*Ricinus communis* Linn.
124.	Eranda (Sd.)	*Ricinus communis* Linn.
125.	Gambhari (St.)	*Gmelina arborea* Roxb.
126.	Gojihva (Aer. Pt.)	*Onosma bracteatum* Wall.

127.	Granthiparni (Rt.)	*Leonotis nepetaefolia* R. Br.
128.	Hamsapadi (W.P.)	*Adiantum lunulatum* Burm
129.	Hapusa (Frt.)	*Juniperus communis* Linn.
130.	Indravaruni (Frt.)	*Citrullus colocynthis* Schrad.
131.	Indrayava (Sd.)	*Holarrhena antidysenterica* Wall.
132.	Isvari (Rt.)	*Aristolochia indica* Linn.
133.	Jati (Lf.)	*Jasminum officinale* Linn.
134.	Kadali (Rz.)	*Musa paradisiaca* Linn.
135.	Kakajangha (Rt.)	*Peristrophe bicalyculata* Linn.
136.	Kakanasika (Sd.)	*Martynia annua* Linn.
137.	Kakoli (Tub. Rt.)	*Lilium polyphyllum* D. Don
138.	Kamala (Rz.)	*Nelumbo nucifera* Gaertn.
139.	Karavira (Rt.)	*Nerium indicum* Mill.
140.	Karinkara (Rt.)	*Carissa carandas* Linn.
141.	Kasa (Rt.)	*Saccharum spontaneum* Linn.
142.	Katphala (Frt.)	*Myrica esculenta* Buch.-Ham. ex D. Don
143.	Katphala (St. Bk.)	*Myrica esculenta* Buch.-Ham. ex D. Don
144.	Kola (Frt. Pulp)	*Zizypus jujuba* Lam.
145.	Kola (St. Bk.)	*Zizypus jujuba* Lam.
146.	Kosataki (W.P.)	*Luffa acutangula* (Linn.) Roxb.
147.	Kumuda (Fl.)	*Nymphaea alba* Linn.
148.	Kusa (Rt. St.)	*Desmostachya bipinnata* Stapf.
149.	Langali (Rz.)	*Gloriosa superba* Linn.
150.	Lasuna (Bulb)	*Allium sativum* Linn.
151.	Mahabala (Rt.)	*Sida rhombifolia* Linn.
152.	Manjistha (St.)	*Rubia cordifolia* Linn.
153.	Marica (Frt.)	*Piper nigrum* Linn.
154.	Masaparni (W.P.)	*Teramnus labialis* Spreng.
155.	Masura (Sd.)	*Lens culinaris* Medic.
156.	Mudga (Sd.)	*Phaseolus radiatus* Linn.
157.	Mulaka (Sd.)	*Raphanus sativus* Linn.
158.	Munditika (Lf.)	*Sphaeranthus indicus* Linn.
159.	Musta (Rz.)	*Cyperus rotundus* Linn.
160.	Nagavalli (Lf.)	*Piper betle* Linn.

161.	Narikela (Endo.)	*Cocos nucifera* Linn.
162.	Nicula (Frt.)	*Barringtonia acutangula* (Linn.) Gaertn.
163.	Nili (W.P.)	*Indigofera tinctoria* Linn.
164.	Nirgundi (Lf.)	*Vitex negundo* Linn.
165.	Padmaka (Ht. Wd.)	*Prunus cerasoides* D. Don
166.	Patalai (Rt.)	*Stereospermum suaveolens* DC.
167.	Phalgu (Frt.)	*Ficus hispida* Linn.
168.	Phalgu (Rt.)	*Ficus hispida* Linn.
169.	Prapunnada (Sd.)	*Cassia tora* Linn.
170.	Raktacandana (Ht.Wd.)	*Pterocarpus santalinus* Linn.
171.	Raktapunarnava (Rt.)	*Boerhaavia diffusa* Linn.
172.	Ramasitalika (W. P.)	*Amaranthus tricolor* Linn.
173.	Rasna (Lf.)	*Pluchea lanceolata* Oliver & Hiem.
174.	Sahacara (W.P.)	*Barleria prionitis* Linn.
175.	Sahadevi (W.P.)	*Vernonia cinerea* Lees.
176.	Saileya (Lichen-'Thallus')	*Parmelia perlata* (Huds.) Ach.
177.	Saka (Ht. Wd.)	*Tectona grandis* Linn.
178.	Sakhotaka (St. Bk.)	*Streblus asper* Lour.
179.	Salaparni (Rt.)	*Desmodium gangeticum* DC.
180.	Sali (Frt.)	*Oryza sativa* Linn.
181.	Salmali (St.Bk.)	*Bombax ceiba* Linn.
182.	Sana (Sd.)	*Crotolaria juncea* Linn.
183.	Sara (Rt.)	*Saccharum bengalense* Retz.
184.	Sarala (Ht. Wd.)	*Pinus roxburghii* Sargent
185.	Sarala (Rt.)	*Pinus roxburghii* Sargent
186.	Sarsapa (Sd.)	*Brassica campestris* Linn.
187.	Satapatrika (Fl.)	*Rosa centifolia* Linn.
188.	Simsapa (Ht. Wd.)	Dalbergia *sissoo* Roxb.
189.	Simsapa (St. Bk.)	*Dalbergia sissoo* Roxb.
190.	Sirisa (St. Bk.)	*Albizzia lebbeck* Benth.
191.	Sthauneya (Lf.)	*Taxus baccata* Linn.
192.	Surana (Corm.)	*Amorphophallus campanulatus* (Roxb.) Bl.
193.	Svetacandana (Ht.Wd.)	*Santalum album* Linn.
194.	Syonaka (Rt.)	*Oroxylum indicum* Vent.

195.	Tala (Infl.)	*Borassus flabellifer* Linn.
196.	Trivrta (Rt.)	*Operculina turpethum* (Linn.) Silva Manso
197.	Tumbini (Frt.)	*Lagenaria siceraria* (Mol.) Standl.
198.	Udambara (Frt.)	*Ficus glomerata* Roxb.
199.	Usira (Rt.)	*Vetiveria zizanioides* (Linn.) Nash
200.	Utpala (Fl.)	*Nymphaea stellata* Willd.

MONOGRAPHS PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA
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69. Adhaki (Sd.) *Cajanus cajan* Linn.
70. Agaru (Ht. Wd.) *Aquilaria agallocha* Roxb.
71. Aklari (Endm.) *Lodoicea maldivica* Pers.
72. Aparajita (Lf.) *Clitoria ternatea* Linn.
73. Atmagupta (Rt.) *Mucuna prurita* Hook.
74. Bilva (St. Bk.) *Aegle marmelos* Corr.
75. Champaka (Fl.) *Michelia champaca* Linn.
76. Cinca (Ft. Pl.) *Tamarindus indica* Linn.
77. Dadima (Fr. Fruit) *Punica granatum* Linn.
78. Dadima (Ft. Rind) *Punica granatum* Linn.
79. Dadima (Lf.) *Punica granatum* Linn.
80. Devadaru (Ht. Wd.) *Cedrus deodara* (Roxb.) Loud.
81. Dhattura (W.P.) *Datura metel* Linn.
82. Durva (W.P.) *Cynodon dactylon* (Linn.)
83. Gambhari (St. Bk.) *Gmelina arborea* Linn.
84. Iksu (Rt. Stock) *Saccharum officinarum* Linn.
85. Kadali (Fl.) *Musa paradisiaca* Linn.
86. Karcura (Rz.) *Curcuma zedoaria* Rosc.
87. Kasturilatika (Sd.) *Hibiscus abelmoschus* Linn.
88. Kataka (Sd.) *Strychnos potatorum* Linn. f.
89. Kharjura (Drd. Ft.) *Phoenix dactylifera* Linn.
90. Kharjura (Fr. Ft.) *Phoenix dactylifera* Linn.
91. Krsnasariva (Rt.) *Cryptolepis buchanani* Roem. & Schult.
92. Kunduru (Exud.) *Boswellia serrata* Roxb.
93. Kunkuma (Sty. & Stg.) *Crocus sativus* Linn.
94. Kusmanda (Ft.) *Benincasa hispida* (Thunb.) Cogn.
95. Madayanti (Lf.) *Lawsonia inermis* Linn.
96. Mahanimba (St. Bk.) *Melia azedarach* Linn.
97. Mandukaparni (W.P.) *Centella asiatica* (Linn.) Urban
98. Mayakku (Gall) *Quercus infectoria* Oliv.
99. Mudgaparni (W.P.) *Vigna trilobata* (Linn.) Verdc.
100. Munditika (W.P.) *Sphaeranthus indicus* Linn.
101. Nayagrodha Jata (Ar. Rt.) *Ficus bengalensis* Linn.

102. Nimbu (Fr. Ft.) *Citrus limon* (Linn.) Burm. f.
103. Nirgundi (Rt.) *Vitex negundo* Linn.
104. Palasa (Fl.) *Butea monosperma* (Lam.) Kuntze.
105. Palasa (Gum) *Butea monosperma* (Lam.) Kuntze.
106. Palasa (Sd.) *Butea monosperma* (Lam.) Kuntze.
107. Parpata (W.P.) *Fumaria parviflora* Lam.
108. Patalai (St. Bk.) *Stereospermum chelonoides* (L.F.)DC.
109. Pattanga (Ht. Wd.) *Caesaplinia sappan* Linn.
110. Pippali (Ft.) *Piper longum* Linn.
111. Plaksa (Ft.) *Ficus lacor Buch*. – Ham.
112. Priyala (St. Bk.) *Buchanania lanzan* Spreng.
113. Priyangu (Fruit) *Callicarpa macrophylla* Vahl.
114. Prsniparni (W.P.) *Uraria picta* Desv.
115. Puskara (Rt.) *Inula racemosa* Hook. f.
116. Rudraksa (Sd.) *Elaeocarpus sphaericus* Gaertn. K. Schum
117. Saraja (Exud.) *Vateria indica* Linn.
118. Satavari (Rt.) *Asparagus recemosus* Willd.
119. Sigru (Rt. Bk.) *Moringa oleifera* Lam.
120. Sigru (Sd.) *Moringa oleifera* Lam.
121. Sigru (St. Bk) *Moringa oleifera* Lam.
122. Srngataka (Drd.Sd) *Trapa natans* Linn.
123. Sruvavrksa (Lf.) *Flacourtia indica* Merr.
124. Sruvavrksa (St. Bk) *Flacourtia indica* Merr.
125. Talamuli (Rz.) *Curculigo orchioides* Gaertn.
126. Talisa (Drd. Lf.) *Abies webbiana* Lindl.
127. Tila (Sd.) *Sesamum indicum* Linn.
128. Tulasi (Sd.) *Ocimum sanctum* Linn.
129. Tumburu (Ft.) *Zanthoxylum armatum* DC.
130. Utingana (Sd.) *Blepharis persica* (Burm.f.) O. Kuntze.
131. Varahi (Rz.) *Dioscorea bulbifera* Linn.
132. Varsabhu (Rt.) *Trianthema portulacastrum* Linn.
133. Vasa (Rt.) *Adhatoda zeylanica* Medic.
134. Visamusti (Sd.) *Strychnos nux-vomica* Linn.
135. Vrscikalli (W.P.) *Tragia involucrata* Linn.

136. Yava (W.P.) *Hordeum vulgare* Linn.

PHARMACOPOEIAL MONOGRAPHS TO BE PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL.-V

1. Amra Haridra (Rz.)	*Curcuma amada* Roxb.
2. Anisoon (Fr.)	*Pimpinelia anisum* Linn.
3. Ankola (Lf.)	*Alangium salviifolium* (Linn.f.) Wang.
4. Aragvadha (St.Bk.)	*Cassia fistula* Linn.
5. Asphota (Rt.)	*Vallaris solanacea* Kuntze
6. Bastantri (Rt.)	*Argyreia nervosa* (Burm.f.) Boj.
7. Bhurja (St.Bk.)	*Betula utilis* D.Don
8. Canda (Rt.)	*Angelica archangelica* Linn.
9. Coraka (Rt. &Rt.Stock)	*Angelica glauca* Edgw.
10. Darbha (Rt.)	*Imperata cylindrica* (Linn.) Beauv.
11. Dhanvayasa (Wh.Pl.)	*Fagonia cretica* Linn.
12. Dravanti (Sd.)	*Jatropha glandulifera* Roxb.
13. Dugdhika (Wh.Pl.)	*Euphorbia prostrata* W. Ait.
14. Elavaluka (Sd.)	*Prunus avium* Linn.f.
15. Gandira (Rt.)	*Coleus forskohlii* Briq.
16. Gavedhuka (Rt.)	*Coix lachryma-jobi* Linn.
17. Ghonta (Fr.)	*Ziziphus xylopyrus* Willd.
18. Gundrah (Rz. & Rt.)	*Typha australis* Schum. and Thonn.
19. Himsra (Rt.)	*Capparis spinosa* Linn.
20. Hingupatri (Lf.)	*Ferula jaeschkeana* Vatke
21. Itkata (Rt.)	*Sesbania bispinosa* W.F.Wight
22. Itkata (St.)	*Sesbania bispinosa* W.F.Wight
23. Jalpippalika (Wh.Pl.)	*Phyla nodiflora* Greene
24. Jivak (Pseudo-bulb)	*Malaxis acuminata* D.Don
25. Kadara (Ht. Wd.)	*Acacia suma* Buch.-Ham.
26.Kakajangha (Sd.)	*Peristrophe bicalyculata* (Retz.) Nees
27. Kakanaja (Fr.)	*Physalis alkekengi* Linn.
28. Kapitan (St.Bk.)	*Thespesia populnea* (L.) Soland. ex Correa
29. Karkash (Rt.)	*Momordica dioica* Roxb. ex Willd.
30. Karnasphota (Sd.)	*Cardiospermum halicacabum* Linn.
31. Karnasphota (Rt.)	*Cardiospermum halicacabum* Linn.
32. Kattrna (Wh.Pl.)	*Cymbopogon citratus* (DC.) Stapf
33. Kebuka (Rz.)	*Costus speciosus* (Koerning ex Retz.) Smith.
34. Khaskhas (Sd.)	*Papaver somniferum* Linn.
35. Khatmi (Rt.)	*Althaea officinalis* Linn.
36. Khatmi (Sd.)	*Althaea officinalis* Linn.
37. Khubkalan (Sd.)	*Sisymbrium irio* Linn.
38. Kodrava (Grain)	*Paspalum scrobiculatum* Linn.
39. Ksirakakoli (Bulb)	*Fritillaria roylei* Hook.
40. Kshiravidari (Rt.)	*Ipomoea digitata* Linn.
41. Kulanjan (Rz.)	*Alpinia galanga* Willd.
42. Kumbhikah (Sd.)	*Careya arborea* Roxb.
43. Latakaranja (Sd.)	*Caesalpinia bonduc* (Linn.) Roxb.
44. Lavaliphala (Fr.)	*Phyllanthus acidus* (Linn.) Skeels

45. Madhulika (Rt.) *Eleusine corocana* (L.) Gaertn.
46. Mahameda (Rz.&Rt.) *Polygonatum cirrhifolium* Royle
47. Mahdusnuhi (Tub.Rt.) *Smilax china* Linn.
48. Maramanjal (Rt. & St.) *Coscinium fenestratum* (Gaertn.) Colebr.
49. Medasakah (St.Bk.) *Litsea chinensis* Lam.
50. Medasakah (Wd.) *Litsea chinensis* Lam.
51. Mesasrngi (Lf.) *Gymnema sylvestre* R.Br.
52. Mesasrngi (Rt.) *Gymnema sylvestre* R.Br.
53. Nandi (Rt.) *Ficus arnottiana* Miq.
54. Nilajhintika (Rt.) *Barleria strigosa* Willd.
55. Nimba (Rt.Bk.) *Azadirachta indica* A.Juss.
56. Nimba (Fl.) *Azadirachta indica* A.Juss.
57. Nimba (Fr.) *Azadirachta indica* A.Juss.
58. Palas (Sd.) *Butea monosperma* (Lam.) Kuntze
59. Palas (Fl.) *Butea monosperma* (Lam.) Kuntze
60. Parasikayavani (Sd.) *Hyoscyamus niger* Linn.
61. Pattura (Wh.Pl.) *Aerva lanata* (Linn.) Juss.
62. Pilu (Fr.) *Salvadora persica* Linn.
63. Pilu (Lf.) *Salvadora persica* Linn.
64. Pilu (Rt.Bk.) *Salvadora persica* Linn.
65. Potagala (Rt.) *Typha elephantina* Roxb.
66. Pudina (Aerial Part) *Mentha viridis* Linn.
67. Pullani (Lf.) *Calycopteris floribunda* Lam.
68. Pullani (Rt.) *Calycopteris floribunda* Lam.
69. Pullani (St.) *Calycopteris floribunda* Lam.
70. Putikaranjah (St.Bk.) *Caesalpinia crista* Linn.
71. Renuka (Fr.) *Vitex negundo* Linn.
72. Riddhi (Tuber) *Habenaria intermedia* D.Don
73. Rohisa (Wh.Pl.) *Cymbopogon martinii* (Roxb.) Wats
74. Rumimustagi (Resin) *Pistacia lentiscus* Linn.
75. Sarala (Exudate) *Pinus roxburghii* Sargent
76. Sarpagandha (Rt.) *Rauwolfia serpentina* (Linn.) Benth. ex Kurz
77. Svetapunarnava (Rt.) *Boerhaavia verticillata* Poir.
78. Tailaparna (Lf.) *Eucalyptus globulus* Labill.
79. Tinisha (Wd.) *Ougeinia oojeinensis* (Roxb.) Hochr.
80. Tintidika (Aerial Part) *Rhus parviflora* Roxb.
81. Trapusa (Sd.) *Cucumis sativus* Linn.
82. Tuni (St.Bk.) *Cedrela toona* Roxb.
83. Vanda (Lf.) *Dendrophthoe falcata* (Linn.f.) Ettingsh.
84. Vanda (St.) *Dendrophthoe falcata* (Linn.f.) Ettingsh.
85. Vanda (Aerial Rt.) *Dendrophthoe falcata* (Linn.f.) Ettingsh.
86. Vanda (Fl.) *Dendrophthoe falcata* (Linn.f.) Ettingsh.
87. Vanda (Fr.) *Dendrophthoe falcata* (Linn.f.) Ettingsh.
88. Vanyajiraka (Fr.) *Centratherum anthelminticum* (L.) Kuntze
89. Vidarikand (Tuber) *Pueraria tuberosa* DC.
90. Virala (St.Bk.) *Diospyros exsculpta* Buch.-Ham.
91. Visala (Rt.) *Trichosanthes bracteata* (Lam.) Voigt
92. Vyaghranakhi (Fr.) *Capparis horrida* Linn.

CDV

APPENDIX-7

7.1. CLASSICAL AYURVEDIC REFERENCES

अरण्य सूरण (कन्द)

वज्राण्डयाः कर्षमात्रायाः कल्कं दध्यादिवेष्टितम्
निगिलेहारिणा नित्यं उदरव्याधि शान्तये ॥
वज्राण्डीनि 'वनसूरणे' तिलके

(भा0 मिश्र)
(नि0 आ0 पृ0 699)

अस्थिशृंखला (वायवीय भाग)

वज्रवल्ली सरा रूक्षा कृमिदुर्नाम नाशिनी ॥ **1594** ॥
दीपन्युष्णा विपाके च स्याद्री वृष्या बलप्रदा ।
अस्थिसंधानजननी वातश्लेष्महरा गुरुः ॥ **1595** ॥

(कै नि0 औषधि वर्ग.)

अस्थिसंहारकः प्रोक्तो वातश्लेष्महरोऽस्थियुक् ॥ **226** ॥
उष्णः सरः कृमिघ्नश्चदुर्नामघ्नोऽक्षिरोगाजित् ।
रुक्षः स्वादुर्लघुर्वृष्यः पाचनः पित्तलः स्मृतः ॥ **227** ॥

(भा0 प्र0 नि0, गुडूच्यादि वर्ग.)

वज्रवल्लीसरारूक्षाकृमिदुर्नामर्नाशिनी ।
दीपन्युष्णाविपाकेऽम्लास्वाद्वीवृष्याबलप्रदा ॥
अर्शसांतुविशेषेणहिताचैवाग्निदीपनी ।
चतुर्धाराकाण्डवल्लीभूतोपद्रवशूलहा ॥
अत्युष्णाऽऽध्मानवातांश्चतिमिरंवातरक्तकम् ।
अपस्मारंवातरोगंनाशयेदितिकीर्त्तितम् ।

(नि0 र0)

रूक्षोष्णामधुरावातकृम्यर्शःकफनाशिनी ॥
काण्डवल्लीतुकटुकातिक्ताचोष्णासरामता ।
पित्तलाचकफंगुल्मंलूतांदुष्टव्रणंतथा ।
प्लीहोदराग्निमांद्ययोनिशूलंवातंचनाशयेत् ।
मलस्तम्भहराचैवकीर्त्तितामुनिभिःपुरा ॥

भूतकेशी (फलम्)

मांसीद्वयं कषायं च वर्ण्यं पित्तकफापहम् ।
रक्षोघ्नं च सुगन्धि स्याद् वातघ्नं केश्यमुत्तमम् ॥ **46** ॥

(ध0 नि0 चन्दनादि वर्ग.)

मुरा तिक्ता कटुः शीता कषाया कफपित्तहृत् ।
श्वासकृच्छ्रविषदाहार्त्ति-भ्रममूर्च्छातृक्षापहा ॥ **132** ॥

(रा0 नि0, चन्दनादि वर्ग.)

द्वितीया गन्धमांसी च केशी भूतजटा स्मृता ।
पिशाची पूतना चैव भूतकेशी च लोमशा ॥ **93** ॥

गन्धमांसी तिक्तशीता कफकण्ठामयापहा ।
रक्तपित्तहरा वर्ण्या विषभूतज्वरापहा ॥ **94** ॥

(रा0 नि0 चन्दनादि वर्ग)

भूतकेशी (प्रकन्द)

गोलोमी चाजलोमी च भूतकेशी जरातथा ।
अस्मिन् वर्गे भिषक् कुर्यात्तैलानि च घृतानि च ।
एष सर्वविकारांस्तु मानसानपराजितः ॥ **47** ॥

(सु0 उ0 60)

सुरसयुगफणिज्जं कालमाला विडगड़ं
खरबुसवृषकर्णीकटफलं कासमर्दः ।
क्षवकसरसि भागर्डीकार्मुकाः काकमाची
कुलहलविषमुष्टी भूस्तृणो भूतकेशी ॥ **30** ॥
सुरसादिर्गणः श्लेष्मभेदः कृमिनिषूदनः
प्रतिश्यायरूचि श्वासकासघ्नो व्रणशोधनः ॥ **31** ॥
भूतकेशी निर्गुण्डी(आर. हेमाद्रि); भूतकेशी मांसी (अरूण्ो)

(अ0 ह0 सू0 15)

हिगुड. व्योषालनेपाली लशुनार्कजटाजटाः
अजलोमी सगोलामी भूतकेशी वचा लता ॥ **2** ॥
प्रयोगाऽयं ग्रहोन्मादान् सापस्माराञ्शमं नयेत्

(अ0 ह्र0 उ0 5)

बीजपत्रा (सं0 व0)

हंसपादी हिमा गुर्वी रोपणी हन्ति शोणितम् ॥ **767** ॥
दाहातीसारविसर्पलूताभूतविषव्रणान् ।

(कै0 नि0, ओषधि वर्ग.)

हंसपादी गुरुः शीता हन्ति रक्तविषव्रणान् ।
विसर्पदाहातीसारलूताभूताग्निरोहिणीः ॥ **256** ॥

(भा0 प्र0 नि0, गुडूच्यादि वर्ग.)

बिम्बी (पत्रम्)

बिम्बी स्वाद्वी रसे पाके वामन्यश्लेष्मला जयेत् ।
रक्तपित्तक्षयश्वासपाण्डुश्वयथुकामलाः ॥ **583** ॥
शाकं तुं मधुरं तिक्तं कषायं शीतलं लघु ।
संग्राहि कटुकं पाके वातलं कफपित्तजित् ॥ **584** ॥
तिक्तं प्रसूनं पित्तघ्नं तत्परं कामलापहम् ।
बिम्बीफलं स्वादु शीतं स्तम्भनं लेखनं गुरु ॥ **585** ॥
पित्तास्रदाहशोफघ्नं वाताध्मानविबन्धकृत् ।

(कै0 नि0 ओषधि वर्ग,)

तिक्ततुण्डी तु तिक्ताख्या कटुका कटुतुण्डिका ।
बिम्बी च कटुतिक्तादि तुण्डि पर्यायगा च सा ॥

(रा0 नि0)

कटुतुण्डी कटुस्तिक्ता कफपित्तविषापहा ।
अरोचकास्रपित्तघ्नी सदा पथ्या च रोचनी ॥

(रा0 नि0)

तिक्ततुण्डी वान्तिकरा पित्तरक्तविकारनुत् ।
कफपाण्डुहरा प्रोक्ता मुनिभिश्चरकादिभिः ॥
फलमस्या गुरुस्तिक्तं वामकं वातकोपनम् ।
शोफरुग्विषपित्तघ्नं रक्तरुक्कफपाण्डुहर ॥

(नि0 र0)

बिम्बिका मधुरा शीता रक्तपित्तज्वरान् हरेत् ।
फलमस्या गुरुः स्वादुः शीतलं लेखनं मतम् ॥
मलस्तम्भकरं रुच्यं कासश्वासहरं मतम् ।
अस्य पर्णोद्भवा शाखा शीतला मधुरा लघुः ॥
ग्राहका तुवरा तिक्ता पाके कट्वी च वातला ।
कफपित्तहरा प्रोक्ता पूर्वैवैद्यवरैः स्फुटम् ॥
मूलमस्य हिमं मेहनाशनं धातुवर्द्धकम् ।
बस्तिदाहहरं भ्रान्तिवान्तिनाशकरं मतम् ॥ **(स्व0)** ॥

(इ0 मे0 प्लँ0, कोट्टाक्कल)

तिक्ततुण्डी तु तिक्ताख्या कटुका कटुतुण्डिका ।

बिम्बी च कटुतिक्तादि तुण्डि पर्यायगा च सा ॥

(रा0 नि0)

कटुतुण्डी कटुस्तिक्ता कफपित्तविषापहा ।
अरोचकास्रपित्तघ्नी सदा पथ्या च रोचनी ॥

(रा0 नि0)

तिक्ततुण्डी वान्तिकरा पित्तरक्तविकारनुत् ।
कफपाण्डुहरा प्रोक्ता मुनिश्चरकादिभिः ॥
फलमस्या गुरुस्तिक्तं वामकं वातकोपनम् ।
शोफरुग्विषपित्तघ्नं रक्तरुक्कफपाण्डुहर ॥

(नि0 र0)

बिम्बिका मधुरा शीता रक्तपित्तज्वरान् हरेत् ।
फलमस्या गुरुः स्वादुः शीतलं लेखनं मतम् ॥
मलस्तम्भकरं रुच्यं कासश्वासहरं मतम् ।
अस्य पर्णोद्भवा शाखा शीतला मधुरा लघुः ॥
ग्राहका तुवरा तिक्ता पाके कट्वी च वातला ।
कफपित्तहरा प्रोक्ता पूर्ववैद्यवरैः स्फुटम् ॥
मूलमस्य हिमं मेहनाशनं धातुवर्द्धकम् ।
बस्तिदाहहरं भ्रान्तिवान्तिनाशकरं मतम् ॥ **(स्व0)** ॥

(इं0 मे0 प्लँ0, कोट्टाक्कल)

बृहत् दुग्धिका (सं0व0)

दुग्धिकोष्णा गुरू रूक्षा वातला गर्भकारिणी ॥ **275** ॥
स्वादुक्षीरा कटुस्तिक्ता सृष्टमूत्रा मलापहा ।
स्वादुविष्टम्भिनी वृष्या कफकुष्ठक्रिमिप्रणुत् ॥ **276** ॥

(भा0 प्र0 नि0, गुडूच्यादि वर्ग)

बृहती (सं.व.)

सारिवेक्षुमूलमधुकपिप्पलीद्राक्षाविदारीकैर्श्यहंसपादीबृहतीकण्टरिका ।
इति दशेमानि कण्ठयानि भवन्ति ॥ **9** ॥
शटीपुष्करमूलबदरबीजकण्टकारिकाबृहती...इति दशेमानि ।
हिक्कानिग्रहणानि भवन्ति ॥ **30** ॥

(च0सू0 4)

सिंहिका कफवातघ्नी श्वासशूलज्वरापहा ।
छर्द्रिहृद्रोगमन्दाग्निमामदोषांश्च नाशयेत् ॥ **64** ॥

(ध0नि0, गुडूच्यादि वर्ग)

बृहती कटुका तिक्ता सोष्णा वातकफापहा ॥ **50** ॥
दीपनी पाचनी हृद्या ग्राहिणी ज्वरकुष्ठनुत् ।

श्वासास्यमलवैरस्यकासारोचकशूलजित् ॥ **51** ॥

(कै0नि0, ओषधि वर्ग.)

विज्ञेया श्वेतबृहती वातश्लेष्मविनाशनी ।
रुच्या चाञ्जनयोगेन नानानेत्रामयापहा ॥ **29** ॥

(रा0नि0, शताह्वादि वर्ग.)

कटुतिक्ताऽऽस्यवैरस्यमलारोचकनाशिनी ।
उष्णा कुष्ठज्वरश्वासशूलकासाग्निमान्द्यजित् ॥ **37** ॥

(भा0प्र0नि0, गुडूच्यादि वर्ग.)

बृहतीकण्टकारिकाकुटजफलपाठा मधुकं चेति
पाचनीयो बृहत्यादिर्गणः पित्तमनिलापहः
कफारोचकहृद्रोगमूत्रकृच्छ्ररुजापहः ।

(सु0सू0 38। 31 । 32)

कफास्रपित्तपंस्त्वघ्राश्चणका वातला हिमाः ॥ **89** ॥
लघवो भष्टचण्का आमक्लमहराः पराः ।
छर्दिहना रोचनाः शुष्कास्तेजोवीर्यबलप्रदाः ॥ **90** ॥

(घ0 नि0, सुवर्णादिवर्ग.)

चणको वातलो रूक्षो विष्टम्भी पंस्त्वकारकः ।
सकषायो लघुः शीतः पीत्तस्रकफनाशनः ॥ **70** ॥

(कै0 नि0, धान्यवर्ग.)

चणको मधुरो रूक्षो मेहजित् वातपित्तकृत् ।
दीप्तिवर्णकरो बल्यो रूच्यश्चाध्मानकारकः ॥ **85** ॥

(रा0 नि0, शाल्यादिवर्ग.)

चणकः शीतलो रूक्षः पित्तरक्तकफापहः ।
लघुः कषायो विष्टम्भी वातलो ज्वरनाशनः ॥ **53** ॥

(भा0 प्र0 नि0, धान्यवर्ग.)

दारुहरिद्रा (फलम्)

मुस्तकुठहरिद्रादारुहरिद्रा.....चित्रकचिरबिल्वहैमवत्य
इति दशेमानि लेखनीयानि भवन्ति ॥ 3 ॥

(च0 सू0 4)

हरिद्रादारुहरिद्रा.....मधुकं चेति ॥ 27 ॥
एतौ वचाहरिद्रादी गणौ स्तन्यविशोधनौ ।
आमातिसारशमनो विशेाद्दोपाचनौ ॥ 28 ॥

(सु0 सू0 38)

तिक्ता दारुहरिद्रा स्याद् रुक्षोणा व्रणमेहजित् ।
कर्णनेत्रमुखोद् भूतां रुजं कण्डूं च नाशयेत् ।। 59 ।।
(ध0 नि0, गुडूच्यादि वर्ग,)

तद्वद् दार्वी विशेोण कर्णनेत्रास्यरोगजित् ।। 1117 ।।
(कै0 नि0, ओाधि वर्ग,)

तिक्ता दारुहरिद्रा तु कटूणा व्रणमेहनुत् ।
कण्डूविसर्पत्वग्दोा-विाकर्णाक्षिदोाहा ।। 202 ।।
(रा0 नि0, पिप्पल्यादि वर्ग,)

दार्वी निशागुणा किन्तु नेत्र कर्णास्यरोगनुत् ।। 202 ।।
(भा0 प्र0 नि0, हरीतक्यादि वर्ग,)

धव (फलम्)

मुष्ककपलाशधव.....वृक्षात्रिफला चेति **।। 20 ।।**
मुष्ककादिर्गणो हयेष मेदोघ्नः शुक्रदोषह्नत् **।**
मेहार्शः पाण्डुरोगाश्मशर्करानाशनः परः **।। 21 ।।**
(सु0 सू0 38)

धवस्तु तुवरः शीतो मधुरो मेहपाण्डुहा **।**
कफपित्तहरं तस्य फलं स्वादु कषायकम् **।। 838 ।।**
हिमं रूक्षं गुरू स्तम्भी वातलं कफपित्तजित् **।**
(कै0 नि0, ओषधि वर्ग.)

धवः शीतप्रमेहास्रपाण्डुपित्तकफापहः **।। 41 ।।**
(म0 नि0)

धवः कषायः कटुकः कफघ्नोनिलनाशनः **।**
पित्तप्रकोपणो रूच्यो विज्ञेयो दीपनः परः **।। 109 ।।**
(रा0 नि0, प्रभद्रादि वर्ग.)

धवः शीतः प्रमेहार्शः पाण्डुपित्तकफापहः **।**
मधुरस्तुवरस्तस्य फलं च मधुरं मनाक् **।। 60 ।।**
(भा0 प्र0 नि0, वटादि वर्ग.)

धव (शाखा त्वक्)

मुष्ककपलाश धव.....वृक्षात्रिफला चेति **।। 20 ।।**
मुष्ककादिर्गणो हयेष मेदोघ्नः शुक्रदोषहत् **।**

मेहार्शः पाण्डुरोगाश्मशर्करानाशनः परः **॥ 21 ॥**

(सु0 सू0 38)

कुष्ठे---
खदिरो धवश्च लेपः **॥ 124 ॥**

(च0 चि0 7)

विसर्पे--

खदिरं सप्तपर्णञ्च मुस्तमारग्वधं धवमं ।
.....पृथगालेपनं कुर्याद् द्वन्द्वशः सर्वशोऽपिवा **॥ 88-92 ॥**

(च0 चि0 21)

कर्णस्रावे-
रसमाम्रकपित्थानां मधूक धवशालजम् ।
पूरणार्थं प्रशंसन्ति तैलं वा तैर्विपाचितम् **॥ 47 ॥**

(अ0 छ0 उ0 39)

धवस्तु तुवरः शीतो मधुरो मेहपाण्डुहा ।
कफपित्तहरं ..... **॥ 838 ॥**

(कै0 नि0, ओषधि वर्ग.)

धवः कषायः कटुकः कफघ्नोनिलनाशनः ।
पित्तप्रकोपणो रूक्ष्यो विज्ञेयो दीपनः परः **॥ 109 ॥**

(रा0 नि0, प्रभद्रादि वर्ग)

धवः शीतः प्रमेहार्शः पाण्डुपित्तकफापहः ।
मधुरस्तुवरस्त..... **॥ 60 ॥**

(भा0 प्र0 नि0, वटादि वर्ग.)

धवः शीतप्रमेहास्रपाण्डुपित्तकफापहः **॥ 41 ॥**

(म0 पा0 नि0 पृष्ठ क्र0 115)

एलवालुक (आलुबुखारा) (मूलम्)

कुष्ठैलवालुक.....वसुकोशीराणीति
दशेमानि शुक्रशोधनानि भवन्ति ॥ 20 ॥

(च0 सू0 4)

एल्वालु कटुकं पाके कषायं शीतलं लघु ॥ 1324 ॥
हन्ति कण्डूव्रणच्छर्दितृट्कासारुचिह्रद्रुजः ।
बलासविषपित्तास्रकुष्ठमूत्रविषकृमीन् ॥ 1325 ॥

(कै0 नि0, ओषधि वर्ग.)

एलालु कटुकं पाके कषायं शीतलं लघु ।
हन्तिकण्डूव्रणच्छर्दितृट्कासारुचिह्रद्रुजः ॥
बलासविषपित्ताकुष्ठमूत्रगदक्रिमीन् ॥ 121 ॥

(भा0 प्र0 नि0, कर्पूरादि वर्ग.)

एलवालुक (आलुबुखारा) (काण्ड0 त्वक्)

कुष्ठैलवालुक.....वसुकोशीराणीति
दशेमानि शुक्रशोधनानि भवन्ति ।। 20 ।।

(च0 सू0 4)

एल्वालु कटुकं पाके कषायं शीतलं लघु ।। 1324 ।।
हन्ति कण्डूव्रणच्छर्दितृट्कासारुचिह्रद्रुजः ।
बलासविषपित्तास्रकुष्ठमूत्रविषकृमीन् ।। 1325 ।।

(कै0 नि0, ओषधि वर्ग.)

एलालु कटुकं पाके कषायं शीतलं लघु ।
हन्तिकण्डूव्रणच्छर्दितृट्कासारुचिह्रद्रुजः ।।
बलासविषपित्ताकुष्ठमूत्रगदक्रिमीन् ।। 121 ।।

(भा0 प्र0 नि0, कर्पूरादि वर्ग.)

एरण्ड कर्कटी (फलम्)

फलं कूश्माण्डवत् ह्रघं बृंहणं कृमिजित्परम् ।
दीपनं श्वासकासघ्नं प्रीतिदं पित्तवर्द्धनम् ।। **स्व0** ।।

(इं0 मे0 प्लॅ0, कोट्टाक्कल)

एरण्डकर्कटी लघ्वी तीक्ष्णां कट्वी सतिक्तका ।
वीर्योष्णा पाचनी ह्रघा ग्राहिणी कफवातनुत् ।।
एरण्डकर्कटी क्षीरं पाचनं परमं स्मृतम् ।
फलं सतिक्तमधुरं पक्वं तु मधुरं लघु ।। **स्व0** ।।

(द्र0 गु0 वि0, प्रो. प्रि. व्र. शर्मा)

एरण्डकर्कटी (मूलम्)

त्वड्मूलादिकमस्य तु ।
त्वग्दोषवातरक्तादिरोगेष्वप्युपयुज्यते ।। **स्व0** ।।

(इं0 मे0 प्लॅं कृत कोट्टाक्कल,)

पाटला.....गोक्षुरका इति दशेमानि श्वयथुहराणि भवन्ति ।। **38** ।।

(च0 सू0 4 । 38)

गोक्षुरको मूत्रकृच्छ्रानिलहराणां

(च0 सू0 25 । 40)

श्वदंष्ट्रो बृंहणो वृष्यस्त्रिदोषशमनोऽग्निकृत् ।
शूलह्रद्रोगकृच्छ्रघ्नः प्रमेहविनिवर्तकः ।। **103** ।।

(ध0 नि0 गुडूच्यादि वर्ग.)

गोक्षुरो मधुरो वृष्यो दीपनो बलपुष्टिकृत् ॥ **69** ॥
शीतलो वस्तिवातघ्नो दोषत्रयनिबर्हणः ।
हृद्रोगमेहकृच्छ्राश्म श्वासकास रुजाहरः ॥ **70** ॥

(कै0 नि0 ओषधि वर्ग.)

स्यातामुभौ गौक्षुरकौ सुशीतलौ बलप्रदौ तौ मधुरौ च बृंहणौ ।
कृच्छ्राश्मरीमेहविदाहनाशनौ रसायनौ तत्र बृहद्गुणः प ॥ **43** ॥

(रा0 नि0 गुडूच्यादि वर्ग.)

गोक्षुरः शीतलः स्वादुर्बलकृद्वस्ति शोधनः ॥ **45** ॥
मधुरो दीपनो वृष्यः पुष्टिदश्चाश्मरीहरः ।
प्रमेह श्वासकासर्शः कृच्छ्रहृद्रोग वातनुत् ॥ **46** ॥

(भा0 प्र0 नि0 गुडूच्यादि वर्ग.)

हस्तिशुण्डी (सं0 व0)

हस्तिशुण्डी कटूष्णा स्यात् सान्निपातज्वरापहा ॥ **77** ॥

(रा0 नि0, पर्पटादि वर्ग)

वात्तपित्तहरा शीता चक्षुष्या श्वासकासजित् ।
अङ्गमर्दहरा वृष्या गुल्मघ्नी च विषणिका ॥

(म0 नि0)

जलकुम्भी (सं0व0)

वारिपर्णी हिमा तिक्ता लघ्वी स्वाद्वी सरा कटुः ॥ **1468** ॥
दोषत्रयहरी रूक्षा पित्तास्रज्वरशोषहृत् ।

(कै0 नि0, ओषधि वर्ग.)

जलकुम्भीकजं भस्म पक्वं गोमूत्रगालितम् ।
पिबेत् कोद्रव तक्राशी गलगण्डोपशान्तये ॥

(नि. आ. व. वर्ग.)

जीवन्ती (मूलम्)

जीवन्ती शीतला स्वादुः स्निग्धा दोषत्रयापहा ।
रसायनी बलकरी चक्षुष्या ग्राहिणी लघुः ॥

(भा0 प्र0 नि0, गुडुच्यादि वर्ग,)

चक्षुष्या सर्वदोषघ्नी जीवन्ती मधुरा हिमा ।
शाकानां प्रवरान्यूना द्वितीया किञ्चिदेव तु ॥ **37** ॥

(ध0 नि0, गुडुच्यादि वर्ग,)

जीवन्ती मधुरा शीता रक्तपित्तानिलापहा ।
क्षयदाहज्वरान् हन्ति कफवीर्यविवर्धनी ॥ **39** ॥

(रा0 नि0, गुडुच्यादि वर्ग,)

नेत्ररोगहरा शीता पित्तासृक्कफनाशनी ।
रसायनी जीवनीया जीवन्ती मधुरा रसे ॥

(म0 नि0)

जीवन्ती श्वासकासघ्नी स्वर्या च क्षयनाशिनी ।

(रा0 व0)

करफ्स (मूलम्)

पिप्पलीपिप्पलीमूल.....मरिचाजमोदा....दशेमानि
शूलप्रशमनानि भवन्ति ॥ **45** ॥

(च0 सू0 04)

पिप्पलीपिप्पलीमूल.....हरेणुकैलाजमोदेन्द्रयव....कटुरोहिणी चेति ॥ **22** ॥
पिप्पल्यादिः कफहरः प्रतिश्यायानिलारुचिः ।
निहन्याद्दीपनो गुल्मशूलघ्न श्चामपाचनः ॥ **23** ॥

(सु0 सू0 28)

अजमोदा तु शूलघ्नी तिक्तोष्णा कफवातजित् ।
हिक्काध्मानारुचीर्हन्ति कृमिजिद्वह्निदीपनी ॥ **96** ॥

(ध0 नि0, शतपुष्पादि वर्ग.)

अजमोदा कटुस्तीक्ष्णा दीपनी कफवातनुत ।
उष्णा विदाहिनी हृद्या वृष्या बलकरी लघुः ॥
नेत्रामयकफच्छर्दिहिक्काबस्तिरुजो हरेत् ॥ **79** ॥

(भा0 प्र0 नि0, हरीतक्यादि वर्ग.)

केशराज (सं0 व0)

पीतभृङ्गो कटुस्तिक्तस्तीक्ष्णोष्णश्च कषायकः ।
मूत्रलो स्वेदजननी हृद्यो वृष्यः शिरोर्त्तिनुत् ॥
कफवातज्वरप्लीहवृद्धिश्लीपदनाशनः ।
नक्तान्ध्यदृष्टि दौर्बल्यकृच्छ्रपाण्डुव्रणापहः ॥
कर्णामयपेश्वासकासहृद्रोग कृमिशूलनुत् ।
वलीपलितहृत् केश्यो विशेषात् कामिलापहः ॥ **स्व0** ॥

(इं0 मे0 प्लॅ0 कृत कोट्टाक्कल)

कटुपाकरसं युग्मं तद्भस्म व्रणशातभित् ।

(सो0 नि0 II- 585)

केतकी (मूलम्)

तस्याः स्तनोऽतिशिशिरः कटुः पित्तकफापहः ।
रसायनकरो बल्यो देहदाढर्यकरः परः ॥ **71** ॥

(रा0 नि0, करवीरादि वर्ग.)

कीटमारी (पत्रम्)

वातश्लेष्मज्वरहरा संध्यस्थीनि प्रसारिणी ॥

(शोढल नि0)

तिक्ता कृमिघ्नी शोफघ्नी ह्युष्णा रुच्या च दीपनी ।
कासघ्नी .....

(रा0 नि0)

कुसुम्भ (फलम्)

कुसुम्भतैलमुष्णं च विपाके कटुकं गुरु ।
विदाहि च विशेषेण सर्वदोषप्रकोपणम् ॥ **293** ॥

(च0 सू0 27)

निम्बातसीकुसुम्भमूलक.....ज्योतिष्मती
फलतैलानि तीक्ष्णानि लघून्युष्णवीर्याणि कटूनि
कटुविपाकानि सराण्यनिलकफकृमिकुष्ठप्रमेहशिरोरोगा
पहराणि चेति ॥ **115** ॥

(सु0 सू0 45)

स्निग्घोमा स्वादुतिक्तोष्णा कफपित्तकरी गुरुः ॥ **22** ॥
दृक् शुक्रहृत्कटुः पाके तद्वब्दीजं कुसुम्भजम् ।

(अ0 ह्र0 सू0 6)

तद्वत्कुसुम्भः कटुको विदाही कफनाशनः॥ **87** ॥

(कै0 नि0, धान्यवर्ग,)

कुसुम्भबीजं मधुरं स्निग्धं शीतं कषायकम् ।
अवृष्यं गुरु च प्रोक्तं कफवातास्रपित्तनुत् ॥

(नि0 र0)

कुसुम्भं वातलं कृच्छ्ररक्तपित्तकफापहम् **॥ 192 ॥**

(भा0 प्र0 नि0, हरीतक्यादि वर्ग,)

कुसुम्भ (पत्रम्)

कौसम्भं मधुरं रूक्षमुष्मं श्लेष्महरं लघु **॥ 272 ॥**

(सु0 सू0 46)

रूक्षोणम्लं कौसुम्भं गुरु पित्तकरं सरम् **॥ 101 ॥**

(अ0 छ0 सू0 6)

कुसुम्भं वातलं रूक्षं रक्तपित्तकफापहम् **॥ 105 ॥**

(ध0 नि0, सुवर्णादिवर्ग,)

कौसुम्भं पित्तलं स्वादु रूक्षोष्णं श्लेष्महृल्लघु ॥ 639 ॥

(कै0 नि0, ओषधि वर्ग,)

कौसम्भशाकं मधुरं कटूष्णं विण्मूत्रदोषापहरं मदघ्नम् ।
दृष्टिप्रसादं करूते विशेषाद्रचिप्रदं दीप्तिकरं च वह्नः ॥ 143 ॥

(रा0 प्र0 नि0, हरीतक्यादि वर्ग,)

कुसुम्भं वातलं कृच्छ्रारक्तपित्तकफापहम् ॥ 192 ॥

(भा0 प्र0 नि0, हरीतक्यादि वर्ग,)

शाकं गुरु च रूक्षं च प्रायो विष्टभ्य जीर्यति ।
मधुरं शीतवीर्य च पुरीषस्य च भेदनम् ॥

(च0 सू0 27)

माधवी (पुष्पम्)

अतिमुक्तं सुगन्धि स्याद् हृदयमुक्त सुमण्डनम् **॥ 141 ॥**

(ध0 नि0, आम्रादि वर्ग,)

अतिमुक्तो लघुः शीतः दोषत्रयनिबर्हणः **॥ 1487 ॥**

(कै0 नि0, ओषधि वर्ग,)

माधवी कटुका तिक्ता कषाया मदगन्धिका **।**
पित्तकासव्रणान् हन्ति दाहशोष विनाशिनी **॥ 108 ॥**

(रा0 नि0, करवीरादि वर्ग,)

माधवी मधुरा शीता लघुर्दोषत्रयापहा **॥**

(म0 पा0 नि0)

माधवी मधुरा शीता लघ्वी दोषत्रयापहा ॥ **41** ॥

(भा0 प्र0 नि0, पुष्पवर्ग,)

मत्स्यपत्रिका (सं0 व0)

प्रसारणी गुरूस्तिक्ता सरा सन्धानकृन्मता ।
त्रिदोषशमनी वृष्या तेजःकान्तिबलप्रदा ॥ **278** ॥

(ध0 नि0,गुडूच्यादि वर्ग.)

प्रसारणी सरा तिक्ता वीर्योष्णा शुक्लला गुरूः ॥ **106** ॥
व्रणसन्धानबलकृत् वातरक्तत्रिदोषहा ॥

(कै0 नि0 औषधि वर्ग.)

प्रसारणी गुरूष्णा च तिक्ता वातविनाशिनी ।
अर्शःश्वयथुहन्त्री च मलविष्टम्भहारिणी ॥ **38** ॥

(रा0 नि0,पर्पयदि वर्ग.)

वातपित्तहरा सोष्णा बल्या वृष्या प्रसारणी ।

(रा0 नि0)

प्रसारणी गुरूर्वृष्या सन्धानबलकृत्सरा ।
वीर्योष्णा वातनुत्तिक्ता वातरक्तकफापहा ॥

(म0 पा0 नि0)

सारणी वातरक्तघ्नी सोष्णा वृष्या बलप्रदा ।
कट्वी च लघु चक्षुष्या स्वर्या ज्वरनिशान्ध्यजित् ॥

(सो0 नि0)

प्रसारणी गुरूश्चोष्णा तिक्ता बल्या सरा मता ।
भग्नास्थिसन्धानकरी कान्तिकृद्धातुवर्द्धका ॥
वातार्शः शोफकफहा मलस्तम्भकरी मता ।
वातरक्तं त्रिदोषं च नाशयेदिति कीर्त्तिता ॥

(नि0 र0)

प्रसारिणी गुरूर्वृष्या बलसन्धानकृत्सरा ।
वीर्योष्णा वातहृत् तिक्ता वातरक्तकफापहा ॥ **235** ॥

(भा0 प्र0 नि0,गुडूच्यादि वर्ग.)

मेदा (प्रकन्द)

मेदा स्वादुरसा शीता क्षयदाहज्वरापहा ।
सा पित्तं तु जयेच्छुक्रं सकफं च विवर्धयेत् ॥ **124** ॥

(ध0 नि0, गुडूच्यादि वर्ग.)

नाडीहिंगु (निर्यास)

नाडिहिंगस्तु कटुकस्तीक्ष्णोष्णश्चापि दीपकः
कफवातमलस्तभ्भमनोमोहामनाशनः ॥

(नि0 र0 717)

नाडीहिङ्गु कटूष्णं च कफवातर्तिशान्तिकृत् ।
विष्टम्भनविबन्धामदोषघ्नं दीपनं परम् ॥ **41** ॥

(ध0 नि0, शतपुष्पादि वर्ग.)

नाडीहिङ्गु कटूष्णं च कफवातार्त्तिशान्तिकृत ।
विष्ठाविबन्धंदोषघ्नमानाहामयहारि चं ॥ **76** ॥

(रा0 नि0, पिप्पल्यादि वर्ग.)
(भा0 प्र0 नि0, हरीतक्यादि वर्ग)

नाही (सं0 व0)

नाही तु कथिता तिक्ता लघ्वी पित्तकफापहा ।
मधुमेहे तथा कुष्ठे शस्यते विषमज्वरे ॥ **स्व0** ॥

(द्र0 गु0 वि0, प्रि0 वत्0 शर्मा,)

नागजीह्वा सरा तिक्ता रूक्षोष्णा कृमिशोफह्रत् ।
दीपनी पाचनी बल्या कण्डू त्वग्दोषनाशिनी ॥
मधुमेहं यकृद्शोफं विबन्धं विषमज्वरम् ।
अग्निमान्द्यं च शमयेत् पर रक्तप्रसादनं ॥ **स्वः** ॥

(इ0 मे0 प्लॅ0 कृत कोट्टाक्कल, पृ0 क्र0 376)

कृमिह्रत् क्षारकर्मा च तथा मामज्जकः स्मृतः ॥

(सो0 नि0)

कृमिह्रत् क्षारकर्मा च तथा माभिजकः स्मृतः ॥

(शा0 नि0)

निकोचक (बीज त्वक्)

निकोचकं गुरु स्निग्धं वृष्योष्णं स्वादु बृंहणम् ।
रक्तप्रसादनं बल्यं वातघ्नं कफ पित्तकृत् ॥ **11** ॥

(म0 नि0)

वातामाभिषुकाक्षोटमुकूलकनिकोचकाः ।
गुरूष्णस्निग्धंमधुराः सोरुमाणा बलप्रदाः ॥
वातन्घा बृंहणा वृष्याः कफपित्ताभिवर्धनाः

(च0सू0 27/157-158)

निकोचकं गुâ स्निग्धं वृष्योष्ण धातुवर्धनम् ।

रक्तप्रसादनं स्वादु बल्यं पित्तकरं मतम् ।।

(नि0 र0)

पनस (मूल त्वक्)

तदेव पक्वं मधुरं वातपित्तनिबर्हणम् ।। १७१ ।।
विपाके मधुरं शीतं रक्तपित्तप्रसादनम् ।।

(सु० सू० ४६)

मोचखर्जूरपनसनारिकेलपरुषकम्
आम्रातालकाश्मर्यराजादनमधूकजम् ।। 119 ।।
सौवीरबदराक्षोल्लफल्गुश्लेष्मातकोद्भवम् ।
वातामाभिषुकाक्षोडमुकूलकनिकोचकम् ।। 120 ।।
उरुमाणं प्रियालं च बृंहणं गुरू शीतलम् ।
दाहक्षतक्षयहरं रक्तपित्तप्रसादनम् ।। 121 ।।
स्वादुपाकरसं स्निग्ध विष्टम्भि कफशुक्रकृत् ।।

(अ0 ह्व0 सू0 6)

पनसं तुवरं स्वादु गुरू विष्टम्भि वातलम् ।
.....।। 463 ।।

(कै0 नि0 ओषधि वर्ग.)

पनसं मधुरं सुपिच्छिलं गुरू हृद्य बलवीर्यवृद्धिदम्
श्रमदाहविशोषनाशनं रुचिकृद्ग्राहि च दुर्जरं परम् ।। 33 ।।

(रा0 नि0, आम्रादि वर्ग.)

पनसं शीतलं पक्वं स्निग्धं पित्तानिलापहम् ।। 25 ।।
तर्पणं बृहणं स्वादु मांसलं श्लेष्मलंभृशम् ।
बल्यं शुक्रप्रदं हन्ति रक्तपित्तक्षतव्रणान् ।। 26 ।।
आमं तदेव विष्टम्भि वातलं तुवरं गुरू ।
दाहकृन्मधुरं बल्यं कफमेदो विवर्द्धनम् ।। 27 ।।

(भा0 प्र0, आम्रादिफल वर्ग.)

पर्णयवानी (पत्रम्)

तीक्ष्णा पर्णयवान्युष्णा कटुस्तिक्ता रसे लघुः
दीपनी पाचनी रुच्या मलसंग्राहिणी परम् ।।
अग्निमान्द्ये यकृद्रोगे ग्रहण्यामुदरक्रिमौ ।
विषूचिकायामश्मर्या मूत्रकृच्छ्रे च शस्यते ।।

(द्र0 गु0 वि0 II कृत प्रो0 प्रि0 व्रत शर्मा.)

पत्रस्नुही (क्षीरम्)

पत्रस्नुही च सेहुण्डो वज्री क्षीरयुताऽपि च ।
तत्क्षीरं लघुरूक्षोष्णं तीक्ष्णं तद् दोषभेदनम् ।
अर्शोभगन्दरादीनां कुष्ठानां नाशकं भवेत् ॥ **स्व0** ॥

(डा0 एस0 डी0 कामथ)

रक्त चित्रक (मूल)

चित्रकमूलं दीपनीयपाचनीयगुदशोथार्शःशूलहराणाम् ।

(च0 सू0 25)

छायाशुष्कं ततो मूलं मासं चूर्णीकृतं लिहन् ।
सर्पिषा मधुसर्पिभ्यां पिबन् वा पयसा यतिः ॥ **63** ॥
अम्भसा वा हितान्नाशी शतं जीवति नीरुजः ।
मेधावी बलवान कान्तो वपुष्मान दीप्तपावकः ॥ **64** ॥

(अ0 ह्र0 उ0 39)

कालो व्यालः कालमूलोऽतिदीप्यो
मार्जारोऽग्निर्दाहकः पावकश्च ।
चित्राङ्गोऽयं रक्तचित्रो महाङ्गः
स्याद्व्रह्मश्चित्रकोऽन्यो गुणाढयः ॥ **49** ॥

स्थूलकायकरो रुच्यः कुष्ठघ्नो रक्तचित्रकः ।
रसे नियामको लोहे वेधकश्च रसायनः ॥ **47** ॥

(रा0 नि0 पिप्पल्यादि वर्ग,)

चित्रकः कटुकः पाके वह्निकृत्पाचनो लघुः ॥ **70** ॥
रूक्षोष्णो ग्रहणीकुष्ठशोफार्शःकृमिकासनुत् ।
वातश्लेष्महरो ग्राही वातघ्नः श्लेष्मपित्तहृत् ॥"

(भा0 प्र0 नि0, हरीतक्यादि वर्ग,)

रोहितक (शाखा त्वक्)

रोहीतकलातानां तु काण्डकानभयाजले ॥ **81** ॥
मूत्रे वा सुनुयात्तच्च सप्तरात्रस्थितं पिबेत् ।
कामलागुल्ममेहार्शः प्लीहसर्वोदरक्रिमीन् ॥ **82** ॥
स हन्याज्जोङ्गलरसैर्जीर्णे स्याच्चात्र भोजनम् ।

(च0 चि0 13)

रोहीतकः प्लीहघाती रूच्यो रक्तप्रसादनः ॥ **35** ॥

(भा0 प्र0 नि0, वटादि वर्ग,)

रोहीतको यकृत् प्लीह गुल्मोदरहरः सरः ॥ **120** ॥

(ध0 नि0, आम्रादि वर्ग,)

रोहीतकः कटुस्तिक्तः सरोष्णः कफवातनुत् ॥ **915** ॥
प्लीहोदरयकृद्गुल्ममांसमेदोविषापहः ।
भूतानाहविबधास्रकफशूलरूजापहः ॥

(कै0 नि0, ओषधि वर्ग,)

रोहीतकद्वयं स्निग्धं तुवरं कटुकं मतम् ।
रक्तप्रसादनं तिक्तं शीतलं च सरं मतम् ॥
कृमिप्लीहरक्तदोषव्रणकर्णरूजापहम् ।
विषं नेत्ररूजं गुल्मयकृत्कफविनाशनम् ॥
वातं विबंन्धं मांसं च मेदं शूलं च नाशयेत् ।
आनाहं भूतबाधा च नाशयेदिति कीर्त्तितम् ॥

(नि0 र0)

रोहीतकौ कटुस्निग्धौ कषायौ च सुशीतलौ ।
कृमिदोष व्रण प्लीहरक्तनेत्रामयापहौ ॥ **16** ॥

(रा0 नि0, शाल्मल्यादि वर्ग,)

रोहीतकः सरो गुल्मयकृत् प्लीहोदरापहः ॥

(म0 वि0)

रोहीतको यकृत् प्लीह गुल्मोदरहरः परम् ॥

(सो0 नि0)

शालः (का0 मज्जा.)

शालकट्फल.....इति दशेमानि
वेदनास्थापनानि भवन्ति ॥ **47** ॥

(च0 सू0 4)

लोध्रसावरलोध्र.....शालाः कदली चेति ॥ **14** ॥
एष रोध्रादिरित्युक्तो मेदः कफहरो गणः ।
योनिदोषहरः स्तम्भी वर्ण्यो विषविनाशनः ॥ **15** ॥

(सु0 सू0 38)

असनतिनिश.....शाक शालौ.....छागकर्णाश्वकर्णाः ।
असनादिर्विजयते श्वित्रकुष्ठकफक्रिमीन ।
पाण्डुरोगं प्रमेहं च मेदोदोषनिबर्हणः ॥ **20** ॥

(अ0 ह्र0 सू0 15)

शालः कषायो ग्राहयस्त्रदग्धरूक्कफनिद्धिमः ॥ **809** ॥
कर्णरोगहरो रूक्षो विषहा व्रणशोधनः ।

(कै0 नि0, ओषधि वर्ग,)

शालपर्णी (सं0व0)

ऐन्द्र्यृषभ्यति.....अश्वगन्धा ।
स्थिरा.....इति दशेमानि बल्यानि भवन्ति ।। 7 ।।
(च0 सू0 25) विदारिगन्धा वृष्यसर्वदोषहराणाम् ।। 40 ।।
(च0 सू0 25)

विदारीगन्धा...इति दशेमानि अंगमर्दप्रशमनानि भवन्ति ।। 44 ।।

(च0 सू0 4)

पाटलाग्निमन्थ.....शालपपर्णीपृश्निपर्णीगोक्षुरका
इति दशेमानि श्वयथुहराणि भवन्ति ।। 38 ।।

(च0 सू0 4)

शालिपर्णीबलाबिल्वैः पृश्निपर्ण्या च साधिता ।। 13 ।।
दाडिमम्ला हिता पेया कफपित्ते समुल्बणे ।

(अ0 ह्व0 चि0 9)

शालिपर्णी रसे तिक्ता गुरूष्णा वातदोषजित् ।
विषमज्वरमेहार्शः शोफसन्तापनाशनी ।। 88 ।।

(ध0 नि0, गुडूच्यादि वर्ग.)

शालपर्णी स्वादुतिक्ता वृष्योष्णा बृंहणी गुरुः ।। 45 ।।
रसायनी ज्वरश्वासविषदोषत्रयापहा ।
मेहशोषकृमिच्छर्दिक्षतकासातिसारजित् ।। 46 ।।

(कै0 नि0, ओषधि वर्ग.)

शालपर्णी रसे तिक्ता गुरूष्णा वातदोषजित् ।
विषमज्वरमेहार्शः शोथसंतापनाशिनी ।। 20 ।।

(रा0 नि0, शताह्ववादि वर्ग.)

शालपर्णी गुरुश्छर्दिज्वरश्वासातिसारजित् ।। 32 ।।
शोषदोषत्रयहरी बृंहण्युक्ता रसायनी ।
तिक्ता विषहरी स्वादुः क्षतकासकृमिप्रणुत् ।। 33 ।।

(भा0 प्र0 नि0, गुडूच्यादि वर्ग.)

शालिपर्णीगुरच्छर्द्दिज्वरश्वासातिसारजित् ।
शोषदोषत्रयहरीबृंहण्युक्तारसायनी ।

तिक्ताविषहरीस्वाद्वीक्षतकासकृमिप्रणुत् ।।

(शा0 नि0, गुडूच्यादि वर्ग.)

शमी (पत्रम्)

अर्कमूलं शमीपत्रमर्शोभ्यो धूपनं हितम् **।। 49 ।।**

(च0 चि0 14)

अर्कमूलं शमीपत्रं.....धूपनं हितमर्शसन् **।। 18 ।।**

(अ0 ह्र0 चि0 8)

शम्याः पत्रैर्धूपितं तद्यवैश्च ।
नेत्रेयुक्तं हन्ति सन्धावसंशं .....**।। 35 ।।**

(अ0 ह्र0 उ0 16)

....शम्यामलक पत्राज्यधूपितं शोफलक्प्रणुत **।। 42 ।।**

(अ0 ह0 उ0 16)

शमी तिक्ता कटुः शीता कषाया रेचनी लघुः ।
कफकासभ्रमश्वासकुष्ठार्शःकृमिजित् स्मृता **।। 73 ।।**

(भा0 प्र0 नि0 वटादि वर्ग.)

शमी तिक्ता कट्वनुष्णा कषाया रोचनी लघुः ।
निहन्ति कफकुष्ठार्शः श्वासकास भ्रम कृमीन् **।। 1084-85 ।।**

(कै0 नि0 ओषधि वर्ग.)

शमी रूक्षा कषाया च रक्तपित्तातिसारजित् ।
तत्फलं तु गुरु स्वादु तिक्तोष्णं केशनाशनम् **।। 35 ।।**

(रा0 नि0 शालमल्यादि वर्ग.)

सौरभ निम्ब (पत्रम्)

1. कैडर्य्यः कटुकस्तिक्तः कषायः शीतलो लघुः ।
सन्ताप शोषकुष्ठास्र कृमिभूतविषापहः **।। 14 ।।**

(रा0 नि0,)
(प्रभद्रादि वर्ग.)

2. कैडर्य्यः शीतलस्तिक्तः कटुश्च तुवरो लघुः ।
दाहार्शः कृमिशूलघ्नः सन्तापविषनाशनः **।।**
शोफकण्डू भूतबाधा नाशयेदिति कीर्तितः **।।**

(नि0 र0)

श्लेष्मातक (फलम्)

फलमामंतु विष्टाम्भि रूक्षं पित्तकफास्रजित् ।
तत्पक्वं मधुरं स्निग्धं श्लेष्मलं शीतलं गुरू ।

(भा0 प्र0 नि0)

श्लेष्मातको हिमः स्वादु स्याद् रूक्षः पिच्छिलः शुचिः ॥ **85** ॥

(ध0 नि0, आम्रादि वर्ग,)

हन्ति हयास्य फलं तु शीतमधुरं तिक्तं लघुस्तुवरम् ।
वायोर्वृद्धिकरं च पित्तशमनं विष्टंभि रूच्यं तथा
सृग्दृष्टिं कफनाशनं च गदितं पक्वं तथा माधुरम् ॥
स्निग्धं शीतलबृंहणं निगदितं विष्टंभि रूक्षं गुरू
वायोनाशकरं च पित्तशमनं स्याद्रक्तदोषापहम् ।

(नि0 र0)

श्लेष्मलं मधुरं शीतं श्लेष्मातकफलं गुरू ।

(च0 सू0 27)

फलं तु मधुरं तिक्तं शीतलं वातलं लघु ॥ **615** ॥
कषायं कटुकं पाके ग्राहि पित्तकफास्रजित् ।
तत् पक्वं मधुरं स्निग्धं श्लेष्मलं शीतलं गुरू ॥ **616** ॥

(कै0 नि0, ओषधि वर्ग,)

श्लेष्मातक (शा0 त्वक्)

बहुवारो विषस्फोट व्रणवीसर्पकुष्ठनुत् ।
मधुरस्तुवरस्तिक्तः केश्यश्च कफपित्तहृत् ॥ **106** ॥

(भा0 प्र0 नि0, आम्रादि फल वर्ग,)

श्लेष्मातको हिमः स्वादु रूक्षः पिच्छिलः शुचिः ।

(ध0 नि0, आम्रादि वर्ग,)

श्लेष्मातकः कटुहिमो मधुरः कषायः
स्वादुश्च पाचनकरः कृमिशूलहारी ।
आमास्रदोषमलावरोधबहुव्रणार्त्ति
विस्फोटशान्तिकरणः कफकारकश्च ॥ **20** ॥

(रा0 नि0, आम्रादि वर्ग,)

श्लेष्मातकटुशीतलं च तुवरं स्यात्पाचकं माधुरं
स्निग्धं केश्यवलासदं त्वथ कृमीच्छूलामरक्तापहम् ।
विस्फोट व्रणपित्तनाशनकरं वीसर्पसर्व विषं ॥

(नि0 र0)

शेलुः केश्यः सतिक्तोष्णो मधुरस्तुवरः कटुः ॥ **614** ॥
विषवीसर्पविस्फोटव्रणपित्तकफप्रणुत् ।

(कै0 नि0, ओषधि वर्ग,)

स्पृक्का (सं0 व0)

शैलेय कुष्ठागुरूदारुकौन्ती त्वक्पघ्न कलाम्बु पलाशमुस्तै ।
प्रियंगुथौणेयकहेममांसीतालीशपत्र प्लव पत्रधान्यै ॥ **65** ॥
क्षीवेस्टकध्यामक पिप्पलीभिः स्पृक्का नखैश्चैव यथोपलाभम् ।
वातान्वितेऽभ्यगमुशन्ति तैल सिद्ध सुपिष्टैरपि च प्रदेहम् ॥ **66** ॥

(च0 चि0 12)

एलातगर कुष्ठ.....कुन्दुरूकागुरूस्पृक्काकोशीर भद्र
दारूकुकुमान पुन्नागकेशरं चेति ॥ **24** ॥
एलादिको वातकफौ निहन्याद्विषमेवच ।
वर्णप्रसादनः कण्डू पिडकाकोठनाशनः ॥ **25** ॥

(सु0 सु0 38)

स्पृक्का कटुकषाया च तिक्ता श्लेष्मार्त्तिकासजित् ।
श्लेष्ममेहाश्मरीकृष्छ्र नाशनी च सुगन्धदा ॥ **128** ॥

(रा0 नि0, चन्दनादि वर्ग,)

स्पृक्का स्वाद्वी हिमा वृष्या तिक्ता निखिलदोषनुत् ।
कुष्ठकण्डुविषस्वेददाहघ्नी ज्वरक्तहृत् ॥ **126** ॥

(भा0 प्र0 नि0, कर्पूरादि वर्ग,)

वावृक्ष (फलम्)

नीपं शताह्वकं पीलु तृणशून्यं विकङ्कतम् ।
प्राचीनामलकं चैव दोषघ्नं गरहारि च ॥ 145-146 ॥

(च0 सू0 27)

प्रमेहे- श्रष्टठगाटकगिलोडय.....विकङ्कतेषु वा ।
यवान्नविकारांश्च सेवेत ॥ 10 ॥

(सु0 चि0 11)

हीबेरवैकंकत.....वराङ्गम् ।
पित्तकफानिललूताः पानाञ्जननस्यलेपसेकेन ॥ 85 ॥

(अ0 ह्र0 उ0 37)

ुवद्रुर्मघुरस्तिक्तः कषायः शीतलो जयेत् ।
बलासपित्तशोफास्रं फलं पाकरसोषणम् ॥ 406 ॥

तीक्ष्णं पित्तास्रकृत् पक्वं स्वादु तिक्तं त्रिदोषजित्

(कै0 नि0, ओषधि वर्ग.)

विकङ्कतोऽम्लमधुरः पाकेऽतिमधुरो लघुः ।
दीपनः कामलास्रघ्नः पाचनः पित्तनाशनः ॥ 155 ॥

(रा0नि0, प्रभद्रादिवर्ग.)

विकङ्कतफलं पक्वं मधुरं सर्वदोषजित् ॥ 88 ॥

(भा0 प्र0 नि0, आम्रादिफलवर्ग.)

स्थूलएला (फलम्)

स्थूलैला रोचनी तीक्ष्णा लघूष्णा कफपित्तजित् **॥ 25 ॥**
हृल्लासविषबस्त्यास्यशिरोरुग्वमिकासनुत् **॥ 26 ॥**

(म0 नि0, कर्पूरादि वर्ग.)

एला तिक्ता च लघ्वी स्यात्कफवातविषव्रणान् ।
बस्तिकण्डुरुजो हन्ति मुखमस्तकशोधिनी **॥ 47 ॥**

(ध0 नि0, शतपुष्पादि वर्ग.)

भद्रैला कटुका पाके रसे पित्ताग्निकृत् लघुः **॥ 1343 ॥**
रूक्षोष्णा रोचनी कासकफवातास्रश्वासहा ।
हन्ति हृल्लासतृट्कण्डूशिरोवस्त्यास्यरुग्वमीः **॥ 1344 ॥**

(कै0 नि0, ओषधि वर्ग.)

एलाद्वयं शीतलतिक्तमुक्तं सुगन्धि पित्तार्तिकफापहारि ।
करोति हृद्रोगमलात्तिबस्तिशूलघ्नमत्र स्थविरा गुणाढया **॥ 87 ॥**

(रा0 नि0, पिप्पल्यादि वर्ग.)

स्थूलैला कटुका पाके रसे चानलकृत् लघुः ।
रूक्षोष्णा श्लेष्मपित्तास्रकण्डूश्वासतृषाऽपहा ।
हृल्लासविषबस्त्यास्यशिरोरुक्वमिकासनुत् **॥ 62 ॥**

(भा0 प्र0 नि0, कर्पूरादि वर्ग.)

शुकनासा (प्रकन्द)

अतः सर्वेषामेव द्रव्याण्युपदेक्ष्यामः ।
तद्यथा-पिप्पल्यादिः सुरसादिः.....
.....शुकनासा पीलुप्रभृतीनि सालसारादिश्च
प्रायशः कटुको वर्गः ॥ **11** ॥

(सु0 सू0 42)

तिक्तः कन्दो विरेकी च शोथघ्नो वामकः स्मृतः ।
विषघ्नः पानलेपाभ्यां शिम्बी तिक्ता च तुवरा ॥

(शो0)

विषे-
शुकनासाप्रतिविषाव्याघ्रीमूलैश्च लेपयेत् ॥ **47** ॥

(अ0 ह्र0 उ0 35)

श्वेतवेतस (पत्रम्)

वेतसस्य द्वयं शीतं रक्षोघ्नं व्रणशोधनम् ।
रक्तपित्तहरं तिक्तं सकषायं कफापहम् ॥ **108** ॥

(ध0 नि0 आम्रादि वर्ग.)

तक्कोल (फलम्)

सुरभिः स्वादु तक्कोलं दीपनं पाचनं च तत् ।
कफघ्नं रोचनं हृद्यं गुल्मशूलादिनाशनम् ॥ **स्व0** ॥

(इं0 मे0 प्लँ कृत कोट्टाक्कल,)

तिन्दुक (फलम्)

तिन्दुकप्रियाल.....सप्तपर्णाश्वकर्णार्जुनासनारिमेदा
इति दशेमान्युदर्दप्रशमनानि भवन्ति ॥ **43** ॥

(च0 सू0 4)

तिन्दुकमनन्नद्रव्यरुचिकराणाम ॥ **40** ॥

(च0 सू0 25)

तिन्दुकं कफपित्तघ्नं कषायं मधुरं लघु ॥ **147** ॥

(च0 सू0 27)

न्यग्रो धोदुम्बराश्वत्थप्लक्ष बदरीतिन्दुकी....नन्दीवृक्षश्चेति ॥ **48** ॥

न्यग्रोधादिर्गणो व्रण्य संग्राही भग्नसाधकः ।

रक्तपित्तहरो दाहमेदोघ्नो योनिदोषहृत् ॥ **49** ॥

(सु0 सू0 38)

आमं कषायं संग्राहि तिन्दुकं वातकोपनम् ।
विपाके गुरु संपक्वं मधुरं कफपित्तजित् ॥ **168** ॥

(सु0 सू0 46)

आमं कषायं संग्राहि तिन्दुकं वातकोपनम् ।
विपाके गुरु संपक्वं मधुरं कफपित्तजित् ॥ **36** ॥

(ध0 नि0, आम्रादिवर्ग,)

आमं चास्य फलं स्वादु कषायं लेखनं लघु ।
संग्राहि शीतलं रूक्षं विबन्धाऽ रुचिवातकृत् ॥ **402** ॥
पक्वं बलास पित्तघ्नं स्वादुपाकरसं गुरु ।

(कै0 नि0, ओषधि वर्ग,)

तिन्दुकस्तु कषायः स्यात् संग्राही वातकृत्परः ।
पक्वस्तु मधुरः स्निग्धो दुर्जरः श्लेष्मलो गुरुः ॥ **78** ॥

(रा0 नि0, आम्रादि वर्ग,)

स्यादामं तिन्दुकं ग्राहि वातलं शीतलं लघु ॥
पक्वं पित्तप्रमेहास्रश्लेष्मघ्नं मधुरं गुरु ॥ **65** ॥

(भा0 प्र0 नि0, आम्रादिफलवर्ग,)

आमं चास्यफलं स्निग्धं कषायं लेखनं लघु ।
संग्राहि शीतलं रूक्षं विबन्धारुचिवातकृत् ॥
पक्वं पित्तप्रमेहास्रहयश्मघ्नं मधुरं गुरु ।
स्वादु पाकरसं स्निग्धं दुर्जरं वातनाशकम् ॥

(शा0 नि0, फल वर्ग.)

त्रायमाणा (प्रकन्द)

त्रायन्ती तुवरा तिक्ता सरा पित्तकफापहा ।
ज्वरह्रद्रोग गुल्मार्शोभ्रमशूलविषप्रणुत् ॥ **243** ॥

(भा0 प्र0 नि0, गुडुच्यादि वर्ग,)

त्रायन्ती कफपित्तास्रगुल्मज्वरहरा मता ।
उष्णा कटु कषाया च सूतिकाशूलनाशिनी ॥ **247** ॥

(ध0 नि0, गुडुच्यादि वर्ग,)

त्रायन्ती तुवरा तिक्ता सरा पित्तकफापहा ।
ज्वरह्रद्रोग गुल्मार्शो भ्रमशूलविषप्रणुत् ॥ **1031** ॥

(कै0 नि0, ओषधि वर्ग,)

त्रायन्ती कफपित्तास्रगुल्मज्वरहरा सरा ।

(सो0 नि0)

तुवरक (बीजम्)

आरूष्करं तौवरकं कषायं कटुपाकि च ।
उष्णं कृमिज्वरानाहमेहोदावर्तनाशनम् ॥ **196** ॥

(सु0 सू0 46)

तुवरकभल्लातकतैले उष्णे मधुर कषाये तिक्तानुरसे
वातकफकुष्ठमेदोमेहकृमिप्रशमने उभयतोभागदोषहरे च ॥ **122** ॥

(सु0 सू0 45)

तौवरं कटुकं पाके कषायोष्णं कफापहम् ॥ **504** ॥
कृमिकुष्ठज्वरानाहमेह्यर्शोव्रणशोफजित् ।

(कै0 नि0, ओषधि वर्ग,)

ऊषन्दी (सं0 व0)

ऊषन्द्रयां भिस्सटा प्रोक्ता तडागमृत्तिकोद्भवा ।

(सो0 नि0 696)

वज्रान्न (पत्रवृन्त)

वज्रान्नं मधुरं रूक्षमुष्णं बल्यं च दुर्जरम् ।
वातपित्तकरं पुंस्त्वहरमग्नि प्रदीपनम् ॥

(द्र0 गु0 वि0-कृत प्रो0 प्रि0 व्र0। शर्मा)

वेत्र (प्रकन्द)

मण्डूकपर्णी वेत्राग्रं कुचेला वनतिक्तकम् ।
कर्कोटकावल्गुजकौ पटोलं शकुलादनी ।

वृषपुष्पाणि शार्ङ्गेष्टा केम्बुकं सकटिल्लकम् ॥ **96** ॥
नाडी कलायं गोजिह्वा वार्ताकं तिलपर्णिका ।
कौलकं कार्कशं नैम्बं शाकं पार्पटकं च यत् ॥
कफपित्तहरं तिक्तं शीतं कटु विपच्यते ।

(च0 सू0 27)

आटरूषकवेत्राग्रगुडूचीनिम्बपर्पटाः ।
किराततिक्तिसहितास्तिक्ताः पित्तकफापहाः ॥ **270** ॥

(सु0 सू0 46)

शीतं विपाके कटुकं कृमिघ्नं तिक्तं लघुग्राहि निहन्ति पित्तम् ।
मेहं बलासं च करोति वातं वेत्राग्रमुक्तं रुचिकृद् विशेषात् ॥ **1252** ॥

(कै0 नि0, ओषधि वर्ग,)

वेतसः शीतलो दाहशोथार्शोयोनिरुक्प्रणुत् ।
हन्ति वीसर्प कृच्छ्रास्रपित्ताश्मरिकफानिलान् ॥ **136** ॥

(भा0 प्र0 नि0, गुडूच्यादि वर्ग,)

वेत्रस्तु तुवरः शीतः तिक्तः कटु कफापहः ।
वातं पित्तं च दाहञ्च शोफर्शोऽश्मरिकृच्छ्राकान् ॥
विसर्पातिसारं रक्तं योनिरोगं तृषां जयेत् ।
रक्तदोषं व्रणं मेहं रक्तपित्तञ्च कुष्ठकम् ॥
विषं वै नाशयत्येवांकुराः क्षारो लघुः स्मृतः ।
कटूष्णः कफवातघ्नः पर्ण भेदकरं मतम् ॥
तुवरं लघुशीतञ्च तिक्तं कटुच वातलम् ।
रक्तदोषं कफं पित्तं नाशयेदिति कीर्त्तितम् ॥

(नि0 र0)

विषानिका (सं0 व0)

करम्भा कर्कशा द्रोणी दीर्घवृन्तोत्तमारणी ।
इन्दीवरा युग्मफला सुश्रेणी नलिका मता ॥

(कै0 नि0)

उत्तमारणिका शीता कषाया व्रणशोधनी ।
जयेद् दद्रूमूत्रकृच्छ्रगर्भयोनिरूजानिलान् ॥
शाकमुत्तमवारूण्या उष्णवीर्यं सतिक्तकम् ।
अर्शःकुष्ठकृमिहरं कफवातविनाशनम् ॥
फलमुत्तमवारूण्या सक्षारं दीपनं लघु ।
कटुष्णं तिक्तविशदं कफघ्नं पित्तकोपनम् ॥ **804** ॥

(कै0नि0, ओषधि वर्ग.)

इन्दीवरा युग्मफला दीर्घवृत्तोत्तमारणी ।

पुष्पमञ्जरिका द्रोणी नलिका च सा ॥

(रा0 नि0)

इन्दीवरा कटुः शीता पित्तश्लेष्मापहारिका ।
चक्षुष्या कासदोषघ्नी व्रणकृमिहरा परा ॥

(रा0 नि0)

दद्रुघ्ना मूत्रकृच्छ्रघ्नी कषाया व्रणशोधनी ।
गर्भघ्नी योनिशूलघ्नी कफघ्नी चोत्तमारणी ॥

(म0 नि0)

क्षेत्रज्ञभूषा ज्वरजिद्वातघ्नी शोफनाशिनी ।

(Ø0 ÉÊ|É0)

उत्तरिणी तु कटुका शीता नेत्र्या लघु स्मृता ।
उष्णा स्निग्धा सारका च तुवरा व्रणरोपणी ॥
कासव्रणकृमिश्वासज्वरपित्तप्रमेहकान् ।
कफकुष्ठप्रलापांश्च वातं तन्द्रां च दद्रुकम् ॥
क्षयकासं मूत्रकृच्छ्रं योनिरोगं च शोथकम् ।
नाशयेदिति संप्रोक्ता सुखप्रसवकारिणी ॥

(नि0 र0)

दालचीनी(तैलम्)

वराङ्गं लघु तीक्ष्णोष्णं कफवातविषापहम् ।
कण्ठ वक्त्ररुजो हन्ति शिरोहृद् बस्तिशोधनम् ॥५१॥

(ध०नि०,शतपुष्पादि वर्ग.)

वराङ्गं कटुकं तिक्तं तीक्ष्णोष्णं मधुरं लघु ।
पित्तलं कफवातघ्नं हृदबस्तिगदजन्तुजित् ॥१३३७॥
पीनसारुचिककण्ड् वामवातदुर्नामशुक्रहृत् ।

(कै०नि०, ओषधि वर्ग.)

वह्निमान्द्यानिलहरमाध्यानाक्षेपनाशनम् ।
वान्त्युत्क्लेशप्रशमनंसंग्राहिदशनार्तिहृत् ॥
त्वाचंतैलंरजः स्रावितोयेक्षिप्तंनिमज्जति ।

(आ०सं०)
(आत्रेय संहिता)

उक्ता दारुसिता स्वाद्वी तिक्ताचनिलपित्तहृत् ।
सुरभिः शुक्रलाबल्या मुखशोषतृषापहा ॥६७॥

(भा०प्र०नि०, कर्पूरादि वर्ग.)

गोघृत

सर्पिर्वातपित्तप्रशमनानाम् ॥४०॥

(च०सू० २५)

विपाके मधुरं शीतं वातपित्तविषापहम् ।
चक्षुष्यमग्र्यं बल्यं च गव्यं सर्पिर्गुणोत्तरम् ॥९७॥

(सू०सू० ४५)

शस्तं धीस्मृतिमेधाग्निबलायुःशुक्रचक्षुषाम् ।
बालवृद्धप्रजाकान्तिसौकुमार्यस्थिरार्थिनाम् ॥१३५॥
क्षतक्षीणपरीसर्पशस्त्राग्निग्लपितात्मनाम् ।
विपाके मधुरं शीतं वातपित्तविषापहम् ॥१३६॥
चक्षुष्यं बल्यमग्रयंञ्च गव्यं सर्पिर्गुणोत्तरम् ।

(ध०नि०, सुवर्णादिवर्ग.)

गव्यं सर्पिः स्वादु पाके वातपित्तकफापहम् ।
वृष्येष्वग्र्यं परं बल्यं घृतश्रेष्ठं त्रिदोषजित् ॥२७१॥

(कै०नि०, घृतवर्ग.)

धीकान्तिस्मृतिदायकं बलकरं मेधाप्रदं पुष्टिकृत् ।
वातश्लेष्महरं श्रमोपशमनं पित्तापहं हृद्यम् ॥
वह्नेर्वृद्धिकरं विपाकमधुरं वृष्यं वपुः स्थैर्य्यदं ।
गव्यं हव्यतमं घृतं बहुगुणं भोग्यं भवेद्भाग्यतः॥७७॥

(रा०नि०, क्षीरादिवर्ग.)

गव्यं घृतं विशेषेण चक्षुष्यं वृष्यमग्निकृत ।
स्वादुपाककरं शीतं वातपित्तकफापहम् ॥४॥
मेधालावण्यकान्त्योजस्तेस्तजोवृद्धिकरं परम् ।
अलक्ष्मीपापरक्षोघ्नं वयसः स्थापकं गुरु ॥५॥
बल्यं पवित्रमायुष्यं सुमङ्गल्यं रसायनम् ।
सुगन्धं रोचनं चारु सर्वाज्येषु गुणाधिकम् ॥६॥

(भा०प्र०नि०, घृतवर्ग.)

गुड

प्रभूतक्रिमिमज्जासृङ्मेदो मांसकरो गुडः ॥ **237** ॥

(**च0 सू0 27**)

गुडः सक्षारमधुरो नातिशीतः स्निग्धो मूत्ररक्तशोधनो ।
नातिपित्त जिद्वातघ्नो मेदः कृमिकफकरो बल्यो वृष्यश्च ॥
पित्तघ्नो मधुरः शुद्धो वातघ्नोऽसृक्प्रसादनः ।
सपुराणोऽधिकगुणो गुडः पथ्यतमः स्मृतः ॥ **161** ॥

(**सु0 सू0 45**)

प्रभूतकृमिमज्जासृङ्मेदोमांसकफोऽपरः ।
हृद्य पुराणः पथ्यश्च नवः श्लेष्माग्निसादकृत् ॥ **48** ॥

(अ0 हृ0 5)

गुडः स्यादिक्षुरसाश्च मधुरो रसपाकजः
गुडः समधुरः क्षारो गुरुष्णः कफवातनुत्
अहितः पित्तरक्ते च जीर्णश्चैव रसायनः ।

(ध0 नि0 करवीरादि वर्ग.)

नवोऽधौतो गुडः स्वादुः सक्षारः सारको गुडः ।
वातपित्ताग्निकृत् स्निग्धो मूत्ररक्तविशोधनः ॥ **166** ॥
मेदोमांसकृमिश्लेष्ममज्जास्रबलशुक्रकृत् ।
नातिश्लेष्मकरो धौतो वातघ्नोऽसृक्प्रसादनः ॥ **167** ॥
स्वादुपाकरसः स्निग्धः शकृन्मूत्रानुलोमनः ।
जीर्णः स्वादु पथ्यहृद्यो नाभिष्यन्द्यग्निकृल्लघुः ॥ **168** ॥
प्रपुराणो वरस्तस्यात्सर्वरोगहरो लघुः ।
संवत्सरोषितगुडः पुराण इति कथ्यते ॥ **169** ॥
वर्षत्रयोषितः सोऽपि प्रपुराणः प्रकीर्तितः ।
अरिष्टाद्येषु सर्वेषु प्रपुराणं प्रयोजयेत् ॥ **170** ॥

(कै0 नि0 ओषधि वर्ग.)

गुडः स्यादिक्षुरसास्तु मधुरो रसपाकजः ।
शिशुप्रियः सितादिः स्यादरूणो रसज स्मृतः ॥ **100** ॥

पित्तघ्नः पवनार्तिजिद्रुचिकरो हृद्यस्रिदोषापहः
संयोगेन विशेषतो ज्वरहरः सन्तापशान्तिप्रदः ।
विण्मूत्रामयशोधनोऽग्निजननः पाण्डुप्रमेहान्तकः
स्निग्धः स्वादुतरो लघुः श्रमहरः पथ्यः पुराणो गुडः ॥ **10** ॥

(रा0 नि0, पानीयादि वर्ग.)

गुडो वृष्यो गुरूः स्निग्धो वातघ्नो मूत्रशोधनः
नातिपित्तहरो मेदः कफक्रिमिबलप्रदः ॥ **25** ॥
गुडो जीर्णो लघुः पथ्योऽनभिष्यन्द्यग्निपुष्टिकृत् ।
पित्तघ्नो मधुरो वृष्यो वातघ्नोऽसृक्प्रसादनः ॥ **26** ॥
गुडो नवः कफश्वासकासक्रिमिकरोऽग्निकृत् ॥ **27** ॥

(भा0 प्र0 नि0, इक्षुवर्ग.)

जलम्

साधारणं जलं रुच्यं दीपनं पाचनं लघु ।
श्रमतृष्णापहं वातकफमेदोघ्नपुष्टिदम् ॥२७५॥
पानीयं मधुरं हिमं च रुचिदं तृष्णास्यशोषापहम् ।
मोहभ्रान्तिपाकरोति कुरुते भुक्तन्नपत्ति पंराम् ॥
निद्रालस्यनिरासनं विषहरं भ्रान्तार्तसंतर्पणम् ।
नृणां धीबलवीर्यबुद्धिजननं नष्टाङ्ग पुष्टिप्रदम् ॥२७६॥
(ध०नि०,सुवर्णादि वर्ग)

पानीयं शीतलं रुच्यं शुच्यव्यक्तरसं लघु ॥३॥
अस्यन्दि विशदं हृद्यं मरूक्षं विनियच्छति ।
दाहपित्तास्रमूर्च्छोष्मदच्छर्दिविषश्रमान् ॥४॥
मदात्ययतृषाग्लानिविदग्धतमकभ्रमान् ।
(कै०नि०,द्रववर्ग)

साधारणं जलं रुच्यं दीपनं पाचनं लघु ।
श्रमतृष्णापहं वातकफमेदोघ्नपुष्टिदम् ॥४५॥
(रा०नि०,पानीयादि वर्ग.)

पानीयं श्रमनाशनं क्लमहरं मूर्च्छापिपासापहं-
तन्द्राच्छर्दिविबन्धहृद् बलकरं निद्राहरं तर्पणम् ।
हृद्यं गुप्तरसं हयजीर्णशमकं नित्यं हितं शीतलं-
लघ्वच्छं रसकारणं निगदितं पीयूषवज्जीवनम् ॥२॥
(भा०प्र०नि०,वारिवर्ग.)

कर्पूर (निर्यास)

सतिक्तः सुरभिः शीतः कर्पूरो लघु लेखनः ॥२०३॥
तृष्णायां मुखशोषे च वैरस्ये चापि पूजितः
(सु०सू०४६)

कपूरं कटुतिक्तं च मधुरं शिशिरं विदुः ।
तृण्मेदोविषदोषघ्नं चक्षुष्यं मदकारकम्॥३०॥
(ध०नि०, चन्दनादिवर्ग.)

कर्पूरो मधुरस्तिक्तः सुरभिः शीतलो लघुः ॥१२७८॥
चक्षुष्यो लेखनो वृष्यः कफमेदोविषापहः ।
दाहतृष्णास्यवैरस्यमलदौर्गन्ध्यनाशनः ॥१२७९॥
(कै०नि०,ओषधिवर्ग.)

कर्पूरो नूतनस्तिक्तः स्निग्धश्चोष्णोऽस्रदाहदः ।
चिरस्थो दाहदोषघ्नः स धौतः शुभकृत्परः ॥६३॥
(रा०नि०,चन्दनादिवर्ग.)

कर्पूरः शीतलो वृष्यश्चक्षुष्यो लेखनो लघुः ।
सुरभिर्मधुरस्तिक्तः कफपित्तविषापहः ॥२॥
दाहतृष्णाऽस्यवैरस्यमेदोदौर्गन्ध्यनाशनः ।

(भा०प्र०नि०, कर्पूरदिवर्ग.)

लवंग (पुष्प कलिका)

धार्याण्यास्येन वैशद्यरुक्षिसौगन्ध्यमिच्छिता ॥७६॥
जातीकटूकापूगानां लवंङ्गस्य फलानि च ।

(च०सू० ५)

जातीकोशोऽथ् कर्पूरं जातीकटुकयो फलम् ।
कक्कोलकं लवंङ्ग च तिक्तं कटु कफापहम् ॥२०२॥
लघु तृष्णापहं वक्रक्लेददौर्गन्ध्यनाशनम् ।

(सू०सु० ४६)

लवङ्ग कुसुमं हृद्यं शीतलं पित्तनाशनम् ।
चाक्षुष्यं विषहृत वृष्यं माङ्गल्यं मूर्धरोगहत् ॥४०॥

(ध०नि०, चन्दनादिवर्ग.)

लवङ्गं कटुकं तिक्तं रुक्षं हृद्यं हिमं लघु ।
चक्षुष्यं पाचनं हन्ति शूलानाहक्षतक्षयान् ॥१३३४॥
कफपित्तास्रतृट्कासश्वासाध्माविषपीनसान् ।

(कै०नि०, ओषधिवर्ग.)

लवङ्.गं सोष्णकं तीक्ष्णं विपाके मधुरं हिमम् ।
वातपित्तकफामघ्नं क्षयकासास्रदोषनुत् ॥८४॥

(रा०नि०,चन्दनादिवर्ग.)

लवङ्गं कटुकं तिक्तं लघु नेत्रहितं हिमम् ॥५८॥
दीपनं पाचनं रुच्यं कफपित्तास्रनाशकृत् ।
तृष्णां छर्दि तथाऽऽध्मानं शूलमाशु विनाशयेत् ।
कासं श्वासञ्च हिक्काञ्च क्षयं क्षपयति ध्रुवम् ॥५९॥

(भा०प्र०नि०, कर्पूरादिवर्ग.)

मधु

वातलं गुरु शीतं च रक्तपित्तकफापहम् ।
सन्धातृ च्छेदनं रूक्षं कषायमधुरं मधु ॥२४५॥

(च०सू० २७)

मधु तु मधुरं कषायानुरसं रूक्षं शीतमग्निदीपनं वर्ण्यं स्वर्यं

लघु सुकुमारं लेखनं हृद्यं वाजीकरणं सन्धानं शोधनं रोपणं (संग्राहि)
चक्षुष्यं प्रसादनं सूक्ष्ममार्गानुसारि
पित्तश्लेष्ममेदोमेहहिक्काश्वासकासातिसारच्छर्दितृष्णा
कृमिविषप्रशमनं ह्लादि त्रिदोषप्रशमनं च तत्तु लघुत्वात्
कफघ्नं पैच्छिल्यान्माधुर्यात् कषायभावाच्च वातपित्तघ्नम् ॥१३२॥

(सु०सू० ४५)

कषायनुरसं रूक्षं शीतलं मधुरं मधु ।
दीपनं लेखनं बल्यं व्रणरोपणमुत्तमम् ॥२१७॥
सन्धानं लघु चक्षुष्यं स्वर्यं हृद्यं त्रिदोषनुत् ।
छर्दिहिक्काविषश्वासकासशोषातिसारजित् ॥२१८॥
रक्तपित्तहरं ग्राहि कृमितृणमोहहत्परम् ।

(ध०नि० सुवर्णादि वर्ग.)

मधु स्वादु हिमं रूक्षं कषायानुरसं लघु ।
दीपनं ग्राहि चक्षुष्यं स्वर्यं वर्ण्यं विलेपनम् ॥१७५॥
सौकुमार्यकरं वृष्यं हृद्यं स्त्रोतोविशोधनम् ।
सूक्ष्मं मेधाकरं छेदि व्रणशोधनरोपणम् ॥१७६॥
विशदं रोचनं ह्लादि प्रसादजननं जयेत् ।
मेदःपित्तकफश्वासहिध्ममेहवमिक्षयान् ॥१७७॥
दोषत्रयातिसारास्रतृष्णादाहविषकृमीन् ।
कुष्ठार्शोरक्तपित्तघ्नं योगवाहि च वातलम् ॥१७८॥
वातलं वातकोपेऽपि वर्षासु मधु शस्यते ।

(कै०नि०, ओषधिवर्ग.)

नवं मधु भवेत् स्थौल्यं नातिश्लेष्मकरं परम्।
देहस्थौल्यापहं ग्राहि पुराणं मधु लेखनम् ॥१३१॥

(रा०नि०, पानीयादिवर्ग.)

मधु शीतं लघु स्वादु रूक्षं ग्राहि विलेखनम् ।
चक्षुष्यं दीपनं स्वर्यं व्रणशोधनरोपणम् ॥२॥
सौकुमार्यकरं सूक्ष्मं परं स्त्रोतोविशोधनम् ।
कषायानुरसं ह्लादि प्रसादजनकं परम् ॥३॥
वर्ण्य मेधाकरं वृष्यं विशदं रोचनं हरेत् ।
कुष्ठार्शः कासपित्तास्रकफमेहक्लमक्रिमीन् ॥४॥
मेदस्तृष्णावमिश्वासहिक्काऽतीसारविड्ग्रहान् ।
दाह क्षतक्षयांस्ततु योगवाह्यल्पवातलम् ॥५॥

(भा०प्र०नि०, मधुवर्ग.)

शीतंकषायंमधुरं लघुस्यत्संदीपनंलेहनमेवशस्तम् ।
संशोधनंवाव्रणशोधनञ्चसंरोपणं हृद्यंतमञ्चबल्यम् ॥
त्रिदोषनाशंकुरुतेचपुष्टिंकासक्षयेवाक्षतजेचछर्द्याम् ।
हिक्काभ्रमेशोषणपीनसानांरक्तंप्रमेहेश्वसनेतिसारे ।
रक्तातिसारेचसररक्तपित्तेतृण्मोहहृत्पार्श्वगदेऽपिशस्तः।

नेत्रामयेवाग्रहणीगदेवाविषप्रशस्तंमधुह्यल्पवातलम् ॥

(शा०नि०, मधुवर्ग.)

पूतिहा(मेन्था तैलम्)

पुदिनस्तुगुरुः स्वादूरुच्योह्यद्यः सुखावहः
मलमूत्रस्तम्भकरः कफकासमदापहः ॥
अग्निमांद्यविसूचिघ्नः संग्रहण्यतिसारहा ।
जीर्णज्वरं कुमीश्चैवनायेदितिकीर्तितम् ॥

(नि० र०)

अरोचवैरस्यकृद् वमिक्रिमिप्रभञ्जनश्लेष्मगदप्रभञ्जनः ।
रूक्षस्तयोष्णः सुरभि रजः प्रद पोदीनकः कल्कविधौप्रशस्यते ॥

(सि०भै०म०)

पूतिहा कटुरुष्णश्च रोचनो दीपनो लघुः ।
हन्ति वातकफाध्मानशूलच्छर्दिकृमीस्तथा ॥स्व०॥

(द्र०गु०वि० कृत प्रो०प्रि०व्रत शर्मा)

रोचनी वह्निजननी वक्त्रजाडयनिषूदनी ।
कफवातहरी बल्या छर्द्यरोचकवारिणी ॥

(आ०वि०)

शर्करा

वृष्या क्षीणक्षतहिता सस्नेहागुडशर्करा ।
तृष्णासृक्पित्तदाहेषु प्रशस्ताः सर्वशर्कराः॥२४१॥

(च०सू० २७)

शर्करा शीतवीर्या तु सर्वदाहविनाशनी ।
रक्तपित्तप्रशमनी छर्दिमूर्च्छातृषापहा ॥१०२॥

(ध०नि०, शतपुष्पादिवर्ग.)

शर्करा वातपित्तासृड्मृर्च्छाच्छर्दिविषापहा ।

द्र०सं० (चक्रपाणिदत्तकृत्)

शर्कराशीतवीर्य्याचविपाकेमधुरासरा ।
दाहतृटछर्द्दिमूर्च्छास्रकृमिकोपविनाशिनी ॥

(शा०नि०, इक्षुवर्ग.)

सिता सुमधुरा रुच्या वातपित्तास्रदाहहृत् ।

मूर्च्छाच्छर्दिज्वरान्हन्ति सुशीता शुक्रकारिणी ॥३०॥

(भा०प्र०नि०, इक्षुवर्ग.)

सर्षप (तैलम्)

कटूष्णं सार्षपं तैलं रक्तपित्तप्रदूषणम् ।
कफशुक्रानिलहरं कण्डूकोठविनाशनम् ॥२९०॥

(च०सू० २७)

कृमिघ्नं सार्षपं तैलं कण्डूकुष्ठापहं लघु ।
कफमेदोनिलहरं लेखनं कटु दीपनम् ॥११७॥

(सु०सु० ४५)

सर्षपतैलं तिक्तं कटुकोष्णं वातकफविकारघ्नम् ।
पित्तास्रदोषदं क्रिमिकुष्ठघ्नं तिलजवच्च चक्षुष्यम् ॥११०॥

(रा०नि०, क्षीरादिवर्ग.)

दीपनं सार्षपं तैलं कटुपाकरसं लघु ।
लेखनं स्पर्शवीर्य्योष्णं तीक्ष्णं पित्तास्रदूषकम् ॥१३॥
कफमेदोऽनिलार्शोघ्नं शिरः कर्णामयापहम् ।
कण्डूकुष्ठकृमिश्वित्रकोठदुष्टक्रिमिप्रणुत् ॥१४॥

(भा०प्र०नि०, तैलवर्ग.)

तिल(तैलम्)

कषायानुरसं स्वादु सूक्ष्ममुष्णं व्यवायि च ।
पित्तलं बद्धविण्मूत्रं न च श्लेष्माभिवर्धनम् ॥२८६॥
वातघ्नेषूत्तमं बल्यं त्वच्यं मेधाग्निवर्धनम् ।
तैलं संयोगसंस्कारात्सर्वरोगापहं मतम् ॥२८७॥
तैलप्रयोगादजरा निर्विकारा जितश्रमाः ।
आसन्नतिबलाः संख्ये दैत्याधिपतयः पुरा ॥२८८॥

(च०सू० २७)

तैलं त्वाग्नेयमुष्णं तीक्ष्णं मधुरं मधुरविपाकं
बृंहणं प्रीणनं व्यवायि सूक्ष्मं विशदं गुरू सरं विकासि
वृष्यं त्वक्प्रसादनं मेधामार्दवमांसस्थैर्यवर्णबलकरं चक्षुष्यं
बद्धमूत्रं लेखनं तिक्तकषायानुरसं पाचनमनिलबलासक्षयकरं
क्रिमिघ्नमशितपित्तजननं योनिशिरःकर्णशूलप्रशमनं गर्भाशयशोधनं
च, तथा छिन्नभिन्नविद्धोत्पिष्टच्युतमथितक्षतपिच्छितभग्न-
स्फुटितक्षाराग्निदग्धविश्लिष्टदारिताभिहतदुर्भग्नमृगव्यालविदष्टप्रभूतिषुच परिषेकाभ्यङ्गावगाहादिषु तिलतैलं प्रशस्यते ॥११२॥

(सु०सू० ४५)

स्नानाभ्यङ्गावगाहेषु तिलतैलं विशिष्यते ।
तद्वस्तिषु च पानेषु नस्यकर्णाक्षिपूरणे ॥११४॥
अन्नपानविधौ वाऽपि प्रयोज्यं वातशान्तये ।
छिन्नभिन्नच्युतोत्पिष्टमथिक्षतपातिते ॥११५॥
भग्ने स्फुटितविद्धाग्निदग्धविश्लिष्टदारिते ।
भयाभिहतनिर्भुग्ने मृगव्यालादिभक्षिते ॥११६॥
तैलयोगश्च संस्कारात्सर्वरोगापहो मतः।

(ध०नि०, सुवर्णादिवर्ग.)

तिलतैलं गुरु स्थैर्यबलवर्णकरं सरम् ।
वृष्यं विकाशि विशदं मधुरं रसपाकयोः ॥२॥
सूक्ष्मं कषायानुरसं तिक्तं वातकफापहम् ।
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दीपनं बुद्धिदं मेध्यं व्यवायि व्रणमेहनुत् ॥४॥
श्रोत्रयोनिशिरःशूलनाशनं लघूताकरम् ।
त्वच्यं केश्यं च चक्षुष्यमभ्यङ्गे भोजनेऽन्यथा ॥५॥
छिन्नभिन्नच्युतोत्पिष्टमथितक्षतपिञ्चिते ।
भग्नस्फुटितविद्धाग्निदग्धविश्लिष्टदारिते ॥६॥
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बस्तौ पानैश्छन्नसंस्कारे नस्ये कर्णाक्षिपूरणे ॥
सेकाभ्यङ्गावगाहेषु तिलतैलं प्रशस्यते ॥७॥

(भा०प्र०नि०, तैलवर्ग.)

तिलतैलमलङ्करोति केशं मधुरं तिक्तकषायमुष्णतीक्ष्णम् ।
बलकृत्कफवातजन्तुखर्जूव्रणकण्डूतिहरं च कान्तिदायि ॥१०९॥

(रा०नि०, क्षीरादिवर्ग.)

यवानी(सत्व)

यवानी कटुतिक्तोष्णा वातश्लेष्मविषामयान् ॥९२॥
हान्ति गुल्मोदरं शूलं दीपयत्याशु चानलम् ।

(ध० नि०, शतपुष्पादिवर्ग.)

यवानी कटुका तिक्ता तीक्ष्णोष्णा रोचनी लघु ॥१२०४॥
दीपनी पाचनी हृद्या कफशुक्रनिलापहा ।
कृमिशूलोदरानाहगुल्मघ्नी पित्तकोपनी ॥१२०५॥

(कै०नि०, ओषधिवर्ग.)

यवानी कटुतिक्तोष्णावातार्शः श्लेष्मनाशिनी ।
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(रा०नि०, पिप्पल्यादिवर्ग)

यवानीपाचनीरुच्यातीक्ष्णोष्णाकटुकालघुः ॥७६॥
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(भा०प्र०नि०, हरीतक्यादिवर्ग.)

यवानी कुष्ठशूलघ्नी हृद्यापित्ताग्निवर्द्धिनी

(शा०नि०, हरीतक्यादिवर्ग.)

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