THE UNANI PHARMACOPOEIA OF INDIA

PART - I
VOLUME - V

GOVERNMENT OF INDIA
MINISTRY OF HEALTH & FAMILY WELFARE
DEPARTMENT OF AYURVEDA, YOGA & NATUROPATHY,
UNANI, SIDDHA AND HOMOEOPATHY (AYUSH)
NEW DELHI

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आयुर्वेद, योग व प्राकृतिक चिकित्सा,
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रैड क्रॉस भवन, नई दिल्ली – 110001
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF HEALTH & FAMILY WELFARE
DEPTT. OF AYURVEDA, YOGA & NATUROPATHY,
UNANI, SIDDHA AND HOMOEOPATHY (AYUSH)
RED CROSS BUILDING, NEW DELHI-110001
Tel. : 011-23715564, Telefax : 011-23327660
E-mail : secy-ayush@nic.in
Mailing No. 110 108

FOREWORD

Unani medicine alongwith Ayurveda, Yoga & Naturopathy, Siddha & Homoeopathy is an important part of our national health care delivery system. These systems have been in use for centuries and are time tested & efficacious and provide essential health care to a considerable section of our population. India with the largest network of educational research and health care institutions of Unani is well placed to meet the rising international demand for this System.

The drugs used under Unani are safe, affordable and without major side effects. Majority of the drugs are derived from plants but some are also of animal or mineral origin. There is a need for scientific validation and standardization of these drugs for maintaining their quality and purity.

With this in mind the Unani Pharmacopoeia Committee (UPC) was set up in 1964, to not only lay down the standards for preparation of Unani drugs but also develop tests to establish their identity, purity and quality. The Pharmacopoeial Laboratory for Indian Medicine (PLIM) was established at Ghaziabad (U.P.) in 1970 to evolve standards for Ayurveda, Unani & Siddha drugs. It is now mandatory to test all formulations for microbial contaminants and heavy metal contents. 29 drugs testing laboratories across the country have been identified to work on pharmacopoeial standards of both single and compound Unani, Ayurveda and Siddha drugs.

The Central Council for Research in Unani Medicine (CCRUM) is the Secretariat for the UPC. The Council through its different Drug Standardization Research Units (DSRUs) has been engaged in generating data with regard to standardization of Unani drugs. So far four volumes of the first part of the Unani Pharmacopoeia of India containing 45, 50, 53 and 50 drugs, respectively, have been published. The present fifth volume contains pharmacopoeial standards for 50 other Unani single drugs. It is hoped that these volumes would benefit the researchers of Unani Medicine and the manufacturers of Unani Drugs and would help the Government to enforce quality control.

I would like to express my appreciation for the scientific staff of Department of AYUSH, PLIM, Ghaziabad, CCRUM and all the experts associated with the Unani Pharmacopoeia Committee for their valuable contribution and help in brining out these volumes of the Unani Pharmacopoeia of India. Suggestions and advice for further improving the quality of the pharmacopoeial work are welcome from all.

Anita Das

(Anita Das)

New Delhi
3rd January 2008

डा॰ जी. एन. काज़ी
निदेशक
Dr. G.N. QAZI
DIRECTOR

Tel. . +91-191-2569111, 2569222 (O), 2569333 (F)
Res. : +91-191-2569444, 2569445
EPABX : +91-191-2569000-2569010
E-mail : qazi@iiimjammu.org; qazi_gn@yahoo.com
Website : www.iiimjammu.org; www.herbalnet.org

भारतीय समवेत औषध संस्थान
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)
केनाल रोड, जम्मू – **180 001** (भारत)
Indian Institute of Integrative Medicine (CSIR)
(Formerly; Regional Research Laboratory, Jammu)
Canal Road, Jammu - 180 001 (INDIA)

PREFACE

Medicinal plants and the products there of are integral part of traditional systems of heath care. Many such products are also used worldwide as home remedies, over the counter preparations and as a source of phytochemicals by the pharmaceutical industry. These drugs account for a substantial proportion of the global market (over US$ 60 billion/year) and increasing attention is therefore, being paid for assurance of their quality, safety and efficacy. The World Health Assembly (1978, 1987, 1989) has stressed upon the need to ensure the quality of medicinal plant products by using modern analytical techniques and by applying suitable standards. Several guidelines have thus been layed by WHO, USFDA, European Commission for Drugs, Indian FDA, ICMR, AYUSH etc. to name a few. Such guidelines therefore, also apply to Unani, Ayurevda and Homoeopathic finished products for maintaining their quality and efficacy.

Unani System of Medicine is a dynamic healthcare system and its practitioners have been innovative in therapeutics and carried out and recorded clinical trials out of the local flora from the countries it has passed through and discovered newer formulations and added to and thus updated classical literature from time to time. Some of these formulations are used in clinics as polyherbals whereas, some are purely used as Home Remedies. Traditional Unani drugs and formulations like any other system were strictly produced by its practitioners almost on daily basis and dispensed among the patients without having to worry about their self-life. With the growing population and far higher demands for such drugs, the production of these formulations, went into the hands of commercial houses. In this kind of set up the Unani practitioners could no longer process and prepare their own medicines, but started depending on pharmaceutical houses run commercially and on suppliers of the crude drugs to the extent they needed. In the absence of proper pharmacopoeias and monographs there was hardly any governmental control on the manufacturers/pharmaceutical houses to ensure the quality of medicines marketed for Unani system of medicine.

The Government of India has, therefore, brought the manufacture and sale of Unani Drugs under the purview of drugs and cosmetics Act of 1940. In view of multiplicity of combination of different polypharmaceutical formulations, the primary task given and accomplished by the Unani Pharmacopoeia Committee (UPC) has been to select one set of combinations (formulations) for each indication for the purpose of standardization of such products. As a result of such an activity four volumes containing 441, 202, 103 and 166 pages have already been published by Govt. of India. This initiative was taken to ensure that there should be uniformity in the Unani Medicines marketed in so far as their identity, strength and purity was concerned and to assure the quality of the medicine, through proper drug control measures.

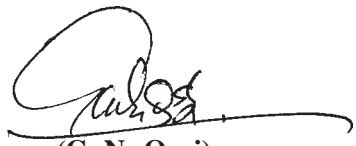
The Committee has made a modest attempt to lay down norms of the single drugs, based on the experimental data worked out at PLIM, Ghaziabad, and Drug Standardization Research Institute/ Units of Central Council of Research in Unani Medicine. The Unani Pharmacopoeia Committee has thus made a beginning in this direction with regard to compilation of the Unani Pharmacopoeia of India Part I Vol. I through V. The Unani Pharmacopoeia of India Part 1, Vol. I to IV comprise 45, 50, 53 & 50 monographs respectively, each for single drugs of plant origin which are used in one or more formulations enlisted in the National Formulary of Unani Medicine. In compiling the monographs the title of each drug has been given as in the Unani Literature. The definition of the drug, its botanical identity, brief morphological features, source of occurrence, distribution, Arabic, Persian, Urdu and names in other Indian regional languages are given. This is followed by macro and microscopic description of the studied drug with particular reference to pharmacognostical key characters having value in the identification; especially when the drug is in powder form. Information on chemical constituents, physico-chemical standards and drug assay, pH-value, extractive values and TLC profile of petroleum ether ($6O^0$ - 80^0) extract are provided for each drug. Further, the classical attributes of the drug according to Unani system like temperament, action and therapeutic uses along with dosages have been mentioned.

The Legal Notices and General Notices have been included for the guidance of the analysts, manufacturers, research workers and pharmacies engaged in the field. Details about the equipment, reagents and solutions, tests, method of preparation of specimens for microscopic examinations are given in appendices.

I am pleased to write the preface to the present publication "Unani Pharmacopoeia of India-Part – I Vol. V'' comprising 50 single drugs of herbal origin, and hope this document will greatly help in maintaining the quality of herbal products within the Unani system of medicinal manufacture. The parameters selected to fix pharmacopoeial standards would provide a scientific basis for the development of national standards. This work should serve as a practical manual and a useful tool for national drug regulatory authorities, the pharmaceutical industry and pharmacist's alike working with medicinal plant materials in India. The pharmacopoeia committee is collectively working hard to further improvise the analytical standards in order to harmonise, in not too distant future, the quality control parameters with other traditions drug streams like that from Ayurveda and Chinese systems of medicine. I am confident that all the volumes published thus far will be updated from time to time as and when the need arises.

I take this opportunity to place on record my sincere thanks and appreciation to the Ministry of Health, Government of India, Pharmacopoeial Laboratory of Indian Medicine (PLIM), Ghaziabad, Central Council for Research in Unani Medicine (CCRUM) fro their contribution. My sincere thanks and appreciation for the hard work and leadership provided by Dr. Mohammed Khalid Siddiqui, Director, CCRUM, New Delhi and the Scientists and Unani Scholars associated with the Council.

Lastly, I thank all the members of Unani Pharmacopoeal Committee who have directly or indirectly contributed in the preparation of this volume.



(G. N. Qazi)
Chairman
Unani Pharmacopoeia Committee

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 those 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, the Poisonous Act, 1999 and the rules framed there under should be consulted.

Under the Drugs and Cosmetics Act, the Unani Pharmacopoeia of India (U.P.I.) Part-I Vol.V is the book of standards for single drugs included therein and the standards prescribed in the Unani Pharmacopoeia of India Part-I Vol.-V would be official. If considered necessary these standards can be amended and the Government of India, Ministry of Health & FW is authorized to issue such amendments. Wherever such amendments are made, the Unani Pharmacopoeia of India Part-I, Vol.-V would be deemed to have been amended accordingly.

GENERAL NOTICES

Title: The title of the book is "The Unani Pharmacopoeia of India" Part-I Vol.-V wherever the abbreviation U.P.I.Pt-1 Vol V is used, it may be presumed to stand for the same and supplements there in.

Name of the drugs: The name given on top of each monograph of the drug is the Unani name as mentioned in the Unani classics and/or in the National Formulary of Unani Medicine Part-I,II,III,IV& V and will be considered official. These names are arranged in English alphabetical order. The Latin name (taxonomical nomenclature) of each drugs as found in the latest 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 shall also be considered legal.

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

Other names: Other names of the drug appearing in each monograph in Arabic, Persian, English, Hindi, Urdu and other Indian regional languages have been mentioned as found in the classical texts, National Formulary of Unani medicine Part-I,II, III, IV & V and as procured from experts, scholars of Unani Medicine and officials working in the same field in different states.

Italics : Italics type has been used for scientific name of the drug appearing in the introductory paragraph of each monograph.

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

When the term "drop" is used, the measurement is to be made by means of a tube which delivers in 20 drops, 1 gramme of distilled water at 15^0 C.

Metric measures are required by the Pharmacopoeia to be graduated at 25^0C 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 "Identity" wherever it comes, 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 by 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 and be within the permitted and specified limits for lead, arsenic and heavy metals and not showing abnormal odour, colour, sliminess, mould or other evidence of deterioration.

Wherever "TASFIYA" (Cleaning) of a drug is specified, it should be subjected to the process as specified in the Appendix. 5.1.2

The quantitative tests, e.g., total ash, acid insoluble 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 Pharmacopoeial method. In suitable instance, the methods of micro analysis, if of equivalent accuracy, may be substituted for the test 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 UPI, 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, whenever 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 descriptions quantity of the substances 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 weighing do not differ by more than 1.0 mg. per g. of the substance taken for the determination, the second weighing may follow after 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

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

Percent w/v (percentage weight in volume) expresses the number of grammes of active substance in 100 milliliters of product.

Percent v/v (percentage volume in volume) expresses the number of milliliters of active substance in 100 milliliters of product.

Percent v/w (percentage volume in weight) expresses the number of milliliters 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 ^0C.

Temperature: Unless otherwise specified all temperatures refer to the 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 tests 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 express 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, fibers 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 milliliter of a liquid is soluble in that number of milliliters 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 recognized Unani classics and in the National Formulary of Unani Medicine (Part-I, II, III, IV &V).

Doses: The doses mentioned in each monograph are in metric system of weights which are the approximate conversions from classical weights mentioned in Unani texts. A conversion table is appended giving classical weights of Unani System of Medicine with their metric equivalents.

Doses mentioned in the Unani Pharmacopoeia of India (U.P.I.) are intended merely for general guidance and represent, unless otherwise stated, the average range of quantities per dose which generally regarded suitable by clinicians for adults only when administered orally.

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

INTRODUCTION

The Unani System of Medicine, one of the oldest systems of medicine, had its origin in Greece. The great Greek Philosopher & Physician Hippocrates (460-377 B.C.) is the founder of Unani Medicine, later Galen, Rhazes and Avicenna enriched the System.

Unani System of Medicine was introduced in India by Arabs in 13th Century. Due to its efficacy and scientific base, it was accepted by masses and this system took firm roots in India.

Unani System prefers treatment through single drugs and their combination in raw form, rather than compound formulations. In Unani system, there is a great emphasis on proper identification of single drugs. Dioscorides (40-90 A.D.) is known in the field of Ilmul Advia (Pharmacology) as its founder. He described about 500 single drugs. Later on, Galen, Abu Hanifa, Ibne Sena etc. contributed a lot to this field.

Ibne Baitar (1176-1248 A.D.), the great scientist of Unani medicine, compiled a book on Pharmacology after extensive field survey and research describing 1500 single drugs used in Unani Medicine.

The practicing physician was solely responsible for identification and collection of single drugs, the manufacturing process of compound formulation was done by the physicians themselves. In the process he was free to substitute any drug and change formulation. All this lead to a state of confusion and uncertainty about the identification of single drugs and also lack of uniformity in compound formulations.

Commercialization of Drug Industry lead the Drug houses manufacturing compound formulations which were available through shelves. At this juncture, it was felt that a statutory control should be ensured in the interest of profession and public. The Govt. of India considered it expedient to utilize the existing law "The Drugs & Cosmetic Act, 1940" to control the Unani, Ayurvedic & Siddha Drugs in a limited manner. The act was accordingly amended in 1964, namely:-

a) The manufacture should be carried under prescribed hygienic conditions, under the supervision of a person having prescribed qualification.

b) The raw material used in the preparation of drugs should be genuine and properly identified.

c) The formula or the true list of all the ingredients used in the drugs should be displayed on the label of every container.

To achieve the desired effects of drugs on the patients, it is essential to procure the standard and authenticated single drugs, and subsequently the compound formulations. For this very purpose, there is an urgent need to develop the pharmacopoeial standards of Unani medicine. Availability of pharmacopoeia will have tremendous effect on the quality of Unani Drugs.

For the development of Unani pharmacy on modern lines and to enable the Unani medicine to withstand commercialization the Government of India has accepted the recommendations of the

Unani Advisory Committee. The Govt. in their letter no.F.25/2/63-RISM dated 2nd March, 1964 constituted the first Unani Pharmacopoeia Committee consisting of the following experts for a period of three years with effect from the date of its first meeting:-

1.	Col. Sir Ram Nath Chopra, Drug Research Laboratory, Srinagar.	Chairman.
2.	Dr. C.G. Pandit, Director Indian Council of Medical Research New Delhi.	Member.
3.	Dr. Sadgopal, Deputy Director (Chemicals), Indian Standard Institution, Manak Bhawan, 9, Bahadur Shah Zafar Marg, New Delhi.	Member.
4.	Hakim Syed Mohd. Shibli, Senior Lecturer, Nizamia Tibbi College, Hyderabad.	Member.
5.	Dr. S. Prasad, Head of Pharmaceutical Department, Banaras Hindu University, Varanasi.	Member.
6.	Dr. H.H. Siddiqui, Institute of History of Medicine and Medical Research, Hamdard Building, Delhi.	Member.
7.	Hakim Abdul Hameed, Hamdard Building, Delhi.	Member.
8.	Shifa-ul-Mulk Hakim Abdul Latif, Principal, Jamia Tibbia College, Qasimjan Street, Delhi.	Member.

9.	Hakim Gurdit Singh Alag, Senior Lecturer, Ayurvedic and Unani Tibbia College, Karol Bagh, New Delhi.	Member.
10.	Hakim Shakeel Ahmad Shamsi, Principal, Takmil-ut-Tibb College, Lucknow.	Member.
11.	Hakim M.A. Razzack, Medical Superintendent, Hamdard Clinic, Hamdard Building, Delhi.	Member.
12.	Dr. A.R. Kidwai, Head of the Department of Chemistry, Aligarh Muslim University, Aligarh.	Member.
13.	Dr. C. Dwarkanath, Advisor in ISM, Ministry of Health New Delhi.	Member-Secretary.

The Unani Pharmacopoeia Committee was reconstituted vide Health Ministry's notification no.F.10-1/68-R & ISM on 19th August, 1968 with Dr. Hussain Zaheer as Chairman. The Committee consisted of the following:-

1.	Dr. Hussain Zaheer 6-3-250, Banjara Hills, Hyderabad.	Chairman.
2.	Dr. Sadgopal, 7, Malka Ganj, Delhi.	Member.
3.	Dr. P.N. Saxena, Head of the Department of Pharmacology, J.N. Medical College, Aligarh Muslim University, Aligarh.	Member.

4.	Hakim Abdul Hameed, Hamdard Building, Delhi.	Member.
5.	Hakim Jamil Mirza, Moosa Baoli, Hyderabad.	Member.
6.	Dr. S.A. Subhan, Research Officer (Unani), Kilpauk Medical College & Hospital, Madras.	Member.
7.	Shifa-ul-Mulk Hakim Abdul Latif, Jhawai Tola, Lucknow.	Member.
8.	Hakim Abdul Ahad, Dy. Director Health, (Indian Medicine), Govt. of Bihar, Patna.	Member.
9.	Dr. P.N.V. Kurup, Advisor in Indian System of Medicines, Department of Health & Urban Development, New Delhi.	Member-Secretary. (ex officio).
10.	Hakim M.A. Razzack, Senior Research Officer (Unani), Department of Health & Urban Development, New Delhi.	Associate Secretary.

On expiry of the tenure of three years in Office of the second committee, on 14th November, 1971, the Government of India extended its term for another three years, vide their notification no.F.62/72-APC dated 25th October 1972. With effect from 15th November 1971, Hakim Shakil Ahmed Shamsi, Hony. Secretary Takmil-ut-Tibb College, Lucknow was nominated as Member of the Committee in place of Late Shifa-ul Mulk Hakim Abdul Latif. After the completion of the extended period of three years the Govt. of India further extended the term of the Second Committee for one year more, vide notification no.F.6-2/72-APC dated 19th November, 1974 which expired on 14th November, 1975.

The Third Unani Pharmacopoeia Committee was appointed by the Government of India vide their notification no.X.19018/1/76-APC dated 10th February, 1977, under the Chairmanship of Dr. Mohd. Yusufuddin Ansari, Professor and Head of the Department of Pharmacology, M.R. Medical College, Gulbarga, Karnataka. The Committee consisted of the following:-

1.	Dr. Mohd. Yusufuddin Ansari, Prof. & Head, Department of Pharmacology, M.R. Medical College, Gulbarga, Karnataka.	Chairman.
2.	Hakim Abdul Hameed, President, Institute of History of Medicine and Medical Research, Hamdard Building, Delhi.	Member.
3.	Hakim Shakeel Ahmed Shamsi, Hakim Abdul Aziz Road, Lucknow.	Member.
4.	Hakim S.M. Shibli, Hony. Director, Central Research Institute of Unani Medicine, 11-4-625, Dilkusha, A.C. Guards, Hyderabad.	Member.
5.	Dr. H.M. Taiyab, Principal, Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh.	Member.
6.	Hakim Syed Khaleefathullah, 75, Pycrofts Road, Madras.	Member.
7.	Hakim Faiyaz Alam, Director, Islahi Dawakhana, Fancy Mahal, Mohd. Ali Road, Bombay.	Member.
8.	Hakim Abdul Qawi, Kachehri Road, Lucknow.	Member.
9.	Prof. Basheer Ahmed Razi, 22, East End Road, Basavangudi, Bangalore.	Member.

10.	Prof. M.M. Taqui Khan, Prof. & Head, Department of Chemistry, Nizam College, Hyderabad.	Member.
11.	Dr. S.A. Mannan, Road No.:11, Banjara Hills, Hyderabad.	Member.
12.	Dr. S.S. Gothoskar, Drugs Controller (India) Directorate General of Health Services, New Delhi.	Member.
13.	Hakim M.A. Razzack, Dy. Advisor (Unani), Ministry of Health & F.W., New Delhi.	Member-Secretary.

The **U.P.C.**, was again reconstituted in 1988 vide notification no.U.20012/1/87 APC dated, the 15th June, 1988, under the Chairmanship of Dr. A.U. Azmi. The Committee consisted of the following:-

1.	Hk. Dr. A.U. Azmi, D-59, Abdul Fazl Enclave, Jamia Nagar, New Delhi-110 025.	Chairman.
2.	Hk. Syed Khaleefathullah, 49, Bharati Salai, Madras-600 005.	Member.
3.	Hk. Saifuddin Ahmed, Hakeem Mahmoodul Haq Road, Meerut (UP).	Member.
4.	Hk. Qamaruzzaman, Director (ISM), Govt. of Bihar, Patna-800 004.	Member.
5.	Hk. Madan Swaroop Gupta, D-3/15, Model Town, Delhi-110 009.	Member.
6.	Dr. A.M. Ansari, Director, CCRUM, 5, Panchsheel Shopping Centre, New Delhi-110 017.	Member.

7.	Hk. Malik Inamul Haq, Superintendent, Govt. Unani Pharmacy, Bhopal.	Member.
8.	Prof. Hkm. M. Arshad Sheikh, Principal, Tibbia College & Hospital, Nagpada, Bombay-400 008.	Member.
9.	Hk. Syed Mehmood Najmi, Regional Dy. Director, Deptt. of ISM & H, Hyderabad - 500 001 (AP).	Member.
10.	Hk. Mohd. Qayamuddin, Principal, Ajmal Khan Tibbia College, A.M.U., Aligarh-202 001 (UP).	Member.
11.	Hk. R.L. Verma, Deptt. of Anatomy and History of Medicine, All India Institute of Medical Sciences, Ansari Nagar, New Delhi-110 029.	Member.
12.	Dr. Rajendra Gupta, Project Co-ordinator, National Bureau of Plant Genetic Resources, Pusa Road, New Delhi.	Member.
13.	Dr. A.H. Israily, Div. Manager, Hamdard (Wakf) Laboratories, Hamdard Marg, Lalkuan, Delhi-110 006.	Member.
14.	Dy. Advisor (Unani), Ministry of Health & F.W., New Delhi.	Member Secretary.

Keeping in view the vacancy in the post of Dy. Advisor (Unani) in the Ministry of Health & F.W., the Govt. of India decided that Research Officer (Unani) shall function with immediate effect as

Member Secretary of Unani Pharmacopoeia Committee reconstituted vide this Ministry's order no.U.20012/1/87-APC dated 13/15-6-1988, till such time the post of Dy. Advisor/Advisor (Unani) is filled up.

The Unani Pharmacopoeia Committee was reconstituted in September, 1994 vide Office Order No.:U.20012/1/94-APC dated September, 1994, under the Chairmanship of Prof. Hakim Syed Khaleefathullah. The Committee consisted of:-

1.	Prof. Hakim Syed Khaleefathullah, 49, Bharati Salai, Madras-600 005.	Chairman.
2.	Hakim Iqbal Ali, 11-4-614/6-3, Bazar Guard, Hyderabad-500 004 (AP).	Member.
3.	Hakim Faiyaz Alam, Director, Islahi Dawakhana, Fancy Mahal, Mohd. Ali Road, Bombay-400 003.	Member.
4.	Hakim Jameel Ahmed, Dean, Faculty of Medicine, Jamia Hamdard, Hamdard Nagar, New Delhi.	Member.
5.	Prof. Hakim S. Zilur Rahaman, Head, P.G. Department of Ilmul Adviya, A.K. Tibbia College, A.M.U., Aligarh-202 001 (UP).	Member.
6.	Hakim Ved Prakash Sharma, Bassi Pathanan, Distt. Fatehgarh, Patiala, Punjab.	Member.
7.	Hakim Syed M. Ghayasuddin Ahmed, Regional Research Institute of Unani Medicine, 1, West Mada Church Street, Royapuram, Madras-400 006.	Member.

8.	Prof. Hakim S. Shaji Haider, Principal, Govt. Unani Medical College, Red Cross Building, Race Course Road, Bangalore (Karnataka).	Member.
9.	Hakim Mohd. Khalid Siddiqui, Director, CCRUM, 61-65, Institutional Area, Janakpuri, New Delhi-110 058.	Member.
10.	Hakim M.A. Wajid, C.R.I.U.M., Opp. E.S.I. Hospital, Eragadda, Hyderabad (AP).	Member.
11.	Hakim (Mrs.) Ummul Fazal, Dy. Director, CCRUM, 61-65, Institutional Area, Janakpuri, New Delhi-110 058.	Member.
12.	Prof. M.S.Y. Khan, Deptt. of Pharmaceutical Chemistry, Jamia Hamdard, Hamdard Nagar, New Delhi.	Member.
13.	Dr. S.S. Handa, Deptt. of Pharmaceutical Chemistry, Patiala University, Patiala, Punjab.	Member.
14.	Dr. R.U. Ahmed, Director, P.L.I.M., C.G.O. Complex, Kamala Nehru Nagar, Ghaziabad.	Member.
15.	Prof. Wazahat Hussain, Chairman, Deptt. of Botany, A.M.U., Aligarh - 202 001 (UP).	Member.

16.	Hakim (Mrs.) Aliya Aman, Dy. Advisor (Unani), Deptt. of ISM & H, Ministry of Health & F.W., Red Cross Bldg., Annexe, New Delhi.	Member-Secretary.

The Unani Pharmacopoeia Committee was reconstituted in October 2002 vide Office Order No.:U.20012/1/2002-APC dated 17 October 2002 under the Chairmanship of Dr.Sajid Husain. The Committee consisted of:-

1.	Dr. Sajid Hussain, Hyderabad	Chairman
2.	Prof. Hkm. S. Zillur Rehman, Aligarh	Member
3.	Prof. Hkm. M.A. Jafry, Bangalore	Member
4.	Hkm. S. Jaleel Hussain Hyderbad	Member
5.	Prof. Hkm. Naim A.Khan Aligarh	Member
6.	Prof. Dr. M .S. Y. Khan New Delhi	Member
7.	Dr. M. Sajid Anasari, Ghaziabad	Member
8.	Prof. Dr. S. H. Afaq Aligarh	Member
9.	Dr. Yatender Kumar Singh Rathore, New Delhi	Member
10.	Prof. Hkm. Jamil Ahmed, New Delhi	Member
11.	Mr. Asad Mueed, Delhi	Member
12.	Hkm. Farooqi, Ghaziabad	Member
13.	Prof. Wazahat Hussain, Aligarh	Special Invitee
14.	Hkm. Mohd. Iqbal, New Delhi	Special Invitee
15.	Deputy Adviser (Unani) New Delhi	Member
16.	Drug Controller General of India, New Delhi	Member (Ex-Officio)
17.	The Director, PLIM Ghaziabad	Member (Ex-Officio)
18.	The Director, CCRUM, New Delhi	Member Secretary

The functions of the committee shall be as follows:-

1. To prepare draft pharmacopoeia of Unani drugs.
2. To lay down principles and standards for the preparation of Unani drugs.
3. To lay down tests of identity, quality, purity
4. Such other matters as are identical and necessary for preparation of Unani Pharmacopoeia.

The committee will achieve the following targets with the next three years:

(1) Standard of 200 single drugs mentioned in the in the Unani Formulary of India per year.
(2) Standards of 200 Compound formulation mentioned in the in the Unani Formulary of India per year.
(3) The Committee will meet every 03 month.

The Unani Pharmacopoeia Committee was reconstituted in October 2002 vide Office Order No.:U.20012/6/2005-(R&P)APC dated 26th April 2007 under the Chairmanship of Dr.G.N.Qazi. The Committee consisted of:-

S.No.	Name	
1.	Dr. G.N.Qazi, The Director, RRL Jammu, Canal Road, Jammu Tawi	Chaiman
2.	Drug Controller General of India DGHS, Nirman Bhawan, New Delhi	Member (Ex-Officio)
3.	The Director, Pharmacopoeial laboratory of Indian Medicine CGO Complex, Kamla Nehru Nagar Ghaziabad -201002	Member (Ex-Officio)
4.	The Director Central Council for Research in Unani Medicine, New Delhi.	Member-Secretary
5.	The Director, National Institute of Unani Medicine Kottigetalya, Magadimainain Road Vishwaneedom post, Bangalore	Member (Ex-Officio)
6.	Adviser (Unani)/ Deputy Adviser (Unani) Deptt. Of AYUSH, New Delhi	Member (Ex-Officio)
7.	Prof. Hm. S.Zillur Rehman, Chairman, Ibn-e-Sina academy, Tijara House, Doodhpur, Aligarh-202001	Member

8.	Dr. Tajuddin, Chairman, Dept. of Ilmul Advia, A.K.Tibbia Collage, AMU, Aligarh-202001	Member
9.	Dr. E.H. Qureshi, Famida Collage, 92, Katra Mohd. Ali Road, Tope Darwaza, Lucknow-3	Member
10.	Dr. S.M. Ashraf, Aleurone grains Ashraf, C-117,Street No. 3, Greater Azad Enclave, Doharra Mafi, Aligarh	Member
11.	Prof. MSY Khan, Professor Emeritus, Hamdard University, Hamdard Nagar, New Delhi-62	Member
12.	Prof. Shakir Jamil, Dean, F/O Unani Medicine Hamdard University, Hamdard Nagar, New Delhi-62	Member
13.	Prof. S.H. Afaq I/C Pharmacogonosy Division Dept. of Ilmul Advia, A.K.Tibbia Collage, AMU, Aligarh-202001	Member
14.	Prof. A.K. Khar, Dept. of Pharmaceutics, F/O Pharmacy, Hamdard University, Hamdard Nagar, New Delhi-62	Member
15.	Dr. Surender Singh, Dept. of Pharmacology, AIIMS, Ansari Nagar, New Delhi	Member
16	Prof. Mohd. Ali, Dept. of Chemistry, F/O Pharmacy, Hamdard University, Hamdard Nagar, New Delhi-62	Member
17.	Dr. Asad Mueed, Manager, R&D Division, Hadard Dawakhana, Delhi-110006	Member
18.	Hm. Farooqi FIDAI Dawakhana, P.O. Murad Nagar, Distt Ghaziabad	Member

19 Dr. (Mrs.) Alia Aman. Member
D-109,Abul Fazl Enclave,
Jamia Nagar, New Delhi-110025

The functions of the committee shall be as follows:-

- To prepare draft pharmacopoeia of Unani drugs.
- To lay down principles and standards for the preparation of Unani drugs.
- To lay down tests of identity, quality, purity
- Such other matters as are identical and necessary for preparation of Unani Pharmacopoeia

The committee will achieve the following targets with the next three years:

(1) Standard of 200 single drugs mentioned in the in the Unani Formulary of India per year.
(2) Standards of 200 Compound formulation mentioned in the in the Unani Formulary of India per year.
(3) The Committee will meet every 03 month.

The Unani Pharmacopoeia Committee also places on record the appreciation of the work done by the members of various sub-committees viz. Drug Safety and Standardization Sub-committee, Single Drugs sub-committee, Formulary Sub-committee and Pharmacopoeial Standard Review Working Group and the officers and staff working in the Ministry of Health & F.W., Central Council for Research in Unani Medicine and Department of AYUSH in bringing out this volume.

The Committee is also grateful to the Director Pharmaceutical Laboratory of Indian Medicine, and Director, Central Council for Research in Unani Medicine who have, from time to time, offered their valuable suggestions and co-operations.

The Unani Pharmacopoeia Committee have already prepared and published four Volumes of National Formulary of Unani Medicine consisting of 441,202,103 and 166 compound formulations respectively.

For the purpose of determining and finalizing pharmacopoeial standards for Unani Medicine, the Pharmacopoeia Committee considered various aspects relating to the development of pharmacopoeial standards. The laboratory work for the development of standards is being carried out by the laboratories of CCRUM as well as in various other laboratories under Central Scheme for the development of pharmacopoieal standards of ASU drugs. So far 200 monographs of single drugs of plant origin included in National Formulary of Unani Medicine has been finalized by the present Unani Pharmacopoeia Committee. The format adopted for laying down standards has been prepared more or less on the pattern of different pharmacopoeia of Herbal medicines.

CHAIMAN
UNANI PHARMACOPOEIA COMMITTEE

NEW DELHI.
DATED: 3rd January 2008

ABBREVIATIONS OF TECHNICAL TERMS

Abbreviations of technical terms : The abbreviations commonly employed are as follows:-

m	–	Meter
l	–	Liter
mm	–	Millimeter
cm	–	Centimeter
µ	–	Micron (.001 mm)
Kg	–	Kilogram
g	–	Gramme
mg	–	Milligram
ml	–	Milliliter
1N	–	Normal solution
0.5 N	–	Half-normal solution
0.1 N	–	Decinormal solution
1M	–	Molar solution
Fam	–	Family
PS	–	Primary Standard

MONOGRAPHS

AJAWAIN KHURASANI
(Seed)

The drug Ajawain Khurasani consists of the seed of *Hyoscyamus niger* Linn. (Fam. Solanaceae), an annual or biennial herb, native to the Mediterranean region and temperate Asia, occurring in Western Himalayas from Kashmir to Kumaon at an altitude of 1600 to 4000 m, imported into India.

OTHER NAMES:

Urdu	:	Ajwain Khurasani
Arabic	:	Bazrulbanj
English	:	Henbane
Hindi	:	Khurasanee ajvayan,
Bengali	:	Khorasani ajwan
Gujrati	:	Khurasanee ajma, Khurasanee ajmo
Kannad	:	Khurasanee, Ajawaana
Tamil	:	Kuraasanee Yomam
Malyalam	:	Khurasaanee, Paarasika, Yavaani
Marathi	:	Khurasanee ova
Punjabi	:	Khurasanee ajvain, Bangidewana
Telugu	:	Kurasanee vamu, Khurasanee omam

DESCRIPTION:

Macroscopic: Seeds irregularly reniform or sub-quadrate, slightly over a mm in size, dark grey, surface concave, odour pleasantly aromatic, taste bitter, mucilaginous and pungent, aromatic.

Microscopic : Transverse section of seed shows the presence of thick cuticle, testa with two layers, outer one with a row of osteosclereids size ranging from 50 to 80 μ, inner one with crushed parenchyma, endosperm cells thin walled, containing oil globules, embryo coiled; starch absent.

Powder: Dark brown aromatic smell, bitter mucilagenous taste and an oily texture; a number of flask-shaped or dumb-bell shaped osteosclereids seen; fragments of testa in surface view, showing cells with sinuous walls; powder when treated with Sudan IV and mounted in glycerin shows the presence of oil globules which turn orange red; powder cleared with dilute nitric acid shows surface view of sculpturing on testa.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total Ash	:	Not more than 4 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 10 percent, Appendix 2.2.7.

T.L.C.:

T.L.C of the methanolic extract on silica gel 'G' plate (0.2 mm thick) using toluene : ethyl acetate : diethyl amine (70:20:10) shows under UV (366 nm) one fluorescent spot at Rf. 0.49 (blue). After spraying with anisaldehyde-sulphuric acid reagent and heating the plate at 105 °C for ten minutes spots appear at Rf. 0.09 (Brown), 0.49 (brown), 0.69 (greenish brown). After spraying with modified Dragendorff's reagent spots appear at Rf. 0.90, 0.77, 0.61, 0.23 and 0.10. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Tropane alkaloids hyoscyamine, (its racemic mixture and atropine) and hyoscine, seopolamine..
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Mukhaddir, Musakkin, Munawwim, Habis, Rade Mawad.
THERAPEUTIC USES	**:**	Sual Yabis, Wajaul Mafasil, **I**rqun Nasa, Niqris, Junoon, Sehar
DOSE	**:**	0.5 – 1.0 g
IMPORTANT FORMULATIONS	**:**	Barshasha

AMBA HALDI
(RHIZOME)

The drug Aamba Haldi consists of the rhizome of *Curcuma amada* Roxb. (Fam. Zingiberaceae), a biannual with ovoid root stock, 60 to 90 cm high, grown in W. Bengal and on the hills of west coast of India.

OTHER NAMES :

Urdu	:	Aamba Haldi
Persian	:	Darchoba
English	:	Mango-ginger
Hindi	:	Aamaa-haldi, Amiyaa haldi
Bengali	:	Aamaa Aadaa
Gujrati	:	Aambaa haldhar
Kannad	:	Ambarasini, Huli Arsin
Tamil	:	Mankayyinji
Malayalam	:	Mangayinji
Marathi	:	Aambe halad, Ambaa halad
Punjabi	:	Ambiya haladi
Telugu	:	Mamidi Allamu

DESCRIPTION:

Macroscopic: Rhizome laterally flattened, longitudinally wrinkled, 2 to 6 cm long, 0.5 to 2 cm in diameter, branched, remnant of scaly leaves arranged circularly giving the appearance of growth rings; cut pieces 1.5 to 3.5 cm in diameter, circular, punctate scars on the surface, branching sympodial, horizontal; roots long, unbranched, tapering, thread like, yellowish-brown; rhizome buff coloured with short and smooth fracture; odour and taste like raw mango.

Microscopic : T.S. of rhizome circular in outline; epidermal cells rectangular-oval; cuticle thick, long unicellular trichomes present, storied suberized cork cells interrupted by lysigenous oil glands; a wide cortex having irregularly scattered vascular bundles, each vascular bundle with a prominent fibrous sheath; inner limit of cortex marked by endodermis followed by pericycle; vascular bundles devoid of sheath, arranged in a ring; schizogenous canals and abundant oil cells with suberized walls found in cortex and in central region; most of the parenchymatous cells filled with starch grains, which are oval-ellipsoidal, sometimes polygonal in shape, 10 to 60 μm, simple, hilum circular or a 2 to 5 rayed cleft, lamellae distinct and concentric; vascular bundles in the central cylinder are similar to those in the cortex, scattered, closed, collateral, surrounded by sheath of thick walled cells; secondary wall thickening reticulate; fibres thin walled lignified, lumen narrow.

Powder : Powder light yellow, sweet, raw mango like odour; shows fragments of storied cork, xylem vessels with reticulate thickenings, lignified xylem fibres, oil cells, patches of parenchymatous cells filled with starch grains which are oval-ellipsoidal, sometimes polygonal in shape, 10 to 60 μm, simple, hilum circular or a 2 to 5 rayed cleft, lamellae distinct and concentric. Powder when treated with 1N aqueous NaOH becomes green with yellowish tinge under UV 254 nm; with 1N HCl and nitrocellulose in amylacetate added one after the other, powder becomes orange in daylight.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 percent, Appendix 2.2.2.
Total ash	:	Not more than 12 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 2 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 9 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 14 percent, Appendix 2.2.7.
Essential oil	:	Not less than 1 percent, Appendix 2.2.13
Starch	:	Not less than 16 percent, Appendix 2.2.14

T.L.C.:

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using toluene : ethyl acetate : methanol (5 : 0.5 : 0.05) shows fluorescent zones at Rf. 0.10 (green) and 0.34 (blue) under UV (366 nm). On spraying with anisaldehyde- sulphuric acid reagent and heating the plate for ten minutes at 120^0C, spots of purple colour appear at Rf. 0.16, 0.32, 0.72 and 0.97. Appendix 2.2.10

CHEMICAL CONSTITUENTS **:** Volatile oil (α-pinene, δ-camphor), α-curcumene, 1-β curcumene, phytosterol.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Mohallil, Musakkin, Musaffi-e-Khoon.

THERAPEUTIC USES **:** Zarba wa Sakta, Amraz-e-Jildiya

IMPORTANT FORMULATIONS **:** Takmeed Bara-e-Majlooq

DOSE **:** 2- 3 g.

ANKOL
(Leaf)

The drug Ankol consists of dried leaf of *Alangium salviifolium* (Linn. f.) Wang. syn. *A. lamarckii* Thw.; (Fam. Alangiaceae), a small tree found over the plains and foothills throughout India.

OTHER NAMES:

Urdu	:	Ankola
English	:	Sage-leaved Alangium
Hindi	:	Ankol, Ankora, Dhera
Bengali	:	Akarkanta, Baghankura, Aankod, Angkura, Dhalakura
Gujrati	:	Ankol, Onkla
Kannad	:	Ankolimara, Ansaroli, Arinjil, Ankol
Tamil	:	Alangi, Ankolum, Atikoevam
Malayalam	:	Ankolam, Velittanti, Irinjil, Chemmaram
Mararathi	:	Ankola
Oriya	:	Ankul, Baghonokhiya, Dolanku, Konkonolo
Telugu	:	Ankolamu, Udagu, Urgen

DESCRIPTION:

Macroscopic : Leaves 8 to13 cm in length and 3 to 5 cm in width, simple, petiolate, petiole 6 to13 mm long, lanceolate, narrowly oblong or ovate, base rounded or acute, glabrous above, pubescent on the nerves, venation reticulate.

Microscopic : Leaf : *Petiole :* Epidermis single layered, covered by cuticle; nonglandular, mostly unicellular, rarely bicellular, uniseriate trichomes, measuring upto 280 μ in length and upto 16 μ in width; 7 to10 layered collenchyma present just beneath the epidermis, followed by parenchymatous tissue; collateral vascular bundles 3 to10 in number arranged in an arch and surrounding parenchymatous pith; vascular bundles composed of xylem and phloem; xylem consists of fibres, tracheids and xylem parenchyma; abundant rosette crystals of calcium oxalate present in the parenchyma tissue, measuring upto 45 μ in diam.; granulated pigments noticed in all tissues except in the vascular bundle.

Midrib **:** T.S. shows biconvex outline; epidermis on both surfaces covered by cuticle; abundant nonglandular, unicellular trichomes measuring upto 385 μ in length and upto 16 μ in width present on epidermis; 4 or 5 layered collenchyma situated just beneath the epidermis; collenchyma followed by 3 or 4 layered chlorenchyma; vascular bundle surrounded by sclerenchymatous tissue except on lateral sides; phloem located on the outer peripheral parts of xylem; xylem mainly consists of tracheids, vessels and fibres; central part of the midrib occupied by parenchyma cells, containing rosettes of calcium oxalate crystals, measuring upto 20 μ in diam.

Lamina: T. S. shows dorsiventral structure; epidermis on both the sides covered by cuticle; in surface view the lower epidermis shows straight walled, polygonal cells with prominent cuticular striations and anomocytic type of stomata; upper epidermis either devoid of stomata or with rare ones; cuticular striations also absent; nonglandular, unicellular trichomes similar to midrib abundant on lower epidermis; upper epidermis followed by a two layered palisade; mesophyll traversed by veins. Dispersed in the region are rhomboid calcium oxalate crystals, measuring 10 to 26 μ in length and 6 to 16 μ in width; palisade ratio 7 to 11; vein islet number 8 to 12; stomatal index 7 to 14.

Powder : Greenish brown, taste bitter; shows tracheids, vessels, lignified fibres with tapered ends measuring 40 to 280 μ in length and upto 20 μ in width, rosettes of calcium oxalate crystals, rhomboid crystals, nonglandular unicellular trichomes, groups of palisade cells, fragments of upper epidermis and lower 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 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 15 per cent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the alcoholic extract on silica gel G plates (0.2 mm thick) using toluene: ethyl acetate: diethylamine (60:30:10) shows under UV (254 nm) six spots at Rf. 0.12 (brown), 0.17, 0.21,0.38 (all violet), 0.60 and 0.66 (both yellowish green). Under UV (366 nm) eight fluorescent spots appear at Rf. 0.12, (yellow) 0.17, 0.21(both faint blue), 0.24 (blue), 0.30 (pink), 0.38 (blue), 0.60 and 0.66 (both pink). On exposure to iodine vapour nine spots appear at Rf. 0.12, 0.17, 0.21 (all yellowish brown), 0.24 (reddish brown), 0.30, 0.38, 0.50 (all yellowish brown), 0.60 and 0.66 (both green). On spraying with Dragendorff's reagent six orange spots appear at Rf. 0.17, 0.21, 0.24, 0.30, 0.38, 0.50. Appendix 2.2.10

ASSAY:

Contains not less than 0.35 per cent of alkaloid as determined by the following method:

Soxlet extract coarsely crushed (25g) dried leaves of *A. salviifolium* with n-hexane (700 ml) for 15 hours. Leave the exhausted (defatted) plant material to dry at room temperature and then extract with methanol (500 ml) for 16 hours. Remove methanol under reduced pressure, acidify with 3 % acetic acid, wash with diethyl ether (3 x 100 ml) and make aqueous phase alkaline with 10 % aqueous sodium carbonate. Extract the liberated (free) alkaloids first with dichloromethane (3 x 100 ml) and then with ethyl acetate (5 x 100 ml). Combine both the extracts, evaporate to dryness and weigh the residue as total alkaloids.

CHEMICAL CONSTITUENTS **:** Alkaloids (Alangimarckine, deoxytubulosine, ankorine); campesterol, episterol, stigmast-5,22,25-trien-3β-ol, alangidiol and isoalangidiol.

TEMPERAMENT **:** Hot2^0 and Moist2^0

ACTION **:** Nafa Amraze Balgham Muhallil warm

THERAPEUTIC USES **:** Wajaul Mafasil, Niqris, Irqunnasa

DOSE : 5 g as Joshanda (Decoction)

ASROL
(ROOT)

The drug Asrol consists of air dried root of *Rauwolfia serpentina* (Linn.) Benth. ex Kurz (Fam. Apocynaceae); a perennial undershrub widely distributed in India in the sub-Himalayan tracts upto 1,000 m as well as, in the lower ranges of the eastern and western Ghats and in the Andaman.

OTHER NAMES:

Urdu	:	Asrol
English	:	Rauvolfia Root, Serpentina Root
Hindi	:	Chhotaa Chaand, Dhavalbaruaa, Pagal Booti, Sarap gandha
Bengali	:	Chaandar
Gujrati	:	Amelpodee
Kannade	:	Sutranaabhu
Tamil	:	Sarppaganti
Malayalam	:	Amalpori
Marathi	:	Adkai, Chandra
Oriya	:	Dhanbarua, Sanochado
Telugu	:	Sarpagandhi

DESCRIPTION:

Macroscopic : Pieces of roots mostly about 8 to 15 cm long and 0.5 to 2 cm in thickness, sub-cylindrical, curved, stout, thick and rarely branched; outer surface grayish-yellow to brown with irregular longitudinal fissures; rootlets 0.1mm in diameter; fracture, short, slight odor and bitter taste.

Microscopic : Root : Root comprises of stratified cork of about 18 layers, of which the cells of 8 to 12 layers are smaller, suberized and unlignified; cells of remaining layers large, suberized and lignified; phelloderm parenchymatous, some cells packed with starch grains and prismatic and clusters crystals of calcium oxalate; secondary phloem tissue consists of sieve cells, companion cells and parenchymatous cell containing starch grains and crystals of calcium oxalate; phloem fiber absent; phloem parenchyma occasionally filled with granular substances; starch grains mostly simple but compound granules also occur with 2 to 4 components; individual granules spherical, about 5 to 15 m in diameter, with well marked hilum simple or split in a radiate form; stone cells are absent (distinction from many other species such as *R. canescens, R. micrantha, R. densiflora, R. perakensis and R. vomitoria*); secondary xylem is traversed by well developed lignified medullary rays of about 1 to 5 cell wide but uniseriate rays are more prominent; vessels singly or in pairs; xylem parenchyma cells lignified; fiber present; cells of medullary rays thick walled also filled with starch grains and calcium oxalate prisms.

Powder: Coarse to fine, yellowish-brown, free flowing, odour slight, bitter in taste; characterized by spherical, simple to compound starch grains, calcium oxalate prisms and clusters; vessels with simple perforation, occasionally tailed; tracheids lignified; xylem fibers irregular in shape, occurs singly or in small groups, walls lignified, tips occasionally forked or truncated; wood parenchyma cells are filled with calcium oxalate crystals and starch grains; stone cells phloem fibers absent.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 8 percent, Appendix 2.2.3.
Acid–insoluble ash	:	Not more than 1 percent, Appendix 2.2.4.

Alcohol-soluble extractive : Not less than 4 percent, Appendix 2.2.6.
Water-soluble extractive : Not less than 10 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the methanol and Ammonia extract of root powder on silica gel 'G' plate using Toluene : Ethyl acetate : Diethylamine (70 : 20: 10) shows eight spot on spraying with Dragendorff reagent at Rf. 0.11, 0.13, 0.25, 0.37, 0.47, 0.51, 0.61 and 0.82 (all reddish brown). The spot at Rf. 0.82 is of reserpine. Appendix 2.2.10

CHEMICAL CONSTITUENTS **:** Rauwolfia contains indole alkaloids, such as reserpinine, serpentinine and ajmalicine.

TEMPERAMENT **:** Cold and Dry

ACTION **:** Musakkin, Mukhaddir, Musakkine Aasab, Musakkine Fisharuddam Qawi, Tiryaqe Samoon, Munawwim.

THERAPEUTIC USES **:** Junoon, Ikhtinaq-ur-Raham, Fisharuddam Qawi, Sehar, Sara

DOSE **:** 0.5 g – 1.0 g

IMPORTANT FORMULATIONS **:** Dawa-ul-Shifa

BADARI KAND
(Root)

The drug Badari Kand is the dried root of *Ipomoea digitata* Linn. syn. *Ipomoea paniculata* (Linn.) R. Br. (Fam. Convolvulaceae); a perennial climber, distributed throughout the warm and moist regions of India.

OTHER NAMES:

Urdu	:	Badari Kand
English	:	Giant potato
Hindi	:	Vidaaree Kanda, Bhuh Kumdaa, Bhui Kumbhadaa
Bengli	:	Bhuh Kumdaa, Bhooi Kumhdaa
Gujrati	:	Vidaaree Kand
Kannad	:	Nelkumbal, Naadakumbala
Tamil	:	Nilappuchani, Paalmudamgi
Malayalam	:	Paalmutakku
Marathi	:	Bhui Kohalaa
Oriya	:	Bhuin Kakhaaru
Telugu	:	Paalagummudu, Nelagummudu

DESCRIPTION:

Macroscopic : The root consists of thick pieces of different sizes, usually 2 to 8 mm in diameter; outer surface brownish and rough due to the presence of longitudinal fissures, ridges and numerous circular lenticels; core light brown and fibrous; fracture, fibrous, odourless and sweetish in taste.

Microscopic : Root : Root shows 6 to 9 layers of thin walled cork cells, externally covered by rhytidoma; phelloderm composed of 8 to10 layers of cells, thin walled and filled with starch grains, individual starch grain rounded to irregular in shape, variable in size measuring about 13 to 24 m, with distinct centric hilum; rosettes of calcium oxalate present; secondary phloem consists of companion cells, sieve tube elements and phloem parenchyma, traversed by uni- or biseriate medullary ray; numerous resin ducts and starch grains occur in the secondary phloem; secondary xylem consists of xylem parenchyma, xylem vessels, xylem fibers and tracheids; vessels large in size and numerous.

Powder: Light to dark brown, fine to coarse texture; simple and compound starch grains of variable size, crystals of calcium oxalate in prismatic and cluster form; pitted vessels; tracheids; parenchymatous cells with simple pits and long fibres with wide lumen and pointed ends.

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 20 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 8 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the alcoholic extract of dried root powder on Silica gel ‘G’ plate (0.2 mm thick) using Petroleum ether: Diethyl ether: Glacial acetic acid (8: 2: 0.1) under UV light (365 nm) shows two

fluorescent zones at Rf. 0.24 and 0.42 (both green). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for 15 minutes at 105 ^{0}C, three spots appear at Rf. 0.18, 0.55 and 0.95 (all black). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glycosides, steroids, tannins and fixed oil.
TEMPERAMENT	**:**	Hot and Moist
ACTION	**:**	Mughallize Mani, Muqawwie Bah**,** Muwallide Sheer
THERAPEUTIC USES	**:**	Zofe Bah, Badan, Jaryan, Surate Inzal.
Dose	:	0.5 g – 1.0 g

BAI KHUMBI
(Seed)

The drug Bai Khumbi consists of dried seed of *Careya arborea* Roxb. (Fam. Lecythidaceae), a medium sized deciduous tree attaining a height of 9 to 18 m. occurring throughout India upto an altitude of 1,500 m.

OTHER NAMES:

Urdu	:	Bai Khumbi
English	:	Kumbi
Hindi	:	Sthala Kumbhi
Bengali	:	Kumbhi
Kannad	:	Daddala, Gudda, Daddippe
Tamil	:	Kumbi
Malayalam	:	Pezuntol
Marathi	:	Kumbhaa
Telugu	:	Dudippi

DESCRIPTION:

Macroscopic: Seeds, exalbuminous, dark brown, oval ellipsoid, 1.5 to 2 cm long, upto one cm or slightly above in width; indehiscent; testa hard and wrinkled; odour, pleasant; taste, astringent.

Microscopic : Testa sclerenchymatous followed by a zone of collapsed cells of outer integument, inner integument lined by cuticle on both sides; outer layers of both integuments filled with dark brown material; cotyledons of many layered, thin walled, polygonal parenchymatous cells, filled abundantly with starch grains and occasionally with oil.

Powder: Creamish-yellow to light-brown, shows fragments of cotyledon cells; scattered stone cells of testa, abundant starch grains, simple and round, about 5 μ.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than 4 percent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 7 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 15 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the hexane extract on recoated silica gel 'G' plate (0.2 mm thick) using petroleum ether : diethyl ether : acetic acid (9:1:0.1) shows spots at Rf. 0.14 (purple), 0.26 (brown), 0.32 (light pink), 0.44 (pink) and 0.77 (purple) on spraying with vanillin-sulphuric acid reagent and heating the plate at 105 °C for about ten minutes. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Saponins (five sapogenols- careyagenol A, B, C, D & E); sterols, α- spinosterol and α-spinosterone.
TEMPERAMENT	**:**	Moderate towards Hotness and Dryness.
ACTION	**:**	Kasire Riyah, Mulaiyin, Munzij.
THERAPEUTIC USES	**:**	Nafakhe Shikam, Qabz
DOSE	**:**	500 mg - 1 g.

BEKH KHATMI
(Root)

The drug Baikh-e-Khatmi consists of the root of *Althaea officinalis* Linn. (Fam. Malvaceae) a perennial, uniformly downy herb, occurring in Kashmir region.

OTHER NAMES:

Urdu	:	Bekh Khatmi
Arabic	:	Bekh Khatmi
Persian	:	Resha Khatmi
English	:	Marsh Mallow
Hindi	:	Khatmi
Tamil	:	Shemaitute
Marathi	:	Khatmi
Telugu	:	Khatmi

DESCRIPTION:

Macroscopic : Roots 0.2 to 3 cm in diameter, light brown in colour, strongly longitudinally furrowed, often spirally twisted; fracture, short, texture rough, internally yellowish white; odour, pleasant; taste, sweet and mucilaginous.

Microscopic : T. S. root circular in outline; cork 8 to 12 cells broad, radially arranged flattened cells; cortex broad, loosely arranged, parenchymatous, cells filled with mucilage; small patches of lignified fibres present; large number of schizogenous and lysigenous mucilage canals present; phloem well developed consisting of sieve tubes, companion cells and phloem parenchyma filled with mucilage; cambium 2 to 3 celled, xylem diffuse porous, made up of vessels, tracheids, fibres, and tracheidal fibres, vessels mostly solitary: filled with tyloses at some places, medullary rays 3 to 5 cells deep; rosette crystals of calcium oxalate present in cortical, phloem and xylem region; cells contain mucilage, stained red with 1% ruthenium red, and deep yellow with potassium hydroxide solution; most of the parenchymatous cells contain starch grains, polygonal to rounded, 5 to 20 μm, most grains less than 12 μm in diameter, simple, hilum circular or a 2 to 5 rayed cleft lamellae indistinct.

Powder : Powder white to light yellow, sweet in taste; under the microscope numerous fragments of parenchyma, the cells containing mucilage and starch grains polygonal to rounded, 5-20 μm, most grains less than 12 μm in diameter, simple, hilum circular or a 2-5 rayed cleft lamellae indistinct; occasionally small rosette crystals of calcium oxalate, group of sclerenchymatous cells, vessels measuring 113 to 262 μm long, fibres measuring 519 to 1038 μm long and 9 to 19 μm broad; mucilaginous canals; when treated with 50% HNO_3 turns yellowish-orange and emits yellow fluorescence under UV 254 nm; with 50% KOH, it emits light yellow fluorescence under UV 254 nm, while with 1 N-NaOH in methanol orangeish brown colour is seen in day light.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 7 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 1.5 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 8 percent, Appendix 2.2.6.

Water soluble extractive	:	Not less than 21 percent, Appendix 2.2.7.
Moisture content	:	Not more than 8 percent, Appendix 2.2.9.

T.L.C.:

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using toluene : ethyl acetate : methanol (80 : 20 : 0.05) shows under UV (366 nm) fluorescent zones at Rf. 0.12, 0.27, 0.33, 0.82. On spraying with anisaldehyde-sulphuric acid and heating for ten minutes at 120^0C, shows spots at Rf. 0.12, 0.18, 0.43, 0.47, 0.69 and 0.82. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Galacturonic acid, galactose, glucose, xylose & rhamnose, polysaccharide althaea mucilage-O, asparaginene, betaine, lecithin and phytosterol, polysaccharides.
TEMPERAMENT	**:**	Cold, Moist
ACTION	**:**	Muzliqe Ama, Musakkin, Mohallil
THERAPEUTIC USES	**:**	Warme Ama, Suddae Ama, Zaheer, Ishaal Safravi.
DOSE	**:**	5-7 g.
IMPORTANT FORMULATIONS	**:**	Laooq Sapistan, Sharbat Ejaz, Laooq Nazli.

BEHROZA
(Exudate)

The drug Behroza arala is an exudate obtained by tapping the wood of *Pinus roxburghii* Sargent syn. *P. longifolia* Roxb. (Fam. Pinaceae), a monoecious conifer found in north-western Himalayas at an altitude between 460 and 1400 m.

OTHER NAMES:

Urdu	:	Behroza
Arabic	:	Qinnaha
Persian	:	Bersu Barzad
English	:	Oleo-resine of Pine
Hindi	:	Cheer Gond, Gandabirojaa
Bengali	:	Sarala gaachh
Gujrati	:	Teliyo devdaar, Pilo berajo
Kannad	:	Saral, Sriveshtaka
Tamil	:	Pinaimaaru
Malyalam	:	Charalam, Saralam
Marathi	:	Sarala deeka
Oriya	:	Sidhaa, Saral
Punjabi	:	Cheed
Telugu	:	Saral

DESCRIPTION:

Macroscopic: Blackish brown in colour, semi solid, mostly associated with debris from needles, wood chips and bark of the source tree; odour, turbinthene.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 percent, Appendix 2.2.2.
Total ash	:	Not more than 0.6 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 0.40 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 74 percent, Appendix 2.2.6.
Water soluble extractive	:	Not less than 0.15 percent, Appendix 2.2.7.
Volatile oil	:	Not less than 18 percent, Appendix 2.2.10.

G.L.C.:

G.L.C. of Turpentine oil on the Gas Chromatograph Model NUCON – 5765, Column & Stationary phase : 30m fused silica capillary column walls coated with FFAP, Carrier Gas : Helium, 1.5 ml. min^{-1}, Column Temperature : 90^0 C for 2 min. then programmed at the rate of 7^0 C min^{-1} to 220^0 C, Injection port Temperature : 220^0 C, Detector Temperature : 240^0 C, Recorder : 2mV, signal attenuation 1:100, Chart speed : 1 $cm.min^{-1}$, Sample size : 0.10 ml (For GC analyses, pure (0.1ml) is injected with a 1.0 ml syringe).

The identification of compounds is done by comparing the retention time of peaks and by peak enrichment technique with standard samples run under similar operating conditions such as l-α-pinene (Rt = 6.31 min.); l-ß-pinene (Rt = 7.18 min.); car-3-ene (Rt = 7.76 min.); longifolene (Rt = 15.46 min.).

T.L.C.:

T.L.C. of rosin (Material left after separation of essential oil) on a precoated silica gel G plate, using methanol: hexane (5:95). One spot at Rf. 0.80 on spraying with 2% vanillin in sulfuric acid (dark pink to purple flourescent) and on spray with 0.04 per cent bromocresol green solution shows yellow spot. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	l-α-pinene, l-β-pinene, car-3-ene, longifolene and other mono & sesquiterpenes.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mohallil, Mujaffif Qurooh, Mudir Baul Haiz, Tams, Dafe Tauffun
THERAPEUTIC USES	**:**	Ehtabas Baul wa Tams, Qurroh Mutaffine Khanazeer, Suzak.
DOSE	**:**	2 – 4 g
IMPORTANT FORMULATIONS	**:**	Marhame Jadwar, Marhame Zangar, Zimad Jalinoos, Marham Rusl.

BHOJPATR
(Stem bark)

The drud Bhojpatr consists of the stem bark of *Betula utilis* D.Don syn. *B.bhojpattra* Wall. (Fam. Betulaceae), a moderate sized tree, usually with a somewhat irregular bole; occasionally a mere shrub, forming the upper limit of forest vegetation, found throughout the main Himalayan range ascending to an altitude of 4200 m.

OTHER NAMES:

English	:	Himalayan Silver Birch
Hindi	:	Bhojapatra
Bengali	:	Bhoojpatra, Bhujipatra
Gujrati	:	Bhojpatra
Tamil	:	Bhojapatram
Malayalam	:	Bhurjamaram
Marathi	:	Bhoorjapatra
Telugu	:	Bhurjapatri
Urdu	:	Bhojpatr

DESCRIPTION:

Macroscopic :*Broad, horizontal paper like strips, flaps or flakes of varying sizes or loosely laminated exfoliating pieces of bark; outer surface smooth silver grey or cremish-yellow with brown streaks; inner surface shining, reddish brown in colour, slightly wrinkled, more often devoid of markings; odour, slightly terbinthene; taste-none.*

Microscopic: T.S. shows rectangular cells, 6 to 9 layers of thin walled parenchymatous cells, containing prismatic calcium oxalate crystals.

Powder: Light brown; parenchymatous cells, with a few prismatic calcium oxalate crystals present.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 2.1 per cent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 1.1 per cent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 19 per cent, Appendix 2.2.6.
Water soluble extractive	:	Not less than 0.8 per cent, Appendix 2.2.7.

T.L.C.:

T.L.C. of chloroform extract of the drug on a precoated silica gel G plate using n-hexane: ethyl acetate (9:1), on spraying with Liberman-Burchard reagent and heating the plate for about 5 minutes at 110^{o}C, three spots appear at Rf. 0.31 (blackish-grey), 0.62 (dark pink) and 0.54 (light pink) and were comparable to the spots of betulin, lupeol and 3β-acetoxy-12-oleanen-28-oic acid respectively. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Betulin, lupeol and 3 β - aetoxy: 12 - oleanen 28 - oic acid.
TEMPERAMENT	**:**	Hot & Dry
ACTION	:	Musaffie Khoon, Dafe Taffun, Kasire Riyah.
THERAPEUTIC USES	**:**	Fasade Khoon, Nafakhe Shikam, Busoore Gosh
DOSE	**:**	1-3 g.

CHARELA
(LICHEN)

Charela consists of the whole thallus of *Parmelia perlata* (Huds.) Ach. (Fam. Parmelliaceae); a perennial lichen found on rocks or dead wood in temperate Himalayas.

OTHER NAMES:

Urdu	:	Ushna
Arabic	:	Ushna
Persian	:	Dawali/Dawala
Sanskriti	:	Sitasiva, Silapuspa
Hindi	:	Charela, chharila, Chhadila
Bengali	:	Shailaj
Gujarati	:	Patthar Phool, Chhadilo
Kannad	:	Shilapushpa, Kalppuvu
Tamil	:	Kalpashee
Malayalam	:	Sheleyam, Kalppuvu
Marathi	:	Dagad phool
Punjabi	:	Ausneh, Chhadila
Telugu	:	Ratipuvvu

DESCRIPTION

Macroscopic: Thallus consists of a flattened, foliose structure with a more or less deeply incised upper surface, yellowish-white on top and black on the lower surface, leathery to touch; delicate rhizoids arise form lower surface; odour and taste not distinct; but like bodies known as soredia are also present on the upper surface of the thallus.

Microscopic: Thallus shows upper cortex consisting of compact hypahae of fungus, followed by gonidiameter l layers with algal cells; medulla consisting of loosely arranged mass of fungal hyphal tissue; lower cortex black, consisting of compact mass of fungal thyphae; a few asci with ascospores embedded in the upper portion of the thallus; thallus on soaking in water gives orange colour

Powder: Brown shows fungal hyphae, gonidia, compact mass of cortex and apores, and algal cells.

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 3per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 4 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 Silical gel 'G'plate using n-Butanol: Acetic aid: water (4:1:5) shows in visible light four spots at Rf. 0.11, 0.28, 0.40, 0.91. / (all grey). Under UV (366 nm) six fluorescent zones are visible at Rf. 0.11(dark blue), 0.28 (dark blue), 0.40, 0.61, (both blue) 0.83 (dirty yellow) and 0.91 (light yellow). On exposure to Iodine vapour six appear at Rf. 0.11, 0.28, 0.40, 0.61, 0.83, and 0.91 (all yellow)). On Spraying with 5% Methanolic-Sulphuric acid reagent and on heating

the plate for 10 minutes at 105^0 C six spots appear at rf. 0.11,0.28,0.40,0.61,0.83 and 0.91 (all grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Lichen acids-atranorin and Lecanoric acid.
TEMPERAMENT	**:**	Hot1^0 and Dry1^0
ACTION	**:**	Muqawwi wa Mufarreh Qalb, Mulattif Sudad, Musakkine Alam, Qabiz, Mohallil.
THERAPEUTIC USES	**:**	Amraze Qalb, Taqwiyate Dimagh, Taskeene Dard.
DOSE	**:**	3 - 5 gm
IMPORTANT FORMULATION	**:**	Dawaul misk Motadil, Dawaul Misk Motadil Jawahar wali, Raughan Kalan.

CHOBCHINI
(Tuberous Root)

The drug Chobchini consists of tuberous root of *Smilax china* Linn. (Fam. Liliaceae), a deciduous climber with sparsely prickled or unarmed stem. It is imported from China and Japan.

OTHER NAMES:

Urdu	:	Chob Chini
Arabic	:	Ashusseenee, Khushabusseenee
Persian	:	Chob Chini
English	:	China root
Hindi	:	Chopcheenee
Bengali	:	Chopcheenee, Kumarika, Shukchin
Gujrati	:	Chopcheenee
Tamil	:	Parangichekkai
Malyalam	:	China Pairu
Marathi	:	Chopcheenee
Telugu	:	Pirngichekka

DESCRIPTION:

Macroscopic : Tubers about 6 to 12 cm long, 2 to 4 cm wide, rough, irregular, cylindrical, curved, slightly tapering with brownish or blackish scars; externally brownish-yellow in colour, and internally brown in colour; fracture, hard; odour not characteristic; taste, slightly bitter.

Microscopic: Cortex shows several layers of thin-walled, polygonal, elongated mucilaginous parenchymatous cells, a few cells containing raphides of calcium oxalate; endodermis not distinguished; ground tissue having several vascular bundles consisting of usual elements; fibres long and aseptate; numerous simple and compound starch grains, measuring 16 to 38 μ in dia. with 2 to more than 9 components mostly spherical to ovoid, having hilum in centre.

Powder: Shows light brown, fragments of mucilaginous parenchymatous cells of cortex fibres and vessels with reticulate thickening; a few scattered needles of calcium oxalate from raphides; numerous simple and compound starch grains measuring 16 to 38 μ in dia. with 2 to more than 9 components, mostly spherical to ovoid having hilum in centre.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2	per cent, Appendix 2.2.2.
Total ash	:	Not more than 0.6	per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 0.06	per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 0.8	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 precoated Silica gel 'G' plate (0.2 mm thick) using Toluene : Ethyl acetate : Methanol (10 : 10 : 4) as mobile phase and on spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate at 105°C for ten minutes ten spots appear at Rf. 0.09 (dark green), 0.17 (violet), 0.21 (dirty yellow), 0.26 (grey), 0.32 (yellow), 0.48, 0.55 and 0.58 (all violet), 0.73 (greenish blue) and 0.77 (violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS : Saponins, sarsaponin and parallin, which yield isomeric sapogenins, sarsapogenin and smilogenin. It also contains sitosterol and stigmasterol in the free form and as glucosides.

TEMPERAMENT : Murakkab-ul-Quwa, Mayil ba Hararat wa Yabusat.

ACTION : Muqawwi Azae Raeesa, Musaffi Khoon, Mohallil, Mulattif, Muarrriq, Muqawwi Bah, Mudirr Baul wa Haiz, Munawwim wa Musakkin.

THERAPEUTIC USES : Suda Muzmin, Shaqiqa, Nazla, Zukam, Zof Bah, Fasad Dam, Waja-ul-Mafasil.

DOSE : 5 - 10 g

IMPORTANT FORMULATIONS : Majoon Chobchini

DOODHI KHURD
(WHOLE PLANT)

The drug Doodhi Khurd consists of whole plant of *Euphorbia prostrata* W. Ait. (Fam. Euphorbiaceae), an accepted substitute for *E. thymifolia,* the official drug; it is a small more or less pubescent, much branched prostrate annual, found throughout India as a naturalized weed.

OTHER NAMES :

Urdu	:	Dudhi Kalan
Arabic	:	Sosfand
Persian	:	Sheer-e-Gayah
Hindi	:	Dudhi, Duddhi, Dudhdee, Chhotidudhi
Bengali	:	Bara, Kharui, Kerai, Dudiya, Shwet Keruee
Gujrati	:	Raati Dudhelee, Naagalaa dudhelee
Kannad	:	Kempu nene hakki
Tamil	:	Sittirappaladi, Sittirappaladi
Malyalam	:	Nilappal
Marathi	:	Lahaan naaytee, Naayeti, Lahaandudhi
Punjabi	:	Dodhak, Hajardana, Baradodk, Hazardana
Telugu	:	Peddivari manubaala

DESCRIPTION:

Macroscopic : Branched prostrate with many stems spreading from the roots, slender upto 20 cm long; leaves green but occasionally purplish red, opposite, 2.5 to 5 mm long and 2 to 4 mm broad, oblong or subquadrate, tip mucronate, base symmetric and more or less cordate, margin serrulate in upper portion, glabrous above, slightly pubescent beneath especially on the apex; petiole short, 1 mm or even less in length; tap root 1 to 3 mm in diameter; inflorescence cyathium in short axillary racemiform clusters, involucre lobes 5, deltoid ovate, ciliate; nectary gland 4, minute; ovary tricarpellary, suborbicular, stipitate, narrowly limbed long styles; stigma three branched, each bifid; capsule 1 to 1.5 mm long, densely hairy on ridges, hairs occasionally present on the surface; fruit subglobosely trigamous, long stalked; seeds 0.6 to 0.8 mm long, oblong, 4 angled, smooth with 5 to7 transverse ribs, reddish brown and bluntly pointed; smell oily; no characteristic taste.

Microscopic: Root: T. S. of young root circular in outline, endodermis without casparian bands; triarch stele; mature roots phelloderm 6 to 8 layers, outer most layer thickly suberized; cork cells obliterated; cambium indistinct; broad xylem vessels solitary or in a group of 2 or 3, surrounded by a number of radially arranged narrow vessels and tracheids; medullary rays short, one or two seriate and extend upto phloem.

Stem: Cross section of stem circular in outline, thick, non striated cuticle, interrupted by unicellular or multicellular uniseritate trichomes upto 185 µ long and 15 µ broad; paracytic stomata at some places; cortex with a few latex canals; pericyclic fibres in groups; cambium not discernible; medullary rays narrow, 1 or 2 cell wide, parenchymatous pith with intercellular spaces.

Leaf: Two types of hairs present (a) multicellular, multiseriate glandular hairs with single apical cell at leaf margins only, (b) uniseriate 1 to 3 celled hairs on the margins, at abaxial side and in apex; cross section shows dorso-ventral structure, single layered upper and lower epidermis, mesophyll and vascular bundles; in surface view, the abaxial epidermal cells angular with straight cell walls, stomata anomocytic

to anisocytic, stomatal indices 17.6 to 26.3 and density 60 to 130; adaxial epidermal cell walls slightly wavy with globular thickening at the angles; stomata anisocytic, stomatal indices 11.4 to 18.7 and stomatal density 25 to 60; palisade ratio 3 to 6; vascular bundles collateral, with bundle sheath; laticiferous canals observed; vein islet 1 to 5 and vein termination numbers is 3 to 13.

Powder: Powder yellowish-green, tasteless with oily odour; on microscopical examination it shows angular and slightly wavy epidermal cells with stomata, uniseriate, 1 to 3 celled trichomes or hairs and some pieces of glandular hairs parenchymatous patches, laticiferous canals, pollen grains, pieces of nectary glands, fragments of vessels, tracheids, fibres and stomata; when treated with 1N NaOH in methanol shows purple colour with yellowish tinge, and in acetic acid reddish yellow colour under UV – 254 nm.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 percent, Appendix 2.2.2.
Total ash	:	Not more than 11 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 0.2 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 11 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 27 percent, 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 (80 : 20) shows under UV (366 nm.) fluorescent zones at Rf. 0.05 (Maroon), 0.15 (light blue) and 0.66 (red). On spraying with anisaldehyde-sulphuric acid reagent and heating the plate for ten minutes at 120^0C, spots appear at Rf. 0.12 (bright green), 0.23 (pinkish blue), 0.32 (pink), 0.38 (grey), 0.48 (dark greyish blue), 0.52 (pink), 0.61 (magenta), 0.66 (magenta) and 0.94 (blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glucoside, Galactoside, β-sitosterol, Compesterol, Stigmasterol, Cholesterol.
TEMPERAMENT	**:**	Hot and Dry / Cold & Dry
ACTION	**:**	Qabize Ama, Musakkin, Musaffie Khoon, Habise Ishal, Dafe Tashunnuj.
THERAPEUTIC USES	**:**	Ishal, Istahaza Bawaseer, Jiryan, Fasad-e-Dam, Sailanur raham, Surate Inzal, Nafe Ziabetus
DOSE	**:**	3 - 5 g.

GAOZABAN
(LEAF)

Barg Gaozaban consists of dried leaf and stem protion of *Onosma bracteatum* Wall. (Fam. Boraginaceae) a perennial, hirsute or hispid herb, sparsely sparsly distributed in North estern Himalayas from Kashmir to Kumaon at altitudes of 3,500-4,500 m.

OTHER NAMES:

Urdu	:	Gaozaban
Arabic	:	Lisanussoor
Persian	:	Lisanussoor
Hindi	:	Gaujaban, Gojiya
Bengali	:	Gojika Sak, sojialata, Dadisha
Gujarati	:	Bhonpathari, Galajibhi
Kannad	:	Shankha Huli, Aakalanalige, Gojaba
Tamil	:	Kharaptra, Dhaivipatra, Kozha
Malayalam	:	Kozhuppu
Marathi	:	Goazaban, Paatharee
Orissa	:	Kharsah, Kharaptta
Punjabi	:	Kazban
Telugu	:	Yeddunaluka

DESCRIPTION:

Macroscopic : Stem: Cut pieces available in 5.9 cm long and 3.2 to 4.7 cm in diameter ., flattened, erect, stout; rough due to white, hard, hispid hairs, cicatrices, and longitudinal wrinkles; colour greenish-yellow; fracture, short; odour and taste not characteristic.

Leaf: Lanceolate to ovate-lanceolate, 12-30 cm long, 1.5-3.5 cm broad, acuminate tubercle based hispid hairs present on both surfaces; greenish to light yellow on top and . white beneath.

Microscopic : Stem: shows single-layered epidermis, covered with thick cuticle, some epidermal cells elongate to form long, warty, tubercle-based unicellular hairs; cortex differentiated 'in two zones, 5-7 layered.outer collenchyma, 3-4 layered inner parenchymatous cells, consisting of thin-walled, round to oval cells; phloem composed of usual elements; phloem fibres absent; xylem consisting of usual elements, vessels mostly solitary or rarely 2-3 in groups having spiral thickening, and fibres and tracheids having blunt tips and simple pits; xylem ray not distinct; pith consisting of round, thin-walled parenchymatous cells.

Leaf: *Midrib:* single layered epidermis with thick cuticle and long. warty, tubercle-based unicellular hairs present on both surfaces followed by 5-7 layers of collenchymatous and 3-4 layers parenchymatous cortical cells; vascular bundle situated centrally.

Lamina: isobilateral, single layered epidermis on either surface covered with thick cuticle, long warty, tubercle-based, simple, unicellular hairs present on both surfaces; palisade 2 layered, and spongy parenchyma 8-10 layered, stomata paracytic.

Powder: Greenish-brown; shows groups of oval to polygonal, thin-walled straight epidermal cells;

vessels with spiral thicking; a few fibres entire or in pieces, elongated with blunt tips; long warty, tubercle-based unicellular hairs and a few paracytic stomata.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 26 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 1 per cent, Appendix 2.2.6

T.L.C:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol ; Acetic acid: Water (4 : 1 : 5) shows in visible light six spots at Rf. 0.38 (yellow), 0.55 (grey), 0.62, 0.69 (both yellow), 0.76 (grey) and 0.99 (green). Under UV (366 nm) six fluorescent zones at Rf. 0.30 (pale blue), 0.55 (violet), 0.62, 0.69 (both yellow), 0.76 (green) and 0.99 (red). On exposure to Iodine vapour eight spots appear at Rf. 0.29, 0.38, 0.46 (all yellow), 0.56 (grey), 0.62, 0.66 (both yellow), 0.76 and 0.99 (both grey). On spraying with Vanillin-Sulphuric acid reagent and heating the plate at 105°C for ten minutes, six spots appear at Rf. 0.29,0.56,0.62,0.66,0.76 and 0.99 (all violet). Appendix 2.2.10

CHEMICAL CONSTITUENT	**:**	Tannin and Sugars.
TEMPERAMENT	**:**	Hot1^0 and Dry1^0
ACTION	**:**	Mufarrah Muqawwi aazae Raisa, Mulattif Ratoobat, Mulayyin Tabaa, Munaffis Balgham
THERAPEUTIC USES	**:**	Zofe Qalb, Khafqan, Nazla wa Zukham, Zofe Dimagh, Suale Balghami
DOSE	**:**	3-5 g
IMPORTANT FORMULATIONS	**:**	Khamira Gaozaban Sada, Khamira Gaozaban Ambari Jadwar Ood Saleeb Wala.

GUL TESU
(Flower)

The drug Gul Tesu consists of dried flower of *Butea monosperma* (Lam.) Kuntze syn. *B. frondosa* Roxb. (Fam. Fabaceae), a moderate sized deciduous tree, commonly called "Flame of the Forest", flowering in March: May found throughout India upto a height of 1250 m, except in the arid zones.

OTHER NAMES:

Urdu	:	Gul Palas
Arabic	:	Gul Tesu
English	:	Butea seed, Flame of the Forest, Bastard teak
Hindi	:	Dhak, Palash, Tesoo
Bengali	:	Palaash
Gujrati	:	Khakharo
Kannad	:	Muttagamara, Muttug
Tamil	:	Purasu
Malyalam	:	Plashu
Marathi	:	Palas, Palash paapada
Telugu	:	Moduga

DESCRIPTION:

Macroscopic : Inflorescence raceme; flowers large, 4 to 6 cm long, alternate, with pubescent long, velvety, olive green peduncle; bright yellowish-red to orange red pedicels, 1.5 cm long, twisted, bracteate, bracts and bracteoles small, linear, velvety, orange green, deciduous; calyx campanulate, 5-partite, oblique, about 1 cm long, dark olive green, densely velvety outside, clothed with silky hairs within, two upper teeth connate, large, three lower ones unequal, the lowest being much shorter than the lateral ones; corolla 4 to 6 cm. long, orange red, covered outside with silky white hairs, papilionaceous; stamen diadelphous; anthers linear, yellow; ovary stipitate, silky, pubescent, style incurved, longer than the stamens.

Microscopic : *Pedicle:* T. S. of pedicel circular in outline, bearing numerous 2 to 4 celled uniseriate hairs; cortex collenchymatous, differentiated in two zones- outer formed of smaller cells with some contents and inner zone of larger cells; cortex and stele separated by endodermis of barrel shaped cells containing starch grains; phloem parenchyma containing tannin; pith parenchymatous; vascular bundles separated by broad medullary rays and arranged in a ring; rhomboidal crystals of calcium oxalate present in cortex.

Sepals: Sepals on upper surface have one type of trichome 3 to 5 celled, with prominent basal cell; on lower surface two types of trichomes, (i) multicellular, uniseriate, long, thick walled with circular basal cell; (ii) a few multicellular, club-shaped, trichomes glandular in nature; stomata anomocytic type.

Petals: Upper surface of wing petal with profuse 2 to 6 celled hairs on its basal part and multicellular trichomes at the tip; lower surface of wing petal covered with multicellular uniseriate trichomes; papillate epidermal cells in the middle region of wing petal, in surface view shows striations radiating from the base of papilla; cells in apical region of wing petal without papillate, but narrow with random striation; upper surface of standard petal glabrous but margins hairy; multicellular, club shaped appendages and uniseriate 2 to 5 celled trichomes present at the apex. In the middle portion cells longer than broad, drawn

out into papillae with striations radiating out from this; upper surface of keel petal cells polygonal, with irregular striations, trichomes profuse except at apical region.

Stamens diadelphous; pollen grain 3 pored, oblate, spheroidal; about 28 µm long and 30 µm broad, pore circular to elongate, 8 to 12.5 µm, exine wall surface foveolate.

Ovary with two types of trichomes, (i) thin walled having dense contents (ii) 2 to 3 celled trichome, placentation marginal; epidermal cells of style long, narrow in surface view, trichomes uniseriate multicellular and thick walled in stylar region.

Powder: Brownish-yellow, slightly bitter in taste, no characteristic odour; shows pieces of various types of trichomes, vascular tissue, epidermal cells with characteristic papillae, polygonal cells with linear striations, pollen grains, and styloid crystals of calcium oxalate; powder treated with 1N HCl followed by one drop of nitrocellulose in amylacetate becomes orange yellow under UV 365 nm and with 1N NaOH in methanol becomes, yellowish-black under UV 254 nm.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 percent, Appendix 2.2.2.
Total ash	:	Not more than 10 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 1 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 15 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 32 percent, 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 : methanol : water (100 : 15 : 5) shows under UV (366 nm) fluorescent zones at Rf. 0.17 (yellow), 0.26 (yellow), 0.53 (light brown), 0.58 (greenish yellow) and 0.63 (greenish yellow). On spraying with 5% KOH reagent spots at Rf. 0.17 (yellow), 0.26 (yellow), 0.58 (green) and 0.63 (green). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Coumarins and glycosides, cumaranone glycosides, butrin, isobutrin, monospermoside, isomonospermoside, carbomethoxy-3, 6-dioxo-5-hydro-1, 2, 4-triazine, coreopsin, isocoreopsin.
TEMPERAMENT	**:**	Cold and Dry towards Hotness
ACTION	**:**	Mohallil warm, Musakkiin alam, Mudirr Baul, Qabiz, Rade Mawad
THERAPEUTIC USES	**:**	Warm Khussiya, Wajaul Mafasil
DOSE	**:**	7-10 g.

GURMAR
(Root)

The drug Gurmar consists of root of *Gymnema sylvestre* R. Br. (Fam. Asclepiadaceae), a large woody, climber, much branched, with pubescent young parts, found throughout India in dry forests upto 600 m.

OTHER NAMES:

Urdu	:	Gurmar
English	:	Periploca of the woods
Hindi	:	Gudmaar, Medhaasingee
Bengali	:	Medhasingi
Gujrati	:	Kaavalee, Medhasinge
Kannad	:	Kadhasige
Tamil	:	Shirukurumkaay, Shakkaraikkolli
Malyalam	:	Cakkarakkolli, Madhunaashini
Marathi	:	Kaavalee, Medhaashingi
Telugu	:	Podapatri

DESCRIPTION:

Macroscopic: Tap root branched, rough, longitudinally fissured, corky, soft and nodulose pieces, 2 to 7 cm long and 0.2 to 1.0 cm in thickness; external surface dark brown and cut surface showing a core cream in colour; fracture, splintery; odour, unpleasant; taste, bitter and acrid.

Microscopic : **Root:** Shows 5 to 20 rows of tangentially elongated and radially arranged cork cells; secondary cortex a wide zone consisting of oval to polygonal cells somewhat irregular in shape and moderately thick walled, filled with rosette crystals of calcium oxalate and a few simple or compound starch grains; secondary phloem composed of sieve tubes, companion cells and phloem parenchyma, with mostly large and a few small rosette crystals and starch grains; medullary rays prominent, uni or multi seriate, generally tetra seriate, extending from primary xylem to secondary phloem; groups of oval to elongated, thick walled, lignified sclereids with clear striations and narrow lumen present in cortex and phloem region; secondary xylem consists of usual lignified elements; vessels simple pitted, single or 2 to 7 in radial groups and dispersed throughout the xylem region; fibres long with tapering ends and wide lumen; primary xylem present diarch.

Powder: Light yellow; shows thick walled cork cells; polygonal, thin walled parenchymatous cells, simple pitted fibres and vessels; groups of sclereids, large and a few small rosette crystals of calcium oxalate, simple and compound starch grains, measuring 5 to 11 μ in dia.

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 5 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 14 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the alcoholic extract on Silica Gel 'G' plate using Toluene : Ethylacetate : Methanol (10:10:4) as mobile phase shows on spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate at 110°C for ten minutes eight spots at Rf. 0.17 (brown), 0.25 (violet), 0.48 (grey), 0.57 (pink), 0.68, 0.80, 0.87 (violet) and 0.95 (pink). Appendix 2.2.10

CHEMICAL CONSTITUENTS:

TEMPERAMENT	**:**	Hot2^0 and Dry2^0
ACTION	**:**	Dafe Sammiyat, Dafe Ziabetus Shakri, Mugi, Mukhrij Balgham
THERAPEUTIC USES	**:**	Sammiyate Afyoon, Ziabetus shakri
DOSE	**:**	5-7 gm.

HABBUL QILQIL
(Seed)

The drug Habb-ul-Qilqil consists of the seed of *Cardiospermum halicacabum* Linn. (Fam. Sapindaceae), commonly found as a weed throughout India, ascending upto 1,200 m. in the North West Himalayas.

OTHER NAMES:

Arabic	:	Habbul Qilqil
Persian	:	Anar Dana Dashti
English	:	Ballon Vine, Heart's Pea
Hindi	:	Kaanphuti, Lataaphataki
Bengali	:	Jyotishmati (of Bengal)
Gujrati	:	Nayaphatki, Kapaalphodi, Bodha, Shivajaala
Kannad	:	Kanakayya
Tamil	:	Mudukkottan, Modikkottan
Malyalam	:	Ulinna
Marathi	:	Fatphati, Kaanphuti, Khiljala
Telugu	:	Vekkudutiga

DESCRIPTION:

Macroscopic : Seeds are about 4 to 6 mm, subglobose, black, shiny with a whitish scar of aril, nutty flavour; no odour.

Microscopic : T.S. shows an outermost thick yellowish layer of cuticle; testa shows a single layer of radially elongated, brown and thick walled palisade like cells showing linea lucida and with stellately lobed lumen as seen in surface view; a wide zone of sclereids with thick walled highly sinuous, light yellow to yellowish-brown lignified cells showing radiating canals on their walls in surface view; tegmen consists of parenchyamatous cells; ground tissue of the embryo consists of angular to hexagonal parenchyma cells with oil globules; starch grains absent.

Powder : Powder light brown in colour, with black fragments of the seed coat and has the taste and odour of cucurbitaceous seed with a nutty flavour; shows surface view of palisade layer with hexagonal outline and stellately lobed lumen, surface view of the much sinuous sclereid layer and oil globules.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total Ash	:	Not more than 5 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 0.5 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 21 percent, Appendix 2.2.6.
Water soluble extractive	:	Not less than 5 percent, Appendix 2.2.7.
Fixed oil	:	Not less than 20 percent, Appendix 2.2.8.

T.L.C.:

T.L.C. of methanolic extract on silica gel 'G' plate (0.2 mm thick) using toluene : ethyl acetate : diethyl amine (85:15:0.5) shows under UV (366 nm) fluorescent spots at Rf. 0.10 (white), 0.21 (blue) and 0.70 (blue). After spraying with anisaldehyde-sulphuric acid reagent and heating the plate at 105 °C for ten minutes spots appear at Rf. 0.15 (blue), 0.34 (greenish blue), 0.44 (bluish black), 0.64 (blue) and 0.71 (blue). T.L.C. of the methanolic extract using butanol : acetic acid : water (6:1:2) after spraying with anisaldehyde-sulphuric acid reagent shows spots at Rf. 0.08 (green), 0.15 (green), 0.23 (green), 0.28 (purple), 0.38 (green), 0.47 (pink), 0.53 (yellowish green), 0.83 (purple) and 0.93 (purple). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil, Sapouins, Proteins
TEMPERAMENT	**:**	Hot1^0 and Moist1^0
ACTION	**:**	Muqawwie Bah, Musammine Badan, Mughallize Mani
THERAPEUTIC USES	**:**	Zofe Bah, Zofe Badan, Jaryan, Surate Inzal
DOSE	**:**	7-10 g.
IMPORTANT FORMULATIONS	**:**	Laboobe Kabir, Laboobe Sagheer

IZKHAR
(Whole Plant)

The drug Izkhar consists of dried leaf, stem and root of *Cymbopogon martinii* (Roxb.) Wats. (Fam. Poaceae) a perennial, sweet scented grass, 1.5 to 3.5 m high, occurs wild in dry localities and cultivated in many parts of India.

OTHER NAMES:

Urdu	:	Izkhar
English	:	Rosha Grass, Rusa grass
Hindi	:	Rohis, Roosaa, Roosaaghaas, Mirchagandha
Bengali	:	Agam ghaas, Agiyaa ghaas
Gujrati	:	Rondso, Ronsdo
Kannad	:	Dunllu, Harehullu
Tamil	:	Kaavattampillu, Munkipul, Chooraippul
Malyalam	:	Sambhaarppullu
Marathi	:	Rohish gavat
Punjabi	:	Agya ghass
Telugu	:	Kaamakchhi: Kassuvu

DESCRIPTION:

Macroscopic: Root: Short, stout and woody; roots fibrous; many culms arise from root stumps.

Culm: Erect, terete, smooth shiny, upto 6 mm in dia., internodes 5 to 16 cm long, solid.

Leaf: Blades linear-lanceolate or lanceolate tapering to long filiform acuminate point, cordate and amplexicaul at base, upto 50 cm long and 3.5 cm broad; upper leaves are smaller, leaf surface glabrous, margin scabrid; midrib prominent and protruded on the lower surface; leaf sheath shorter than the internodes, glabrous, striate, auriculate, tight and clasping the culm, ligules membranous, 2 to 3 cm long.

Inflorescence: Spathate panicle, compound, upto 30 cm long; primary axis bears 2 or 3 branches at each node, these end in a spatheole which bears a pair of racemes, spatheole 1.8 mm long become reddish at maturity; racemes 1.5-2.0 cm long become subsessile or shortly pedicelled, lower raceme base and lower most pedicel swollen; sessile spikelet about 3.5 mm long, lower glume 1 mm wide, ovate, with deep median groove, broadly winged, 2 nerved; awn 12 to 18 mm long; pedicellate spikelet about 4 mm long, glabrous; lower glume lanceolate, 8 nerved, flower hermaphrodite or male, stamens-3, anthers 1 or 2 mm long, style 2, stigma pilose.

Microscopic : **Root –** T.S. shows thin walled epiblema with unicellular root hairs; cortex composed of thin walled, parenchymatous cells; large air chambers present in the cortex; endodermis single layered and pericycle two cell layered; central vascular strand has outer 2 or 3 layers of sclerenchymatous cells followed by 3 to 5 cells deep zones of thin walled phloem with a row of circular cavities of 12 to 25 μ diam.; 5 to 10 cell layer thick zone encloses xylem vessels; which are 35 to 50 μ in diam.; pith cells thick walled and devoid of any cell contents.

Stem: T.S. shows thick cuticle; epidermis devoid of any appendages; hypodermis 6 to 10 cells deep and composed of sclerenchymatous cells; vascular bundles scattered throughout the ground tissue with a row of smaller vascular bundles in the hypodermis; cells of ground tissue thin walled, parenchymatous; vascular bundles present in the ground tissue enclosed by 2 or 3 layers of sclerenchymatous cells.

Leaf : T.S. shows isobilateral structure, with a spongy mesophyll between; outline showing a slightly concave upper surface and a convex lower surface; midrib protruded towards lower side; cells of upper epidermis interrupted by the presence of bulliform or motor cells; lower epidermal cells are more uniform in size and smaller; stomata present on both surfaces, characteristically placed in a straight line between veins, mesophyll consists of chlorenchymatous cells placed radially around smaller vascular bundles; bundle sheath present around smaller vascular bundles, on either side of the midrib vascular bundle; group of sclerenchymatous fibres are found and may extend upto bundle sheath; vascular bundle of midrib usually has two conspicuous metaxylem vessels.

Lower epidermis can be distinguished from the upper epidermis by its having more number of stomata, smaller epidermal cells and presence of microhairs and papillae; stomata of the lower epidermis: oval, mostly with low dome shaped long cells present between the veins; long cells of lower epidermis possess 1 or 2 papillae, while papillae are absent on the long cells of upper epidermis; short cells over the veins in rows of more than 5 cells and may be in pairs; silica bodies abundant over the veins mostly dumbbell shaped, occasionally cross-shaped, narrow and crenate; prickle and micro hairs present; micro hairs two celled, observed only on lower epidermis; the basal cell of micro hairs is wide as compared to distal cell; distal cell tapers to an acutely pointed apex.

Powder: Brown, fibrous, free flowing, shows debris from leaves showing characteristic graminaceous stomata, silica bodies, and micro hairs; also contains pitted parenchyma and fiber.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 14 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 7 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 5 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 7 percent, Appendix 2.2.7.
Essential oil	:	Not less than 0.2 percent, Appendix 2.2.14.

T.L.C.:

T.L.C. of essential oil on silica gel 'G' plate using hexane: ethyl acetate (90:10) shows seven spots at RF 0.25, 0.38, 0.47, 0.57, 0.64, 0.71 and 0.78 on spraying with Vanillin-Sulphuric acid reagent and heating the plate for 15 minutes at 110^0C. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential oil (0.5 percent) containing terpenes such as geraniol, geranyl acetate, citronellol, linalool, geranyl butyrate, myrcene, α- and β-pinene.
TEMPERAMENT	**:**	$Hot2^0$ and $Dry2^0$
ACTION	**:**	Munzij Akhlat Ghaleeza, Dafe Tashnnuj, Mufatteh Sudad, Mohallil Auram, Kasir Riyah, Mudirr Baul wa Haiz, Muqawwi Meda.
THERAPEUTIC USES	**:**	Falij, Laqwa, Tashannuj, Nisyan, Istisqa, Ehtabas-e-Baul wa Hiaz, Warm-e-Meda wa Jigar
DOSE	**:**	5-7 g.
IMPORTANT FORMULATIONS	**:**	Dawaul Kurkum, Majoon Dabeedul Ward

KAKJANGHA
(Seed)

The drug Kakjangha consists of dried mature seed of *Peristrophe bicalyculata* (Retz.) Nees (Fam. Acanthaceae), an erect hispid herb 60 to 180 cm tall, found in forests and waste lands almost throughout the country.

OTHER NAMES:

Urdu	:	Chaksini Booti
Arabic	:	Rejlal Ghorab
Persian	:	Paye Zaghan
Hindi	:	Masi, Kaakjanghaa
Bengali	:	Naaskaaga
Gujrati	:	Kaaliaghedi, Kariaghedi, Aghedi
Kannad	:	Cibigid, Cibirsoppu
Tamil	:	Chebira
Marathi	:	Ghaatipittaapapadaa, Raankiraayat
Telugu	:	Chebira

DESCRIPTION:

Macroscopic: Black, orbicular, 1.7 to 2 mm, slightly rugose, bitter with oily feeling on tongue and no special odour.

Microscopic: Seed: Transverse section of seed shows testa having single layered epidermis, cells appearing straight walled and angular in surface view producing short stout unicellular hairs having recurved hooks and dark contents; tegmen 2 layered, parenchymatous; cotyledon has outer most epidermis and inner single layer of palisade like parenchyma and 4 or 5 layers of shorter cells; cotyledon shows provasculature at some places; cells contain protein aleurone grains and oil at some places.

Powder : The powder is blackish-yellow in colour; it shows hairs, a few cells of palisade parenchyma and cells of cotyledon with oil can also be seen, straight walled packed angular epidermal cells of testa with scars of hairs.

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 0.1 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 10 percent, Appendix 2.2.6.
Water soluble extractive	:	Not less than 20 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the alcoholic extract on silica gel 'G' (0.2 mm thick ness) plate using toluene : dichloromethane : ethanol : formic acid (10:3:3:1) shows under U.V. (366 nm) five greenish blue fluorescent bands at Rf. 0.14, 0.18, 0.22, 0.39, 0.54. On exposure to Iodine vapour six bands appear at Rf. 0.18 (greenish brown), 0.22, 0.37 (both light brown), 0.53, 0.68, 0.74 (all yellow). On spraying with

5% Ethanolic-sulphuric acid reagent and heating the plate for ten minutes at 105^0 C, eleven bands appear at Rf. 0.14, 0.22, 0.30, 0.37 (all light brown), 0.48 (greenish brown), 0.53 (yellowish brown), 0.56 (brown), 0.59 (pinkish brown), 0.68 (lower half blue and upper half pink), 0.74, 0.87 (both pinkish brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS:

TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Jali, Kasire Riyah**,** Musaffie Khoon, Mohallile waram
THERAPEUTIC USES	**:**	Tabkheer Meda, Juzam, Warm Jild
DOSE	**:**	3-5 g.

KAKNAJ
(FRUIT)

The drug Kaknaj consists of dried mature fruit of *Physalis alkekengi* Linn. (Fam. Solanaceae), it occurs in S. Europe through China to Japan; it does not occur in India, but fruits are available in the Indian bazaar, in the name of kakanaja.

OTHER NAMES:

Urdu	:	Kaknaj, Papotan
Persian	:	Uroos Darparda
English	:	Winter cherry, Bladder cherry
Hindi	:	Kakanaja
Bengali	:	Kakanaja
Gujrati	:	Kakanaja
Kannad	:	Kakanaja
Tamil	:	Sisayakkaali, Tottakkaali
Malyalam	:	Kakanaja
Marathi	:	Kakanaja
Punjabi	:	Kaaknaj
Telugu	:	Kupante

DESCRIPTION:

Macroscopic : Red coloured berry, globose, about 1 to 1.5 cm in diameter, outer surface wrinkled, with dried flesh; unilocular, completely packed with seeds, overlapping, centrally oriented, insignificant placenta present; seeds 1.8 to 2.2 mm, numerous, flat, with curved embryo, hilum in the concavity; fruit sweet and sour in taste.

Microscopic: Fruit: Cuticle present; fruit wall not distinguishable as epicarp, mesocarp and endocarp clearly; the outer layer consists of a single layer of non lignified, thin walled cell with brown contents; below this are a few layers of horizontally oriented cells with orange contents and loosely arranged layers of parenchyma, with mucilage cells; inner layers of the fruit wall and the placentae proliferate into the locule packed with minute seeds.

Seed : T.S. is elongated with a projection at both ends; testa has an outermost papillose thin walled cells followed by thickened sclereids, which appear bone shaped at the projected parts, the latter showing pits on their walls; below are 2 or 3 layers of thin walled cells followed by a thick cuticle and inner lignified single layered tegmen; endosperm contains thin walled polygonal parenchymatous cells filled with aleurone grains, oil globules and occasional sandy calcium oxalate crystals; embryo curved if present.

Powder: The powder is brownish-orange in colour; shows sclereids, parenchymatous cells, endospermic parenchymatous cells rich in oil and aleurone grains.

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 10 percent, Appendix 2.2.6.
Water soluble extractive	:	Not less than 22 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the alcoholic extract on silica gel 'G' (0.2 mm thick ness) plate using toluene: methanol (7:3) shows eleven bands at Rf. 0.11 (dark brown), 0.38, 0.44, 0.46, 0.52, 0.56 (all light grey), 0.66 (dark brown), 0.72, 0.78, 0.83, 0.88 (all light grey), on spraying with 5% Ethanolic-sulphuric acid reagent and heating the plate for ten minutes at 105^0 C. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Auroxanthin, mutatoxanthin, phydalein, zeaxanthin, β-Cryptoxanthin from the calyx of the fruit; glycoalkaloids detected in the seeds but alkaloids were absent in the fruit.
TEMPERAMENT	**:**	Cold2^0 and Dry2^0
ACTION	**:**	Mudirre Baul, Muaddile Safra, Musleh Jigar, Mukhrije Deedan.
THERAPEUTIC USES	**:**	Amraz Kulya Gurda wa Masana, Yarqan safravi, Warm Jigar, Deedan Ama
DOSE	:	5-7 g
IMPORTANT FORMULATIONS	:	Qurs Kaknaj

KARANJWA
(Seed)

Karanjwa consists of seed of *Caesalpinia bonduc* (Linn.) Roxb. (Fam. Caesalpiniaceae), an extensive, shrubby, wild, perennial huge shrub distributed throughout tropical parts of India.

OTHER NAMES:

Urdu	:	Akitmakit
Arabic	:	Akitmakit
Persian	:	Khaya-e-Iblees
English	:	Bonduc Nut, Fever Nut
Hindi	:	Karanja, Karanjuaa, Kaantaa Karanj
Bengali	:	Kaantaa Karanjaa, Naataa, Naataa Karanjaa
Gujrati	:	Kaanchakaa, Kaanka
Kannad	:	Gajjike Kaayi, Gajkai
Tamil	:	Kajha shikke, Kalichchikkaai
Malyalam	:	Kalamchikuru, Kaalanchi, Kazhinch: Kai
Marathi	:	Saagar gotaa, Gajarghotaa, Gaajagaa
Oriya	:	Kotokolejaa
Telugu	:	Gachchakaay

DESCRIPTION:

Macroscopic: Seeds globose or rounded, smooth, shiny, 1.2 to 2.5 cm in diameter; slightly flattened on one side due to close pressing of adjacent seeds; hilum and micropyle close together; hilum surrounded by a dark area around 4 mm in diameter, usually with a whitish or yellowish remnant of funiculus- micropyle near the periphery of the dark area; seed coat greenish-grey to bluish-grey, lineate, shiny; 100 seeds weigh from 225 to 250 g.

Microscopic: Testa shows an outer single row of radially elongated, very narrow, transluscent, compactly arranged cells forming a palisade layer (Malpighian layer) passing through which is the 'linea lucida'. These cells appear hexagonal in surface view and possess thick walls (rich in pectin as evident from Chloro-zinc Iodine Test); a sub-epidermal zone of 2 or 3 layers of thick walled bearer cells present, followed by multiple rows of osteosclereids, which progressively increase in size, elongate laterally and have more intercellular spaces towards the inner side; the outer few layers of these osteosclereids contain a brown substance; laterally elongated vascular tissues present in the lower region of this zone. The cells inner to vascular elements gradually compacted and rounded towards the inner margin; cotyledons show an outer single layer of epidermis made of small, isodiametric cells, and inner parenchymatous ground tissue cells rich in fixed oil, and having empty cavities uniformly distributed in them.

Powder: Colour light yellow through mustard to brown, coarse and free-flowing; bitter in taste and possessing tamarind: like odour. Parts of vessels showing scalariform thickenings and groups of narrow, palisade cells with light line are present; groups of cells of height from 150 to 250 μ the sub-epidermal layers of seed coat having 10 to 12 μ, squarish bearer cells and upto 150 μ long osteosclereids; cotyledon cells (upto 35 μ) showing fixed oil when mounted in Sudan III.

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 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 26 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 4.0 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: ethylacetate : acetic acid (5:4.5:0.5), shows under U.V. (366 nm) spots at Rf. 0.13 (Light Blue), 0.28 (Dark Blue), 0.63 (Pink), 0.92 (Pink); on spraying with anisaldehyde- sulphuric acid reagent and heating the plate for ten minutes at 110 ^{0} C spots appear at Rf 0.30(Brown), 0.64 (Bluish Purple), 0.72 (Purple), 0.80 (Purple), 0.89 (Grey).

T.L.C. of the hexane extract on precoated silica gel 'G' plate 0.2 mm thick using chloroform: ethylacetate (98:2), on spraying with anisaldehyde- sulphuric acid reagent and heating the plate for ten minutes at 110 ^{0} C spots appear at Rf 0.03 (Yellow), 0.11 (Greenish Blue), 0.21 (Greenish Yellow), 0.33 (Greenish Blue), 0.43 (Pale yellow), 0.55 (Greenish Blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Seeds contain bitter substance phytosterenin, bonducin, saponin, phytosterol, fixed oil, starch and sucrose. Seeds also contain α, β, γ, δ and ζ caesalpins.
TEMPERAMENT	**:**	Hot2^{0} and Dry2^{0}
ACTION	**:**	Dafae Humma, Kasire Riyah, Mujaffif**,** Musaffie Khoon**,** Dafae Taffun, Qatile Kirm, Dafe Tashannuj
THERAPEUTIC USES	**:**	Humma, Fasadae Dam, Zeequn Nafas, Qoolanje Reehi
DOSE	**:**	560 mg – 1 g
IMPORTANT FORMULATIONS	**:**	Habbe Mubarak, Jawarish Gajga

KHAKSI
(Seed)

Khaksi is the seed of *Sisymbrium irio* Linn. (Fam. Brassicaceae), an annual or biennial herb found in Kashmir, Punjab and Haryana and from Rajasthan to U.P. especially on moist soil.

OTHER NAMES:

Urdu	:	Khaksi
Arabic	:	Khubba
Persian	:	Shibba wa Khakchi, Khubkalas
English	:	Hedge-mustard, London Rocket
Hindi	:	Khub Kalaan, Khaaksee
Marathi	:	Ranteekhee
Punjabi	:	Janglisarson, Maktrusa, Maktaroosaa

DESCRIPTION:

Macroscopic : Seeds more or less ellipsoid, minute, size about a mm, orangish-brown, mucilaginous with warty surface; odour, pungent like mustard oil and taste like bitter mustard oil.

Microscopic : T.S. of seed shows seed coat with six layers, outermost a single layer of epidermis of rectangular, flattened and thin walled cells ranging from 30 to 50 in length containing colourless, concentrically striated mucilage; a two-cell deep layer of parenchymatous cells, a single row of sclerenchymatous cells with their radial and inner tangential walls thickened, a single-cell layer of pigment, a single cell layer of aleurone grains, followed by crushed parenchymatous cells; cotyledons contain aleurone grains and oil globules; embryo folded; starch absent.

Powder: Brown, with pungent mustard oil smell, shows oil globules; aleurone grains containing crystalloids, globoids and sclerenchymatous cells; with ruthenium red mucilage turns pink.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total Ash	:	Not more than 5 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 1 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 22 percent, Appendix 2.2.6.
Water soluble extractive	:	Not less than 14 percent, Appendix 2.2.7.
Fixed oil	:	Not less than 20 percent, Appendix 2.2.8.

T.L.C. :

T.L.C. of the methanolic extract on silica gel 'G' plate (0.2 mm thick) using butanol : acetic acid : methanol (60:10:20) shows under UV (254 nm) green spots at Rf. 0.07, 0.17, 0.23, 0.29, 0.55 and 0.87. After spraying with anisaldehyde-sulphuric acid reagent and heating the plate at 105 °C for ten minutes spots appear at Rf. 0.05 (green), 0.09 (green), 0.13 (light green), 0.21 (dark green), 0.28 (purple), 0.40 (purple), 0.76 (light purple) and 0.93 (dark purple). After spraying with Dragendorff's reagent, one spot appears at Rf. 0.24 (bright orange). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil and Isorhamnetin.
TEMPERAMENT	**:**	Hot2^0 and Moist2^0
ACTION	**:**	Muaariq, Daf-e-Humma, Nafae Haiza, Munaffise Akhlate Sadr, Munaffis Balghum
THERAPEUTIC USES	**:**	Humma, Hasba, Judri. Suale Muzmin
DOSE	**:**	5-7 g.
IMPORTANT FORMULATIONS	**:**	Sharbat Khaksi

KHAYAR
(Seed)

Khayar consists of dried seed of *Cucumis sativus* Linn. (Fam. Cucurbitaceae), an annual trailing or climbing plant, numerous varieties widely cultivated throughout India upto an altitude of 1200 m. The seeds are devoid of mucilagenous outer layer.

OTHER NAMES:

Urdu	:	Kheera
Arabic	:	Kanshad, Kasad, Khayar
Persian	:	Khayaru Badrang
English	:	Cucumber
Hindi	:	Kheeraa
Bengali	:	Ksheeraa, Shashaa
Gujrati	:	Taanslee
Kannad	:	Mullusavte, Santekaayi
Tamil	:	Vellarikkaay, Pippinkaay
Malyalam	:	Vellari
Marathi	:	Tause, Khiraa
Oriya	:	Kantiaali Kaakudi
Punjabi	:	Khiraa
Telugu	:	Khirakaya

DESCRIPTION:

Macroscopic : Seeds compressed, elongated, ellipsoid, dorsiventrally convex and laterally ridged; size variable, about a cm or occasionally more in length and upto 0.5 cm wide; micropyle pointed, distinctly visible; outer surface glossy, brittle, peelable; yellowish-white; kernel, oily, creamish-white; taste, mildly sweet, oily; not slippery to touch when moistened: odour, nil.

Microscopic : Outermost layer of testa absent; hypodermis sclerenchymatous, two layered, outer layer of small, circular, stone cells, inner layer of large, oval, thick walled, striated, lignified sclereids placed at right angle to outer layer; a large zone of aerenchyma filled with loosely packed parenchymatous cells; cotyledon lined by compact layer of cuticularized thin walled epidermis, cotyledon of several layers of elongated, closely packed parenchymatous cells, largely hexagonal, packed with aleurone grains, starch and fat globules; innermost two layers much more elongated, palisade like, and distinct; each cotyledon shows five distinct patches of small, thin walled, polygonal cells present midway, in a roughly trapezial shape.

Powder : Creamish-white to light-green, oily, shows groups of yellowish, wavy-walled sclereids from testa in surface view, also isolated ones; fragments of parenchymatous cells; annular or spiral xylem vessels in groups; abundant oil globules, aleurone grains, and starch grains.

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 5 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 7 percent, 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 chloroform : methanol (20:0.5) shows spots at Rf 0.31 (purple), 0.40 (brown), 0.48 (purple), 0.52 (light purple), 0.60 (purple), 0.70 (light grey) and 0.78 (pinkish brown) . Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil and sugars.
TEMPERAMENT	**:**	Cold2^0 and Moist2^0
ACTION	:	Mudirre Baul, Musakkine safra wa Khoon, Dafe Atash
THERAPEUTIC USES	**:**	Sozishe Baul, Hiddate Safra wa Khoon.
DOSE	**:**	5 – 7 g
IMPORTANTFORMULATIONS	**:**	Sharbat Bazoori Motadil

KIBR
(ROOT)

The drug Kibr consists of root of *Capparis spinosa* Linn. (Fam. Capparidaceae), a thorny shrub distributed in the plains, lower Himalayas, and Western Ghats.

OTHER NAMES:

Urdu	:	Kabar
Arabic	:	Kibr
Persian	:	Kibar
English	:	Ceper Plant
Hindi	:	Kabara, Hainsaa, Kanthara
Gujrati	:	Kabaree
Marathi	:	Kabar
Punjabi	:	Barar, Kaur

DESCRIPTION:

Macroscopic : Root pieces are upto 5.5 cm in thickness; bark rough to touch, thick showing longitudinal lenticels; freshly broken surface light yellowish; wood hard and compact; remnants of robust and slender rootlets present on the bark; colour varies from pale yellow to reddish-brovin; no particular odour or taste.

Microscopic : A transverse section of root characterised by outermost layer of slightly suberised corky zone of several layers showing irregular and broken outline; cork cambium made of 4 or 5 layers of thin walled, small, squarish cells; cortex consisting of thin walled, irregular or somewhat tangentially elongated cells; angular sclereids in groups of 2 to 3 and upto 30 µ in size scattered in cortex; phloem in the form of multiple layers of cells forming a continuous cylinder around inner vascular zone, separated from the xylem by 4 to 5 layers of vascular cambium; wedges of vascular elements with thick walled cells span the centre of the root and the outer zone; vessels isolated or in groups of two, distributed uniformly among xylem parenchyma, which has granular contents; medullary rays of thin walled, mostly uniseriate, rectangular cells, often having granular contents; pith absent.

Powder: Powder shows vessel fragments with simple pitted thickenings and tracheids with tapering or blunt ends; sclereids upto 30 µ size and in groups of 2 or 3.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 per cent, Appendix 2.2.2.
Total ash	:	Not more than 13 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 1 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 alcohol soluble extract of the drug on precoated silica gel 'G' plate (0.2 mm thick) using chloroform: methanol (95:5) under UV (366nm) shows spots at Rf 0.01 (Blue), 0.11 (Blue); 0.93(Blue).On spraying with anisaidehyde: sulphuric acid reagent and heating the plate for ten minutes at 110^0 C three spots appear at Rf 0.32(Orange), 0.62 (Purple), 0.68 (Cream). Appendix 2.2.10.

CHEMICAL CONSTITUENTS	**:**	The roots contain alkaloid stachydrine. Glucobrassicin, neoglu-cobrassicin and 4-methoxyglucobrassicin have also been identified in the roots.
TEMPERAMENT	**:**	$Hot2^0$ and $Dry2^0$
ACTION	**:**	Mufatteh Sudad, Jali, Mohallil, Munaffise Balgham, Qatile Kirm, Mudirre Baul wa Haiz
THERAPEUTIC USES	**:**	Suddae Jigar wa Tihal, Kirm Amaa**,** Ehtabase Baul wa Haiz.
DOSE	**:**	5-7 g.
IMPORTANT FORMULATION	**:**	Sharbat Khaksi
MODE	**:**	Decoction (Basurrah Besta)

MASTAGI
(RESIN)

The drug Mastagi is a resin obtained from *Pistacia lentiscus* Linn. (Fam. Anacardiaceae); a shrub or small tree indigenous to the countries bordering on the Mediterranean.

OTHER NAMES:

Urdu	:	Mastagi
Arabic	:	Mastakee, Alakkhmee, Ilkurumee, Mastagi
Persian	:	Kundur Roomi
English	:	Mastic
Hindi	:	Rumi Mastagee, Rumi Mastiki, Mastagee
Bengali	:	Rumi-Mastungi
Gujrati	:	Rumi Mastagee
Marathi	:	Rumaa Mastakee

DESCRIPTION:

The resin occurs in small, hard, pear shaped, ovoid or nearly globular, sometimes elongated tears, about 2 to 8 mm in diameter; pale yellow in colour; brittle, breaking into clear glossy fracture, interior transparent, crushing to a sandy powder, taste, slightly agreeable; odour, aromatic.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 2.6 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 0.34 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 94.0 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 0.5 percent, Appendix 2.2.7.

ASSAY : The drug on steam distillation yields colourless oil (1.5-2.0% v/w), which is heavier than water.Appendiz 2.2.14

T.L.C.:

T.L.C. of alcoholic extract on Silica gel 'G' precoated plates (Merck), using Toluene:Methanol (95:5); under UV (254nm) shows one spot at Rf. 0.17 (blue fluorescence): on spraying with Vanillin-sulphuric acid and heating the plate at 110^0C for 30 minutes, twelve spots appear at Rf.0.12, 0.17, 0.23 (all violet), 0.40 (blue), 0.41 (purple), 0.44, 0.46, 0.49, 0.56, 0.69, 0.80 and 0.86 (all blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Resin, volatile oil, a bicyclic terpenoid and fatty acids.
TEMPERAMENT	**:**	Hot2^0 and Dry2^0
ACTION	**:**	Muqawwie Meda wa Jigar, Kasire Riyah
THERAPEUTIC USES	**:**	Zof-e-Meda, Zof-e-Jigar, Nafakh-e-Shikam.
DOSE	**:**	1-2 g
IMPORTANT FORMULATIONS	**:**	Jawarish Mastagi**,** Jawarish Jalinoos

MEDA LAKRI
(Stem Bark)

The drug Medalakri consists of stem bark of *Litsea chinensis* Lam. syn. *L. glutinosa* (Lour.) C.B. Robins, *L. sebifera* Pers. (Fam. Lauraceae); an evergreen shrub or tree, upto 25 m in height and about 1.5 m in girth with a clean bole, found throughout India, ascending upto an altitude of 1350 m in outer Himalayas.

OTHER NAMES:

Urdu	:	Meda Lakri
Arabic	:	Magaase Hindi
Hindi	:	Maida Lakdee
Bengali	:	Kukurchite
Gujrati	:	Meda Lakdee
Tamil	:	Medalakavi
Marathi	:	Meda Lakdee
Punjabi	:	Medasaka
Telugu	:	Meda

DESCRIPTION:

Macroscopic : Pieces of bark 1.5 to1.6 cm in length; 0.1 to 0.5 cm in width; external surface rough, corky, greenish yellow to yellowish-brown; internal surface smooth, longitudinally striated, dark brown to black; fracture, short and uneven.

Microscopic: T. S. shows broad zone of cork, 5 to 8 layered; secondary cortex consisting of patches of sclereids, fibres, parenchyma, occasionally containing rhomboidal crystals of calcium oxalate, abundant starch grains, cells containing tannins and mucilage; starch grains spherical to oval, single or in groups, simple or compound, measuring from 1.5 to 8 μ; fibres long, lignified with tapering ends, measuring from 370 to 630 μ in length and 23 to 35 μ in width.

Powder : Light brown in colour, odour strong, bitter and mucilaginous showing cork tissue, starch grains, sclereids, fibres, cells containing tannins and mucilage; sclereids round to oblong, laterally compressed, with narrow lumen, and showing radiating pit canals.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total Ash	:	Not more than 8 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 1 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 5 percent, Appendix 2.2.6.

T. L. C.:

T.L.C. of the alcoholic extract on silica gel 'G' plate (0.2 mm thick) using chloroform: methanol: acetic acid (80:20:2) shows Under UV (254 nm) three spots at Rf. 0.07 (brown), 0.15 and 0.23 (both violet). Under UV (366 nm) two fluorescent spots appear at Rf. 0.68 (pink) and 0.89 (blue). On exposure to iodine vapour five spots appear at Rf. 0.15, 0.20, 0.23, 0.30 and 0.82 (all yellowish

brown). On spraying with 5% ferric chloride solution four spots appear at Rf. 0.07 (violet), 0.15 (blue), 0.23 and 0.30 (both faint green). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alkaloids (Laurotetaline, actinodaphine, boldine, norboldine, sebiferine and litseferine).
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Mohallil, Muqawwi-e-Asab wa Meda, Muqawwi Bah
THERAPEUTIC USES	**:**	Zarba wa Saqta, Amraze Balghami wa Aasabi, Darde Pusht, Wajaul Mafasil, Zofe Bah.
DOSE	**:**	3-5 g
IMPORTANT FORMULATIONS	**:**	Safoof Istahaza, Zimade Dard

NANA (PUDINA)

The drug Pudina consists of the aerial part of *Mentha viridis* Linn. syn. *M. spicata* var. *viridis* Linn. (Fam. Lamiaceae) a perennial, creeping aromatic herb of 30 to 90 cm high, widely cultivated throughout the plains of India for culinary and medicinal purposes.

OTHER NAMES:

Urdu	:	Pudina
Arabic	:	Fodanj, Naana
Persian	:	Pudina
English	:	Spear-Mint, Garden Mint
Hindi	:	Pudeenaa
Bengali	:	Pudinaa
Gujrati	:	Phudino
Tamil	:	Pudeenaa
Marathi	:	Pudinaa
Punjabi	:	Parari pudina
Telugu	:	Pudeenaa

DESCRIPTION:

Macroscopic : Drug consists of small chopped twigs; leaves opposite, decussate, shortly petiolate, petioles 2-mm long; mature leaves 2.5 to 3.5 cm long and 1.5 to 2.0 cm broad, very minutely hairy, ovate, apex acute, coarsely dentate, comparatively smoother and darker upper surface; stem square, minutely hairy, light brown to brown; flowers in loose cylindrical, slender spikes; awl like, throat of calyx naked, corolla smooth; seeds small, mucilaginous; aromatic odour and slightly pungent taste.

Microscopic: Stem: T.S. shows quadrangular outline with corner ridges and thin cuticle; epidermal cells tabular, multicellular uniserate trichomes present, cortex 8 to 9 cells deep below ridges, while 2 to 3 cells deep elsewhere, variable in size; endodermis single layer; pericycle broken, consisting of sclerenchymatous cells; phloem 2 to 4 cells deep and made up of irregular shaped cells; xylem vessels 26 to 46 µ in dia; pith present.

Leaf: *Midrib*: T.S. shows protruded mid rib towards the lower surface; compact parenchymatous cells enclose a crescent-shaped vascular bundle; eollenchymatous cells are absent.

Lamina: Dorsiventral, epidermal cell walls of both the surfaces in the surface view are wavy, stomata diacytic; covering trichomes present on the lower surface, uniseriate, 1 to 4 cells long, 42 to 350 µ in size with pointed apex; glandular trichomes 64 to 80 µ in diam. with a single basal cell and a head of 8 cells, found in depression of the epidermis; a single row of palisade cells towards the upper side followed by spongy parenchyma 3 to 4 cells deep; palisade ratio 6 to 8; vein islet number 18 to 20; stomatal index for upper epidermis 10 to 20, lower epidermis 15 to 30.

Powder: Blackish-brown, fibrous, free flowing, characterized by the presence of uniseriate non-glandular hairs (112 to 350 µ), glandular trichomes 64 to 80 µ in diam, diacytic stomata, epidermal cell walls wavy.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 14 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 4 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 2 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 7 percent, Appendix 2.2.7.
Essential oil	:	Not less than 0.2 percent, Appendix 2.2.10.

T.L.C. :

T.L.C. of essential oil on silica gel 'G' plate using hexane: ethyl acetate (90:10) shows eight spots at RF 0.28, 0.33, 0.38, 0.49, 0.55, 0.66, 0.80 and 0.88 on spraying with Vanillin-Sulphuric acid reagent and heating the plate for 15 minutes at 110^0C. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential oil (0.2 to 0.8 percent) containing terpene such as carvone (60%) and limonene (10%) as major constituents.
TEMPERAMENT	**:**	Hot2^0 and Dry 2^0
ACTION	**:**	Munzij Mawade Ghaleez, Kasire Riyah, Muqawwie Meda, Mudirre Baul wa Tams, Musakkine Dard, Qatile Kirm, Daffe Taaffun.
THERAPEUTIC USES	**:**	Zofe Meda, Nafakhe Shikam, Qai, Ehtabase Baul wa Tams, Ishale Atfal, Nafe Haiza.
DOSE	**:**	3 - 5 g
IMPORTANT FORMULATIONS	**:**	Jawarish Pudina**,** Arq Pudina, Arq Ajeeb, Jawarish Anarain, Sikanjbeen Naanai.

NEEM
(Root Bark)

Bekh Neem consists of dried root bark of *Azadirachta indica* A. Juss. syn. *Melia azadirachta* Linn. (Fam. Meliaceae), a medium to large evergreen tree attaining a height of 15 to 20 m or more under favourable conditions and found throughout the plains of India upto an altitude of 900 m.

OTHER NAMES :

Urdu	:	Neem
Arabic	:	Aazaadarkhtul Hind
Persian	:	Neeb
English	:	Margosa Tree, Neem Tree, Indian Lilac
Hindi	:	Neem
Bengali	:	Nim, Nimgaachh
Gujrati	:	Leemado
Kannad	:	Turakbevu, Huchchabevu, Chikkabevu
Tamil	:	Vempu, Veppu
Malyalam	:	Veppu, Aryaveppu, Aaruveppu
Marathi	:	Kadunimba, Nimb
Oriya	:	Neemo, Nimba
Punjabi	:	Nimb, Nim
Telugu	:	Vemu, Vepa

DESCRIPTION:

Macroscopic : Root bark available in quilled or curved pieces of varying sizes with a thickness of 0.25 to 0.50 cm; outer surface irregular, rough, scaly, fissured, reddish-brown or greyish-brown; inner surface, yellowish-brown with parallel striations; fracture, splintery and fibrous; odour like that of saw dust; taste, bitter.

Microscopic : Root bark shows cork, cortex and phloem; cork generally 6 or 7 layers of polygonal and thin walled cells with reddish-brown contents; outer cortex of tangentially elongated large rectangular cells with tangentially elongated sclereids, singly or in groups in isolated patches; sclereids vary in size and wall thickness, distinctly striated, pitted and often associated with cells containing crystal; inner cortex of polygonal parenchymatous cells with bundles of sclerenchymatous fibres, thick walled with irregular lumen; secondary phloem composed of alternating tangential bands of bast fibres and parenchymatous tissues intercepted by uni to biseriate phloem rays; abundant starch grains present in parenchymatous cells of cortex and phloem; starch grains simple, or more usually, compound with 2 or 3 components, hilum cleft or radiate, individual grain 5 to 20 μ; abundant prismatic crystals of calcium oxalate in cortex, of 10 to 15 μ, also associated with phloem fibres; idioblasts with reddish-brown contents seen in cortex; cells with fat droplets seen in inner cortex and phloem.

Powder: Reddish-brown; shows cork cells; numerous prismatic crystals of calcium oxalate both isolated, and in association with phloem fibres; individual fibres with narrow lumen and elongated tapering ends; pitted macrosclereids with wide lumen and distinct striations; simple, and compound starch grains with 2 or 3 components, of 5 to 20 μ in size; parenchymatous cells large and occasionally filled with brown contents.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 15 percent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 3 percent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 6 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 7 percent, 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 hexane : ethyl acetate (1:1) shows spots at Rf 0.08, 0.12, 0.19 (all violet), 0.25 (mustard yellow), 0.33, 0.39, 0.46 (all light violet) and 0.82 (purple) on spraying with 1% Vanillin-Sulphuric acid reagent followed by heating the plate at 105 °C for about ten minutes. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Tetranortriterpenoids, margocin, nimbidiol, nimbolicin, azadirinin.
TEMPERAMENT	**:**	Hot1^0 and Dry1^0
ACTION	**:**	Musaffie Khoon, Dafe Humma, Qatile Kirme Amaa.
THERAPEUTIC USES	**:**	Amraze Jild, Fasade Dam
DOSE	**:**	6-10 g.
IMPORTANT FORMULATIONS	**:**	Habbe Musaffie Khoon, Habbe Bawaseer, Majoon Musakkin Darde Raham.

NEEM
(Flower)

Gule Neem consists of dried flower and flower bud of *Azadirachta indica* A. Juss. syn. *Melia azadirachta* Linn. (Fam. Meliaceae), a medium to large size evergreen tree attaining a height of 15 to 20 m or more under favourable conditions and found throughout the plains of India upto an altitude of 900 m.

OTHER NAMES:

Urdu	:	Neem
Arabic	:	Aajaadarkhtul hind
Persian	:	Neeb
English	:	Margosa Tree, Neem Tree, Indian Lilac
Hindi	:	Neem
Bengali	:	Nim, Nimgaachh
Gujrati	:	Leemado
Kannad	:	Turakbevu, Huchchabevu, Chikkabevu
Tamil	:	Vempu, Veppu
Malyalam	:	Veppu, Aryaveppu, Aaruveppu
Marathi	:	Kadunimba, Nimb
Oriya	:	Neemo, Nimba
Punjabi	:	Nimb, Nim
Telugu	:	Vemu, Vepa

DESCRIPTION:

Macroscopic : Dried flowers are brown to deep brown; individual flower 5 to 6 mm long and 6 to 11 mm wide, pentamerous, bisexual, regular and hypogynous; calyx 5, short, united at base; corolla 5, free, spathulate, spreading, 4.5 to 5.5 mm long 2 mm wide; stamens 10, monoadelphous, staminal tube inserted at base of corolla; gynoecium tricarpellary, syncarpous, superior, trilocular, two ovules in each locule, style 1, stigma 3-lobed; taste, mildly bitter: odour, indistinct.

Microscopic: Calyx: Sepal shows thin walled polygonal papillose epidermis; elongated thin walled unicellular conical trichomes of varying lengths; rosette crystals in cells of epidermis.

Petals : Petal shows epidermis of rectangular cells papillose at margins, non-glandular unicellular trichomes, over 150 µ long, tubular and hyaline; glandular trichomes of about 20 µ, numerous rosette crystals in epidermal cells.

Androecium: Epidermis of staminal tube composed of thick walled rectangular parenchymatous cells and the endothecium of the anther walls.

Gynoecium: Stigma sticky, parenchymatous epidermal cells, elongated into extensive papillae, style thin walled, rectangular, ovary superior, trilocular.

Pollen Grain – Porous, 4-colporate, spherical 105 to161µ in dia., with a smooth exine.

Powder: Yellowish-brown, fragments of parenchymatous papillose epidermal cells, trichomes, numerous vessels, rosette calcium oxalate crystals, and yellowish-brown pollen grains.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than 14 percent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 5 percent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 5 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 12 percent, 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 chloroform : acetone (20:1) shows spots at Rf 0.12 (violet), 0.17 (light pink), 0.33 (violet), 0.51 (purple), 0.64 (dark purple), 0.80 (light purple), 0.85 (light purple), 0.92 (purple) on spraying with 1% Vanillin-Sulphuric acid reagent followed by heating the plate at 105 °C for about ten minutes. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	15-Acetoxy-7-deacetoxydihydroazadirone (neeflone), nonacosane (saturated hydrocarbon).
TEMPERAMENT	**:**	Hot1^0 and Dry1^0
ACTION	**:**	Musaffie Khoon, Dafe Humma, Qatile Kirme Amaa.
THERAPEUTIC USES	**:**	Amraze Jild, Fasade Dam
DOSE	**:**	6-10 g.
IMPORTANT FORMULATIONS	**:**	Habbe Musaffie Khoon, Habbe Bawaseer, Majoon Musakkin Darde Raham.

NEEM
(Fruit)

Tukhm Neem consists of whole dried fruit including seeds of *Azadirachta indica* A. Juss. syn. *Melia azadirachta* Linn. (Fam. Meliaceae), a medium to large size evergreen tree attaining a height of 15 to 20 m or more under favourable conditions and found throughout the plains of India upto an altitude of 900 m.

OTHER NAMES:

Urdu	:	Neem
Arabic	:	Aazaadarkhtul hind
Persian	:	Neeb
English	:	Margosa Tree, Neem Tree, Indian Lilac
Hindi	:	Neem
Bengali	:	Nim, Nimgaachh
Gujrati	:	Leemado
Kannad	:	Turakbevu, Huchchabevu, Chikkabevu
Tamil	:	Vempu, Veppu
Malyalam	:	Veppu, Aryaveppu, Aaruveppu
Marathi	:	Kadunimba, Nimb
Oriya	:	Neemo, Nimba
Punjabi	:	Nimb, Nim
Telugu	:	Vemu, Vepa

DESCRIPTION:

Macroscopic: Fruit: Glabrous, dark reddish-brown, ovoid to ellipsoid drupes. 0.5 to 2 cm long, over one cm wide; indehiscent, deeply wrinkled, enclosing a single seed in a brownish leathery pulp; odour strong; taste, bitter.

Seed : Brownish, dorsally convex; upto 1.5 cm long and 0.6 cm wide; seed coat thin, brownish, shell-like, cracks to touch, inside of cracked pieces golden yellow; seed kernel, light brown, oily; odour, strong; taste, bitter.

Microscopic : Fruit : Pericarp well differentiated into epicarp, mesocarp and endocarp; epidermis more than one layered; squarish to rectangular cells containing yellowish-brown contents and oil droplets; mesocarp, many layered of loosely packed cells with large elongated sclereids scattered in outer layers; endocarp of two distinct layers, outer of closely packed lignified stone cells, inner fibrous, loosely packed, lignified.

Seed: Seed kernel shows a thin brown testa, of isodiametric stone cells overlying integument of loosely packed parenchymatous cells; cotyledon consisting of parenchymatous cells containing abundant oil droplets.

Powder : Dark brown; shows abundant brachysclereids, columnar sclereids and pitted stone cells with wide lumen and distinct wall striations; groups of lignified fibres, thin-walled, arranged in network of loose strands; parenchymatous cells of cotyledon containing aleurone grains and oil globules; fragments of testa showing distinctly striated isodiametric stone cells; a few scattered rosette crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 8 percent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 2 percent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 16 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 19 percent, 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 chloroform : acetone (18.5:1.5) shows spots at Rf 0.11 (greyish violet), 0.16 (yellow), 0.19 (green), 0.24 (violet), 0.29 (grey), 0.33 (mustard yellow), 0.42 (pink), 0.49 (greyish black), 0.57 (violet) and 0.76 (light purple) on spraying with 1% Vanillin-Sulphuric acid reagent and heating the plate at 105 °C for about ten minutes. Appendix 2.2.10

CHEMISTRY CONSTITUENTS	**:**	Fixed oil containing diterpenoids and triterpenoids (limonoids); nimbin, gedunin, azadirachtin; nimbidinin, salanin.
TEMPERAMENT	**:**	Hot1^0 and Dry1^0
ACTION	:	Musaffie Khoon, Dafe Humma, Qatile Kirme Amaa.
THERAPEUTIC USES	**:**	Amraze Jild, Fasade Dam
DOSE	**:**	6-10 g.
IMPORTANT FORMULATIONS	**:**	Habbe Musaffie Khoon, Habbe Bawaseer, Majoon Musakkin Darde Raham.

PALAS
(STEM BARK)

The drug Palas consists of dried stem bark of *Butea monosperma* (Lam.) Kntze (Fam. Papilionecea); a medium sized tree with somewhat crooked trunk, 12-15 m high with irregular branches, commonly found throughout the greater part of the country upto about 915 m, except in very arid parts.

OTHER NAMES:

Urdu	:	Dhak, Palaspapda
Persian	:	Palah
Hindi	:	Dhak, Tesu
Bengali	:	Palash, palas, Palash Gachha
Gujarati	:	Kesudo, Khakharo, Khakhapado
Kannad	:	Muttug, Muttuga, Muttala
Tamil	:	Purasu, Paras
Malayalam	:	Plasu, Camata, Plas, Chama Tha
Marathi	:	Palas
Punjabi	:	Palash, Dhak, Tesu
Telugu	:	Moduga, Modugu, Chettu

DESCRIPTION;

Macroscopic: Mature stem bark, 0.5-1 cm thick, greyish to pale brown, curved, rough due to presence of rhytidoma, and scattered dark brown spots of exudates; rhytidoma 0.2 cm thick usually peels off, exposing light brown surface, exfoliation of cork and presence of shallow longitudinal and transverse fissures; fracture laminated in outer part and fibrous in inner part; internal surface rough pale brown; taste slightly astringent.

Microscopic : Stem Bark: Mature bark shows rhytidoma consisting of alternating layers of cork, secondary cortex and phloem tissue; cork cells, thin-walled, 5-10 or more layered, rectangular, dark-brown; secondary cortical cells round and irregular in outline, dark brown, moderately thick-walled; tanniniferous cells, often in groups, having brown colour, sometimes containing mucilage and other materials found scattered in this zone; beneath this zone regular cork consisting of 4-12 rows of radiameter lly arranged, rectangular cells followed by a zone of 2-4 layers of sclereids; secondary phloem consisting of sieve tubes, companion cells, phloem parenchyma, phloem fibres, crystal fibres, tranversed by phloem rays; in outer and middle phloem regions phloem tissues get crushed and form tangential bands of ceratenchyma; phloem fibres arranged in tangential bands alternating with sieve tubes and phloem parenchyma; most of the fibres groups contain prismatic crystals of calcium oxalate forming crystal sheath; in macerated preparation phloem fibres appear thick-walled, lignified, elongated with tapering or bifurcated ends; crystal fibres divided into a number of chambers containing a prismatic crystal of calcium oxalate in each chamber; phloem rays multiseriate 4-12 cells wide,7-50 cells in height, straight; prismatic crystals of calcium oxalate found scattered in the secondary phloem tissues and phloem rays; starch grains simple or compound having 2-3 components, measuring 2.75-13.75 µ in diameter found scattered in phloem parenchyma and phloem ray cells abundantly; tanniniferous cells and secretory cavities also occure in secondary phloem. .

Powder : Reddish-brown; shows numerous prismatic crystals of calcium oxalate, starch grains simple and compound with 2-3 components measuring 3-14 µ in diameter dark brown coloured cells, sclereids mostly in groups, thin-walled cork cells, numerous crystal fibres in group or singles.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 02 per cent, Appendix 2.2.2
Total ash	:	Not more than 12 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1.5 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 alcoholic extract of the drug on silica gel 'G' plate using Toluene:Ethylacetate (90:10) under U.V. (366 nm) shows four fluorescent zones at Rf. 0.10, 0.18, 0.48, 0.65 (all blue). On exposure to Iodine vapour three spots appear at Rf. 0.10, 0.48 and 0.67 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Kinotannic acid and Gallic acid**.**
TEMPERAMENT	**:**	Cold2^0 and Dry2^0
ACTION	**:**	Qabiz, Mughallize Mani, Qatile Kirme Amaa.
THERAPEUTIC USES	**:**	Ishal, Sailanur Raham, Jaryan, Riqqate Mani.
DOSE	**:**	5-10 gm in decoction form.
IMPORTANT FORMULATION	**:**	Safoof Moallif

PILU
(Fruit)

The drug Pilu consists of fruit of *Salvadora persica* Linn. var.*wightiana* (Planch.ex Thw.) Verdc, syn. *S. persica* Linn. (Fam. Salvadoraceae), a perennial, woody, glabrous shrub, distributed in the arid tracts of Punjab and north western parts of India.

OTHER NAMES:

Urdu	:	Pilu
Arabic	:	Arak
Persian	:	Darkht-e-Miswak
English	:	Salt bush, Toothbrush Tree
Hindi	:	Pilu, Jhak, Peelu, Kharjal
Bengali	:	Peelugachh, Jhal
Gujrati	:	Peelu, Khareejal
Kannad	:	Gonimara, Kankhina, Genumar
Tamil	:	Kotumaavali, Chittuva, Perungoli, Udhaiputtai
Malyalam	:	Uka
Marathi	:	Pilu, Khakhan
Punjabi	:	Peelu
Telugu	:	Gogu, Varagogu, Gunia

DESCRIPTION:

Macroscopic : Fruits are 3 to 5 mm in diameter, ellipsoid-ovoid, occasionally with a small pedicel attached; surface greenish or greenish-brown to dark brown in colour, with irregular wrinkles, sometimes shrunken; pericarp thin, easily separable, exhibiting creamish to dull brown seed, odour characteristic and taste bitter.

Microscopic : The epidermis is single layered consisting of thick walled, radially elongated cells covered externally with cuticle, the mesocarp differentiated into three zones, the outer and inner zone exhibiting thin walled parenchyma cells while a continuous zone of sclerenchymatous tissue with vascular bundles embedded in it is present in the middle region; testa shows single layered epidermis of thin walled cells followed by parenchymatous cells of the embryo containing aleurone grains and occasional oil globules.

Powder: Powder shows fragments of parenchymatous cells with aleurone grains and oil globules; scalariform, reticulate as well as border-pitted vascular elements; thick walled epidermal cells in surface view and sclereids.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 15 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 4 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 12 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 40 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of alcoholic extract on precoated Silica gel 'G' plate (Merck), using n-Butanol; Acetic acid; water (4:1:5), in visible light shows three spots at Rf.0.23, 0.80 (both light green) and 0.46 (light yellow); under UV (366 nm) two white spots appear at Rf.0.37 and 0.46; under UV (254nm) three spots appear at Rf.0.37 (white), 0.46 and 0.80 (both pink), on exposure to Iodine vapours four yellow spots appear at Rf.0.10, 0.37, 0.46 and 0.80, on spraying with vanillin sulphuric acid and heating the plate at 110^0C for 10 minutes, six spots appear at Rf. 0.10, 0.23 (both violet), 0.37, 0.40, 0.46 and 0.80 (all orange). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	β-sitosterol, sterol glycoside, benzyle isothioagnate, traces of alkaloid, fixed oil, sugar and fat, non-saponifiable portion of oil consists of dibenzylurea and dibenzlethiourea.
TEMPERAMENT	**:**	Hot2^0 and Dry2^0
ACTION	**:**	Mohallile Auram, Mudirre Baul, Muqawwie Meda, Habise Ishal
THERAPEUTIC USES	**:**	Ehtabase Baul, Ishaal, Warme Raham, Zofe Meda
DOSE	**:**	5 - 7 g.

PILU
(Leaf)

The drug Pilu consists of leaf of *Salvadora persica* Linn. var. *wightiana* (Planch. ex Thw.) Verdc, syn. *S .persica* Linn. (Fam. Salvadoraceae), a perennial, woody, glabrous shrub, distributed in the arid tracts of Punjab and north western parts of India.

OTHER NAMES:

Urdu	:	Pilu
Arabic	:	Arak
Persian	:	Darkht-e-Miswak
English	:	Salt bush, Toothbrush Tree
Hindi	:	Pilu, Jhak, Peelu, Kharjal
Bengali	:	Peelugachh, Jhal
Gujrati	:	Peelu, Khareejal
Kannad	:	Gonimara, Kankhina, Genumar
Tamil	:	Kotumaavali, Chittuva, Perungoli, Udhaiputtai
Malyalam	:	Uka
Marathi	:	Pilu, Khakhan
Punjabi	:	Peelu
Telugu	:	Gogu, Varagogu, Gunia

DESCRIPTION:

Macroscopic : Leaves are 3 to 10 cm in length and 1 to 4 cm in breadth, green, simple, stipulate, petiolate, oblong, ovate, margin entire, broad at base and acute at apex; veins prominent and raised on lower surface; both surfaces glabrous; taste and odour characteristic.

Microscopic : Petiole: Petiole somewhat circular in outline with a large crescent-shaped vascular bundle and two small vascular bundles fused together to form a central core of vascular tissue; the presence of interxylary phloem indicates anomalous growth; epidermis single layered, covered externally with thick cuticle; cortex a wide zone consisting of circular to oval parenchyma cells; pericycle represented by small patches of thick walled and lignified fibres; phloem consists of usual elements traversed by uni or biseriate medullary rays; xylem consists of vessels, tracheids, fibres and parenchyma; vessels show scalariform thickening and border pitted walls, tracheids are bordered as well as simple pitted, parenchyma cells and fibres are simple pitted; interxylary phloem present in the central xlyem region; pith composed of thin walled parenchyma cells; rosettes of calcium oxalate crystals and starch grains present in the parenchyma cells of the cortex and pericyclic region.

Midrib: Midrib shows single layered epidermis covered externally with thin cuticle on both the surfaces, except at a few places where a periclinal division is seen; cortex is a wide zone of thin walled parenchyma cells, the centre of midrib is occupied by a vascular cylinder consisting of a large crescent-shaped vascular bundle, the pericycle is represented by small patches of fibres, the phloem consists of usual elements, the xylem is represented by vessels, tracheids, parenchyma and fibres; interxylary phloem is present in the xylem region; the xylem is traversed by uniseriate medullary rays which become bi or tri seriate in the phloem region; rosettes of calcium oxalate

crystals and a few starch grains are present in the parenchymatous cells of cortex and pericyclic region.

Lamina : Lamina shows isobilateral structure; cuticle present, both epidermises are single layered, except for occasional periclinal division; in surface view both the surfaces shows anisocytic and paracytic stomata; 2 or 3 layers of palisade cells are present below the upper and above the lower epidermis, remaining area being occupied by thin walled cells of pongy parenchyma; a number of small vascular bundle and vascular strand are distributed in the mesophyll of the lamina; idioblasts containing large rosettes of calcium oxalate crystals are present beneath both the epidermises; rosettes of calcium oxalate crystals are also present in spongy parenchyma and palisade cells; stomatal index 9 to 11 (upper surface) and 8 to 10 (lower surface); palisade ratio 5 to 6 (upper surface) and 4 to 5 (lower surface); vein islet number 4 to 6 (upper surface) and 5 to 7 (lower surface).

Powder : Pale green, shows presence of thin walled parenchyma cells several containing rosettes of calcium oxalate crystals and a few simple starch grains; fragments of epidermal cells showing anisocytic and paracytic stomata; fragment of scalariform and bordered pitted vessels, border and simple pitted tracheid, simple pitted parenchyma cells and thick walled fibres.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 27 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 1 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 5 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 40 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of alcoholic extract on Silica gel 'G' plate (Merck), using Toluene; Methanol (86:14), shows in visible light nine spots at Rf.0.21, 0.25, 0.28(all green), 0.45 (bright yellow), 0.60 (faint green), 0.72(dark green), 0.79, 0.85 and 0.94 (all green); under UV (254nm) twelve spots appear at Rf.0.14 (faint orange), 0.21, 0.25, 0.28 (all orange), 0.36, 0.45 (both light orange), 0.53 (faint orange), 0.60, 0.72, 0.79 (all light orange), 0.85 and 0.94 (both orange); on exposure to Iodine vapours ten spots appear at Rf 0.14 (yellow), 0.21, 0.25, 0.28 (all green), 0.53, 0.60, 0.72, 0.79 (all faint yellow), 0.85, 0.94 (both bluish green), on spraying with sulphuric acid and heatin'G' plate at 110^0C for 30 minutes, twelve pots appear at Rf. 0.14 (yellow), 0.21, 0.25, 0.28 (all dark green), 0.36 (faint brown), 0.45 (brown), 0.53 (faint brown), 0.60 (violet), 0.72, 0.79 (both faint brown), 0.85 (dark green) and 0.94 (blackish green). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	β-sitosterol, glucotropaeolin, terpenes and flavonoids.
TEMPERAMENT	**:**	Hot2^0 and Dry2^0
ACTION	**:**	Mohallil, Musakkin, Dafe Nazla, Muqawwie Lissa, Dafe Gathia, Wajaul Mafasil.
THERAPEUTIC USES	**:**	Nazla, Wajaul Mafasil, Warme Raham, Bawaseer.
DOSE	**:**	150 ml in the form of Joshanda (decoction).

PILU
(Root Bark)

The drug Pilu consists of root bark of *Salvadora persica* Linn. var. *wightiana* (Planch.ex Thw.) Verdc, syn.*S.persica* Linn. (Fam.Salvadoraceae), a perennial, woody, glabrous shrub, distributed in the arid tracts of Punjab and north western parts of India.

OTHER NAMES:

Urdu	:	Pilu
Arabic	:	Arak
Persian	:	Darkht-e-Miswak
English	:	Salt bush, Toothbrush Tree
Hindi	:	Pilu, Jhak, Peelu, Kharjal
Bengali	:	Peelugachh, Jhal
Gujrati	:	Peelu, Khareejal
Kannad	:	Gonimara, Kankhina, Genumar
Tamil	:	Kotumaavali, Chittuva, Perungoli, Udhaiputtai
Malyalam	:	Uka
Marathi	:	Pilu, Khakhan
Punjabi	:	Peelu
Telugu	:	Gogu, Varagogu, Gunia

DESCRIPTION:

Macroscopic : The root bark is 2 to 3 mm thick, woody, channeled; pale brown with longitudinal wrinkles, exhibiting scars of roots and rootlets; inner surface creamish to yellowish- brown; fracture, short and smooth; odour, foetid and taste characteristic.

Microscopic : The bark shows a wide zone of cork occupying half of the transection; cork cells differentiated into two zones, outer zone consisting of small rectangular cells whereas the lower cells are larger, rectangular and tangentially elongated; phellogen single layered; the phelloderm consist of 10 to 20 layers of thin walled tangentially elongated parenchyma cells with small intercellular spaces; it is followed by a wide phloem being traversed by 2 to 5 seriate medullary rays; the phloem consists of usual element, a few fibres and isolated stone cells; several parenchyma cells are thick walled and arranged in somewhat radial rows in which stone cells and fibres are scattered; prismatic crystals of calcium oxalate are present in the parenchyma cells of outer phloem and phelloderm regions.

Powder: Powder shows fragments of cork cells, thin walled parenchyma cells, thick walled and pitted parenchyma cells, prisms of calcium oxalate, fragment of thin walled fibres and stone cells, with thick walled and narrow central lumen.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 15 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 6 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 2 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 25 percent, Appendix 2.2.7.

T. L. C.:

T.L.C. of alcoholic extract on Silica gel 60 plate (Merck), using Chloroform: Toluene; Methanol (10:75:15), shows under UV (254nm) one yellow fluorescence spot at Rf.0.46; on exposure to Iodine vapours four yellow spots appear at Rf. 0.17, 0.30, 0.46 and 0.67; on spraying with vanillin sulphuric acid and heating the plate at 110^0C for 10 minutes, seven spots appear at Rf. 0.11 (blue), 0.17, 0.23 (both violet), 0.30 (yellow), 0.35, 0.46 and 0.67 (all blue). Appendix 2.2.10

CHEMISTRY CONSTITUENTS	**:**	β-sitosterol and elementral γ–monoclinic sulphur (S-8) and glucotropaeolin isolated from root.
TEMPERAMENT	**:**	Hot2^0 and Dry2^0
ACTION	**:**	Mohallil, Muqawwie Dandan wa Lissa, Nafe Bawaseer, Mutayyabe Dahan.
THERAPEUTIC USES	**:**	Warme Raham, Bawaseer, Zofe Dandan
DOSE	**:**	6 g in the form of decoction.

REHAN
(LEAF)

Barg Rehan consists of dired leaf of *Ocimum sanctum* Linn. (Fam. Lamiaceae), an erect, 30-60 cm high, much branched, annual herb, found throughout the country.

OTHER NAMES:

Urdu	:	Raihan, Tulsi
Arabic	:	Badroj
Persian	:	Persian
Hindi	:	Tulasi
Bengali	:	Tulasi
Gujarati	:	Tulasi, Tulsi
Kannad	:	Tulasi
Tamil	:	Tulasi, Thulasi
Malayalam	:	Tulasi
Marathi	:	Tulas
Punjabi	:	Tulasi
Telugu	:	Tulasi

DESCRIPTION:

Macroscopic : Leaves 2.5-5 cm long, 1.6-3.2 cm wide, elliptic-oblong, obtuse or acute, entire or serrate, pubescent on both surfaces, petiolate, thin, petiole 1.5-3 cm long, hairy; odour, aromatic; taste, characteristic.

Microscopic : Petiole: shows cordate outline, consisting of single layered epidermis composed of thin-walled, oval cells having a number of covering and glandular trichomes; covering trichomes multicellular, uniseriate 1-8 celled long, rarely slightly re flexed at tip; glandular trichomes short, sessile or with 1-2 celled stalk, and 2-8 celled, balloon-shaped head, enclosed in a cut;cular bladder, measuring 22-27 µ diameter ., upper epidermis, followed by 3-4 layers of collenchymatous and 1-2 layers of parenchymatous cells; lower epidermis followed by 1-3 layers of collenchymatous and 2-3 layers of parenchymatous cells; 'three vascular bundles situated centrally, middle one larger than the other : two, consisting of xylem and phloem.

Midrib – epidermis, trichomes arid vascular bundles similar to those of petiole, except reduced in cortical layers towards apical region of midrib.

Lamina: epidermis and trichomes similar to those of petiole on both surfaces; stomata anomocytic and diameter cytic present on both surfaces and slightly raised above the level of epidermis; palisade single layered followed by 4-6 layeres of closely packed spongy parenchyma with chloroplasts and oleo-resin; stomatal index 10-13-15 on upper surface and 14- 15-16 on lower surface; palisade ratio 3.8; vein islet number 31-33.

Powder: Light-green; shows fragments of polygonal, less wavy walled epidermal cells in surface view, covering and glandular trichomes as a whole or in pieces, palisade and spongy parenchyma, anomocytic and diameter cytic stomata.

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 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

T.L.C. :

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows in visible light nine spots at Rf. 0.03 (dark green), 0.04, 0.08 (both ;reen), 0.12 (light green), 0.21, 0.33 (both green) 0.45 (yellowish green), 0.85 & 0.93 both light green). Under DV (366 nm) eight fluorescent zones appear at Rf. 0.04, 0.30, 0.33, 0.45, 0.83 (all pink) 0.85 (blue), 0.93 (pink) & 0.98 (blue). On exposure to Iodine :tpour eleven spots appear at Rf. 0.04, 0.08, 0.12, 0.21, 0.33, 0.45, 0.54, 0.75, 0.83, 0.88 1d 0.93 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate at 110°C for ten minutes ten spots appear at Rf. 0.08 (violet), 0.12 (light violet), 0.21 rown), 0.33 (violet), 0.45 (violet), 0.54 (blue), 0.75 (violet), 0.83 (blue), 0.93 (violet) .d 0.98 (blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential Oil (Carvacrol, Caryophyllene, Nerol and Camphene etc.
TEMPERAMENT	**:**	Hot1^0 and Dry1^0.
ACTION	**:**	Mufarreh wa Muqawwie Qalb, Muqawwie Meda, Mudirre Baul wa Haiz, Mohallile Auram, Munaffise Balgham.
THERAPEUTIC USES	**:**	Wajaule gosh, Khafqan, Ehtabase Haiz, Zofe Meda, Sual.
DOSE	**:**	1-2 (dry leaf) 5-6 g (in juice form)
IMPORTANT FORMULATION	**:**	Khamira Abresham Ood Mastagiwala, Arq Maul laham Ambari.

REHAN
(WHOLE PLANT)

Rehan consists of dired whole plant of *Ocimum sanctum* Linn. (Fam. Lamiaceae); an erect, 30-60 cm high, much branched, annual herb, found throughout the country.

OTHER NAMES:

Urdu	:	Rehan
Arabic	:	Badrooj
Persian	:	Raihan
Hindi	:	Tulasi
Bengali	:	Tulasi
Gujarati	:	Tulasi, Tulsi
Kannad	:	Tulasi, Shree tulasi, Vishnu Tulasi
Tamil	:	Tulasi, Thulasi, Thiru Theezai
Malayalam	:	Tulasi, Tulasa
Marathi	:	Tulasa
Punjabi	:	Tulasi
Telugu	:	Tulasi

DESCRIPTION

Macroscopic: Root: Thin, wiry, branched, hairy, soft, blakish-brown externally and pale violet internally.

Stem: Erect, herbaceaous, woody, branched, hairy, subquadrangular, externally purplish-brown to black, internally cream coloured; fracture, fibrous in bark and short in xylem; odur, faintly aromatic.

Leaf: 2.5-5 cm long 1.6:3.2 cm wide, elliptic obtuse, entire or serrate, pubescent on both sides; petiole thin, about 1.5-3 cm long hairy; odour aromatic; taste pungent.

Flower: Purplish or crimson coloured, small in close whorls; bracts about 3 mm long and broad, pedicels longer tan calyx, slender, pubescent; calyx ovoid or campanulate, 3-4 mm bilipped, upper lip broadly obovate or suborbicular, shortly apiculate, lower lip longer than upper haing four mucronate teeth, lateral tow short and central two largest; corolla about 4 mm long, puibescent; odour, aromatic; taste, pungent.

Fruit*:* A group of 4 nutlets, each with one seed enclosed in an enlarged, membranous, veined calyx, nutlets sub-globose or broadly elliptic, slightly compressed, nearly smooth; pale brown or reddish with small black

Microscopic : **Root :** Shows a single layered epidermis followed by cortex, consisting of seven or more layers of rectangular, round to oval polygonal, thin-walled, parenchymatous cells, filled with brown content, inner layers or cortex devoid of contents; phloem consisting of sieve elements, thin-walled, rectangular parenchyma cells and scattered groups of fibres, found scattered in phloem; xylem consists of vessels, tracheids, fibres and parenchymal vessels spotted; fibre tracheides, long, pitted with pointed ends; fibres thick walled and with pointed ends.

Stem : shows a single layered epidermis with uniseriate, multicellular covering trichomes having 5-6 cells, occasionally a few cells collaped; cortex consists of 10 or more layers of thin-walled, rectangular, parenchymatous cells; phloem consists of sieve elements, thin-walled, rectangular parenchyma cells and

fibres; fibres found scattered mostly throughout phloem in groups and rarely in singles; xylem occupies major portion of stem consisting of vessels, tracheids fibres and parenchyma of; vessels pitted; fibres with pointed ends; centre occupied by narrow pith consisting of round to oval, thin-walled, parenchymatous cells.

Leaf: Petiol: Shows somewhat cordate outline, consisting of single layered epidermis composed of thin-walled, oval cells having a number of covering and glandular trichomes; covering trichomes multicellular 1-8 celled laong, rarely slightly reflexed at tip; glandular trichomes short, sessile with 1-2 celled stalk and 2-8 celled balloon-shaped head, measuring 22-27 in diameter ; epidermis followed by 1-2 layers and 2-3 layers of thin-walled, elongated, parenchymacells towards upper and lower surfaces respectively; three vascular bundles situated centrally, middle one larger than other two ; xylem surrounded by phloem.

Midrib: Epidermis, trichomes and vascular bundles similar to those of pertiole except cortical layers reduced towards apical region.

Lamina: epidermis and trichomes similar to those of petiole; both anomocytic and diameter cytic type of stomata present on both surfaces, slightly raised above the level of epidermis; palisade single layered followed by 4-6 layers of closely packed spongy parenchyma with chloroplast and oleo-resin; stomatal index 10-12-15 on upper surface and 14-15-16 on lower surface; palisade ratio 3.8; vein islet number 31-35.

Powder : Greenish; shows thin-walled, parenchymatous cells, a few containing reddish brown contents, unicellular and lulticellular trichomes either entire or in pieces; thin-walled fibres, xylem vessels with pitted thickenings fragments of epidermal cells in surface view having irregular shape, oil globules, rounded to oval, simple as well as compound starch grains having 2-5 components , measuring 3-17 μ in diameter meter.

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 1.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 04 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 08 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of Tulasi oil obtained by stem distillation is carried out on silica gel ‘g’ plate using Toluene: Ethylacetate (93:7) Tulasi oil is diluted in chloroform-toluene (1:10) Eugenol to be applied as standard also diluted of 10 cm the plate is air drying for 15 minutes and thn kept in the over for 2 to 5 minutes. On cooling spray, in thoroughly vanillin – Sulphuric acid reagent and heat the plate at 110^0 C for 5-1-minutes. Under observation record Rf. Values of eugenol and caryophyllence. Eugenol (orange brown) approx. Rf. Value 0.7, caryophyllence (reddish violet) runs to solvent front. Appendix 2.2.10

CHEMICAL CONSTITUENTS **:** Essential oil

TEMPERAMENT **:** Hot1^0 and Dry1^0

ACTION	**:**	Mufarreh wa Muqawwie Qalb, Muqawwie Meda, Mudirre Baul wa Haiz, Mohallile waram.
THERAPEUTIC USES	**:**	Wajaul Gosh, Khafqan, Ehtabase Haiz, Zofe Meda
DOSE	**:**	5 -7 gm.
IMPORTANT FORMULATION	**:**	Khamira Abresham Ood Mastagiwala, Arq Maullaham Ambari

SAAD KUFI
(RHIZOME)

The drug Saad Kufi consists of dried rhizome of *Cyperus rotundus* Linn. (Fam. Cyperaceae); occurring throughout the country, common in waste grounds, gardens and roadsides, upto an elevation of 1800 m.

OTHER NAMES:

Urdu	:	Saad Kufi
Arabic	:	Saad Kufi
Persian	:	Mushkzenezamin
Hindi	:	Motha, Nagarmotha
Bengali	:	Mutha, Musta
Gujarati	:	Moth, Nagarmotha
Kannad	:	Konnari, Gadde
Tamil	:	Korai, Korai-Kizhangu
Malayalam	:	Muthanga, Kari Mustan
Marathi	:	Moth, Nagarmoth, Motha, Bimbal
Punjabi	:	Mutha, Motha
Telugu	:	Tungamustalu

DESCRIPTION:

Macroscopic : Drug consists of rhizome and stolon having a number of wiry roots, stolon 10-20 cm long having a number of rhizomes, crowded together on the stolons, rhizomes bluntly conical and vary in size and !hickness, crowned with the remains of stem and leaves forming a scaly covering, dark brown or black externally, creamish-yellow internally; odour pleasant.

Microscopic : Rhizome shows single layered epidermis, followed by 2-6 layers, suberised sclerenchymiatous cells; epidermis and outer sclerenchymatous layers filled with dark brown content; ground tissue of cortex consists of circular to oval, thin-walled parenchymatous cells with small intercellular spaces; a few fibro-vascular bundles present in this region; endodermis distinct and surrounding the stele; wide central zone: beneath endodermis, composed of circular to oval, thin-walled parenchymatous cells with intercellular spaces, numerous collateral, closed, vascular bundles surrounded by bundle sheath, scattered in this region; vessels narrow having simple reticulate, and scalariform thickening and oblique pore; simple round to oval starch grains measuring 6-28 µ in diameter a number of pigmented cells filled with reddish-brown content, present throughout the cortex and stele.

Powder : Creamish-brown; shows reddish-brown cells, reticulate and simple pitted vessels; fibre-like, closely packed sclerified cells, narrow vessels with scalariform thickning and oblique pore from the remnants of leaves simple, round to oval, starch grains, measuring 6-28 µ in diameter meter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 02 per cent, Appendix 2.2.2
Total ash	:	Not more than 08 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not less than 04 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 05 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 11 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 alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows under DV (366 nm) a fluorescent zone at Rf. 0.88 (blue). On exposure to Iodine vapour three spots appear at Rf. 0.44, 0.55 and 0.73 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 105°C three spots appear at Rf. 0.44,0.55 and 0.73 (all violet). Appendix 2.2.10

CHEMISTRY CONSTITUENTS	**:**	Pinene, cineole, sesquiterpenes and iso-cyperol.
TEMPERAMENT	**:**	Hot3^0 and Dry3^0
ACTION	**:**	Muqawwie Dimagh, Muqawwi Asab, Kasir Riyah, Mudirre Baul wa Tams.
THERAPEUTIC USES	**:**	Zofe Meda, Zofe Asab, Zofe Dimagh, Nisyan, Yarqan
DOSE	**:**	3- 7 g
IMPORTANT FORMULATION	**:**	Anqarya Sagheer, Jawarish Jalinoos, Dawae Bawaseer

SAMBHALU
(DRIED LEAF)

The drug Sambhalu consists of dried leaf of *Vitex negundo* Linn. (Fam. Verbenaceae); a large aromatic Shrub or a small tree, upto 4.5 m in height, common throughout the country ascending to an altitude of 1500 m in the outer Himalayas. It is common in waste places around villages, river banks, moist localities and in the deciduous forests. .

OTHER NAMES:

Urdu	:	Sambhalu, Panjangusht
Arabic	:	Uslaq
Persian	:	Panchaguskt, Sisban
Hindi	:	Nirgundi, sinduar, Sambhalu
Bengali	:	Nirgundi, Nishinda
Gujarati	:	Nagod
Kannad	:	Lakkigida, Nekkigida
Tamil	:	Karunochchi, Nocchi
Malayalam	:	Indranee, Nirgundi
Marathi	:	Nirgundi
Punjabi	:	Sambhalu, Banna
Telugu	:	Nallavavilli, Vavilli

DESCRIPTION

Macroscopic : Leaves palmately compound petiole 2:5: 3.8 cm long; mostly trifoliate, occasionally pentafoliate; in trifoliate leaf, leaflet lanceolate or narrowly lanceolate, middle leaflet 5- 10 cm long and 1.6:3.2 cm broad, with 1- 1.3 cm long petiolule, remaining two sub-sessile; in pentafoliate leaf inner three leaflets have petiolule and remaining two sub-sessile; surface glabrous above and tomentose beneath; texture leathery.

Microscopic: *Petiole:* shows single layered epidermis having a number of unicellular, bicellular and uniseriate multicellular covering trichomes and also glandular trichomes with uni to tricellular stalk and uni to bicellular head; cortex composed of outer collenchymatous tissue and inner 6: 8 layers of pareIichymatous tissue; collenchyma well developed. in basal region and gradually decreases in middle and apical regions; pericyclic fibres in basal region of petiole present in the form of a discontinuous ring in apical region surrounding central horse shoe-shaped vascular bundle; a few smaller vascular bundles present ventrally between arms of central vascular bundle and two, or rarely three, bundles situated outside the arms.

Lamina: shows single layered epidermis having mostly unicellular hairs bi and multicellular and glandular trichomes being rare; hypodenms 1:3 layered interrupted at places by 4- 8 palisade layers containing chlorophyll; a large number of veins enclosed by bundle sheath traverse mesophyll; stomata present only on the ventral surface, covered densely with trichomes; vein-islet and vein temiination number of leaf are 23-25 and 5-7 respectively

Powder: shows number of pieces or whole, uni-bi and multicellular covering trichomes, glandullar trichomes, palisade tissues with hypodermis, and upper and lower epidermis, xylem vessels with pitted walls.

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 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 20 per cent, Appendix 2.2.7

T.L.C:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows under U.V. (366 nm) two fluorescent zones at Rf. 0.18 (blue) and 0.47 (red). On exposure to Iodine vapour four spots appear at Rf. 0.16, 0.47, 0.67 and 0.91 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and on heating the plate for ten minutes at 105° C four spots appear at Rf. 0.07,0.47,0.58 and 0.67 (all blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alkaloids and Essential Oil.
TEMPERAMENT	**:**	Hot2^0 and Dry2^0
ACTION	**:**	Jali, Musakkine Waja, Mohallile Aurame Sulba, Daf-e-Taffun
THERAPEUTIC USES	**:**	Wajaul Halaq, Qurooh Fam, Warme Raham, Warme Miqad, Warme Khusyatain, Qurooh Mutaffin.
DOSE	**:**	For local application.
IMPORTANT FORMULATION	**:**	Raughan Haft Barg

SANDAL SURKH
(HEART WOOD)

The drug Sandal Surkh consists of heart wood of *Pterocarpus santalinus* Linn. (Papilionaceae); a medium sized, deciduous tree upto 10-11 m high and 1.5 m in girth found in Andhra Pradesh and neighbouring area of Chennai and Kamataka at an of 150-900 m.

OTHER NAMES:

Urdu	:	Sandal Surkh
Arabic	:	Sandal Ahmar
Persian	:	Samdal Surkh
English	:	Red Sanders, Red Sandal Wood
Hindi	:	Raktachandana, Lalchandana
Bengali	:	Raktachandana
Gujarati	:	Ratanjali, Lalchandan
Kannad	:	Raktha Chandanam
Tamil	:	Sanchandanam
Malayalam	:	Rakta Chandanam
Marathi	:	Rakta Chandana
Punjabi	:	Lal Chandan
Telugu	:	Erra Chandanamu

DESCRIPTION:

Macroscopic: Drug occurs as irregular pieces, deep blood-red to dark purplish-red or dull black, hard, but can be easily split, odourless; taste, slightly astringent.

Microscopic : Heart wood shows alternating bands of darker and lighter zones; vessels large mostly isolated and connected by fine, bright red rays, consisting of xylem parenchyma prismatic crystals of calcium oxalate occur in a few cells; red colouring matter present in a number of cells of vessels and other cells; fibres abundant; xylem rays mostly uniseriate.

Powder: Red or purplish-red; shows a number of fibres, vessels and xylem parenchyma cells and prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Identification : **Fluorescence test on aqueous and alcoholic extracts**

1. 5 g powder extracted in 100 ml of water and filtered, shows in day light: pale yellow to brownish-red colour; under .U.V. light (366 nm) emerald green, and under U.V.light (254 nm) light green.

2. 5 g powder extracted in 100 ml of alcohol and filtered shows in day light brownish - red colour; under V.V. light (366 nm) reddish - brown, and under V.V.light (254) yellowish-green colour.

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 0.3 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 1 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows in visible light a spot at Rf. 0.37 (light pink). Under U.V. (366 nm) five fluorescent zones are visible at Rf. 0.07 (blue), 0.13 (grey), 0.39 (blue), 0.37 (grey), and 0.57 (blue). On exposure to Iodine vapour eight spots appear at Rf. 0.07,0.13,0.16, 0.26, 0.37, 0.43, 0.74 and 0.80 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110°C seven' spots appear at Rf. 0.04 (violet), 0.07, 0.13 (both light violet), 0.37, 0.43 (both violet), 0.74 and 0.80 (both light violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glycosides, Colouring Matter
TEMPERAMENT	**:**	Cold2^0 and Dry2^0
ACTION	**:**	Mufarreh, Muqawwie Qalb, Musaffie Khoon, Qabize Ama, Musakkin.
THERAPEUTIC USES	**:**	Zofe Qalb, Khafqan, Taskeene Hararat, Tasfia Khoon
DOSE	**:**	1- 4 g
IMPORTANT FORMULATION	:	Sharbat Anjabar, Majoon Ushba.

SANOBAR
(ROOT)

The drug Sanobar consists of dired root of *Pinus roxburghii* Sargent. (Fam. Pinaceae); a large tree upto 30 m high and 2.5 m in girth, growing on the Himalayas from 600 m to 1830 m.

OTHER NAMES:

Urdu	:	Cheer, Sanobar
Arabic	:	Sanobar
Persian	:	Sanobar
Hindi	:	Cheel
Bengali	:	Tarpin Telargaach, sarala Gaach
Gujarati	:	Sarala
Kannad	:	Sarala
Tamil	:	Sarala, shirsal
Malayalam	:	Sarala, Saralam
Marathi	:	Sarala
Punjabi	:	Cheel
Telugu	:	Sarala

DESCRIPTION:

Macroscopic: Root well- developed, 3-3.5 cm thick, hard, woody, cylindrical; reddish-brown; surface rough due to longitudinal and transverse striations; fracture hard; has smell and taste.

Microscopic : Mature root shows 10-15 layers of thin-walled, tangentially elongated cork cells filled with tannin; secondary cortex consists of a wide zone to thin-walled, rectangular to polygonal elongated cells mostly filled with starch grins, and of embedded resin canals; phloem a narrow strand composed of sieve tubes, parenchyma and phloem rays; tannin and starch grains also present in this region; xylem composed of tracheids, medullary rays and embedded resin ducts; tracheids thin-walled , with bordered pits; xylem rays 1-2 cells wide and filled with starch grains; simple, round to oval, rarely elongated starch grains, measuring 11-25 µ in diameter .

Powder : reddish-brown; shows fragments of cork cells, tracheids with bordered pits, resin canals, simple round to oval, starch grins measuring 11-25 µ in diameter and fragment of of phloem and xylem rays filled with starch grains.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 1 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.3 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 3 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS	**:**	Resins – Oleo-resin.
TEMPERAMENT	**:**	Hot2^0 & Dry2^0
ACTION	**:**	Habisuddam, Musakkine Alam, Muqawwie Raham, Habise Ishal.
THERAPEUTIC USES	**:**	Nakseer, Darde Halaq, Darde Dandan, Ishal
DOSE	**:**	2 g
IMPORTANT FORMULATION	**:**	Habbe-e-Sanobar

SARSON
(SEED)

The drug Sarson consists of dried seeds of *Brassica camperstris* Linn. (Fam. Brassicaceae), an erect, stout, simple or branched, glaucous, annual herb, 50-60 cm tall with amplexicaul leaves, commonly culitivated in Bengal, Bihar, U.P. and Punjab, and also found occasionally as an escape in waste places and fields.

OTHER NAMES:

Urdu	:	Sarson
Arabic	:	Hurf-e-Abyaz
Persian	:	Sarshaf
Hindi	:	Saraso
Bengali	:	Sarisa
Gujarati	:	Sarasad, Rai
Kannad	:	Sasuve, Sasuvae, Sasive
Tamil	:	Kadugu
Malayalam	:	Katuka
Marathi	:	Mohari
Punjabi	:	Sarayo, Sarson
Telugu	:	Avalu

DESCRIPTION

Macroscopic: Seeds small, slightly oblong, pale or reddish-brown, bright, smooth, 1.2-1.5 mm in diameter under magnifying glass it is seen to be minutely reticulated; taste, bitter and sharp.

Microscopic : Seed shows single layered colourless testa followed by 3-5 layered, non-lignified, hexagonal, thick-walled filled with yellowish-brown contents; embryo and endosperm consists of hexagonal, thin-walled parencyhymatous cells contiaining oil globules.

Powder: Yellow in colour with brown particles and oily, slightly bitter and sharp in taste; shows frequently thick walled, fragments of reddish-brown cells of hypodermis, yellowish hyaline masses.

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 0.5 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 16 per cent, Appendix 2.2.7
Fixed oil	:	Not less than 35 per cent, Appendix 2.2.8

T.L.C.

T.L.C. of the alcoholic extract on Silical gel 'G'plate using Toluene: Ethylacetate (9:1) shows under U.V (366 nm) two flurorescent zones at Rf. 0.12 and 0.59(both blue). On exposure to Iodine vapour three spots apper at Rf. 0.12, 0.59 and 0.70 (all yellow). On spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate for 10 minutes at 105^0C three spots appear at Rf. 0.12, 0.59 and 0.70 (all violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed Oil
TEMPERAMENT	**:**	Hot3^0 and Dry3^0
ACTION	**:**	Jali, Jazibe Khoon, Muqawwie Badan, Muqawwie Bah, Mudirre Baul
THERAPEUTIC USES	**:**	Amraze Jild, Zofe Bah, Ehtebase Baul.
DOSE	**:**	3 -5 gm
IMPORTANT FORMULATION	**:**	Raughane Sarshaf

SEER (LAHSAN)
(BULB)

The drug Seer (Lahsan) consists of bulb of *Allium sativum* Linn. (Fam. Liliaceae); a perennial bulbous plant, cultivated as an important condiment crop in the country.

OTHER NAMES:

Urdu	:	Lahsan, Seer
Arabic	:	Som
Persian	:	Seer
English	:	Garlic
Hindi	:	Lahasun
Bengali	:	Lasun
Gujrati	:	Lasan, Lassun
Kannad	:	Balluci
Tamil	:	Vellaipoondu
Malyalam	:	Vellulli, Nelluthulli
Marathi	:	Lasun
Punjabi	:	Lasan
Telugu	:	Vellulli, Tellapya, Tellagadda

DESCRIPTION

Macroscopic : Drug occurs as entire bulb or isolated cloves (bulblets); bulb sub-globular, 4-6 cm in diameter meter, consisting of 8-20 cloves, surrounded by 3-5 whitish papery membranous scales attached to a short, disc-like woody stem having numerous, wiry rootlets on the under side; each clove is irregularly ovoid, tapering at upper end with dorsal convex surface, 2-3 cm long, 0.5:0.8 cm wide, each surrounded by two very thin papery whitish and brittle scales having 2-3 yellowish green folded leaves contained within two white fleshy, modified leaf bases or scales; odour peculiarly pungent and disagreeable; taste acrid gives warmth to the tongue.

Microscopic : A clove of bulb shows tri to tetrangular appearance in outline.; outer scale consists of an outer epidermis, followed by hypodermal crystal layer, mesophyll made of parenchyma cells and an inner epidermis; both outer and inner epidermis consist of sub rectangular cells; hypodermis consists of compressed, irregular, tangentially elongated cells, each cell having large prismatic crystals of calcium oxalate, while many cells contain small prismatic crystals also, mesophyll several layers of parenchymatous cells having a few vascular tissues with spiral vessels; inner epidermis similar to outer one; inner scale similar to outer scale but outer epidermis composed of sclerenchymatous cells; prismatic crystals in hypodermis slightly smaller.

In surface view cells of outer epidermis elongated, narrow with thin porous wall while those of inner epidermis similar to outer one but non-porous; cells of hypodermal crystals layer ellipsoidal with thick porus walls, each cell having large prismatic crystals of calcium oxalate, many cells also contain small prismatic crystals in addition to bigger ones; inner scale shows markedly sclerenchymatous cells with greatly thickened walls and very narrow lumen; cells of hypodermal crystal layers somewhat smaller with walls more frequently pitted, size of crystals also smaller.

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 2.5 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 60 per cent, Appendix 2.2.9
Volatile Oil	:	Not less than 0.1 per cent, Appendix 2.2.10

T.L.C.:

T.L.C of alcoholic extract on Silica gel 'G' plate3 using n-Butanol: Isopropanol: Acetic acid: Water (3:1:1:1) shows under UV (366 nm) two fluorescent zones at Rf. 0.58 and 0.72 (Both light blue). On exposure to Iodine vapour nine spots appear at Rf. 0.18, 0.26, 0.34, 0.38, 0.46, 0.58, 0.72, 0.77 and 0.93 (all yellow). On spraying with ninhydrin reagent and heating the plate for 10 minutes 110^0C seven spots appear at R.f. 0.26, 0.38 , 0.46, 0.58, 0.67, 0.72 and 0.93 (all pink) . On Spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten munutes at 110^0C seven spots appear at Rf. 0.26,0.38,0.46,0.58,0.67,0.72 and 0.93 (all grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Volatile Oil Containing Allyl Disulphide and Diallyl Disulphide. It also contains Allin, Allicin, Mucilage and Albumin
TEMPERAMENT	**:**	Hot3^0 and Dry3^0
ACTION	**:**	**Externally:** Jali, Mohallil, Muqarreh **Internally**: Muqawwie Meda, Musakkine Alam, Muqawwie Bah, Mudirre Baul wa Haiz, Muqatte Akhlate Ghaliza.
THERAPEUTIC USES	**:**	Wajaul Mafasil, Bars, Bahaq, Falij, Laqwa, Rasha, Sual, Dama, Humma.
DOSE	**:**	2 - 3 g
IMPORTANT FORMULATION	**:**	Majoon Seer, Roughan Seer.

SEHJANA
(LEAF)

The drug Sehjana consists of dried leaf of *Moringa oleifera* Lam. Syn. *Moringa pterygosperma* Gaertn. (Fam. Moringaceae); a small or medium sized tree, found with in sub-Himalayan tract, commonly cultivated thourhout the country.

OTHER NAMES:

Urdu	:	Sehjan
Hindi	:	Shajoma, Mungna
Bengali	:	Sajina, Sajna, Sajne
Gujarati	:	Sargavo, Sekato, Saragavo Parna
Kan.	:	Neegge, Nugge ele
Tamil	:	Murungai, Murungai Iali
Malayalam	:	Murinna, Tishnagandha, Muringa, Muringa Elai
Marathi	:	Sevaga, Segata, Segata pana, Shewgachi pane
Orissa	:	Sajana, Munga, Munika
Punjabi	:	Sohanjana
Telugu	:	Munaga Aku

DESCRIPTION:

Macroscopic: Leaves tripinnate compound, available in the form of leaflets and some broken pieces of rachis, slender thickened and articulated at the base; leaflet 1.2-2 cm long and 0.5-1 cm wide, entire, elliptic ovate or obovate, rounded or narrowed at base and obtuse at apex; smooth and greenish-grey to pale green; odour and taste not distinct.

Microscopic : Rachis: Rachis shows single layered epidermis, followed by single layer of pigmented collenchymatous hypodermis; cortex consisting of 5-10 layered, oval to elliptical, thin-walled, parenchymatous cells; pericycle forming a broken ring, consisting of pericyclic fibres; vascular bundle collateral; pith composed of wide zone of thin-walled, parenchymatous cells; rosette crystals of calcium oxalate present in cortex, pith and phloem parenchyma.

Leaflet : Leaflet shows dorsiventral structure; epiderkmis and unicellular hairs present on both the surfaces; palisade single layered; spongy parenchyma 2-3 layers; central region occupied by a crescent-shaped, collateral vascular bundle surrounded by 2-4 layers of collenchymatous cells,; rosette crystals of calcium oxalate present in mesophyll and collenchymatous cells; stomata anomocytic, present on both surface but more on lower surface; palisade ratio 6-11; stomatal index 10-13-15 stomatal number 100-137 upper surface and 290-350 lower surface per mm square ; vein islets muber 50-65.

Powder: Greyish-green; shows groups of spongy parenchym, palisade cells; spiral vessels, unicellular hairs with blunt tip; pieces of polyhedral epidermal cells in surface view, stomata 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 16 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 04 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 08 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 on silica gel 'G' plate using Toluene : Ethylacetate (9:1) shows six spots at Rf. 0.05, 0.18, 0.26 (all green), 0.36 (yellowish green), 0.46 (dark green) and 0.94n (yellow) in visible light. Under u.v. (366 nm) six fluorescent zones are visible at Rf. 0.05, 0.18, 0.26,. 0.36, 0.46 (all red) & 0.94 (Blue). On spraying with 5% methanolic Phosphomolybdic acid reagent six spots appear on heating the plate fo r 10 minutes at 105^0 C at Rf. 0.05, 0.20, 0.26 (all green), 0.30 (pink), 0.36 (green), 0.46 (green), 0.53 (yellow), 0.69 (yellow), 0.82 (yellow) and 0.94 (violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Carbohydrate, Protein, Carotene and Ascorbic acid
TEMPERAMENT	**:**	Hot$3^0$and Dry3^0
ACTION	**:**	Qatile Kirme Amaa, Mushtahi, Mohallile Waram
THERAPEUTIC USES	**:**	Wajaul Mafasil, Wajul Qutu, Zofe Ishtaha, Wajaul Shikam.
DOSE	**:**	6 - 10 gm.

SEMBHAL
(STEM BARK)

The drug Senbhal consists of the mature stem bark of *Bombax ceiba* Linn. Syn. B. *malabaricum* DC., *Salmalia malabarica* Schott. & Endl. (Fam. Bombaceae), a deciduous tree attaining a height upto 40 m and a grith upto 6m or more and and distributed throughout the hotter parts of the country upto 1500 m or more.

OTHER NAMES:

Urdu	:	Sembhal
English	:	Silk Cotton Tree
Hindi	:	Semal, Semar
Bengali	:	Shimul, simul
Gujarati	:	Shemalo
Kannad	:	Kempuburuga
Tamil	:	Elavam
Malayalam	:	Mullilavu
Marathi	:	Sanvar, Katesavar
Punjabi	:	Simble
Telugu	:	Buruga

DESCRIPTION:

Macroscopic : Bark 0.5 - 1 cm thick, pale ashy to silvery grey externally, brownish internally, external surface rough with vertical and transverse cracks, mucilaginous on chewing; fracture, fibrous.

Microscopic : Stem bark shows 10 - 15 layered, transversely elongated, radiameter lly arranged, thin-walled, cork cells with a few outer layers having brown coloured contents; rhytidoma present at certain places interrupting the cork; secondary cortex consists of moderately thin-walled, parenchymatous cells containing orange brown contents; stone cells in singles or in groups, thin-walled, oval to irregular, and tangential bands of stone cells having striations with narrow lumen, measuring 13 - 33µ in diameter occur throughout the secondary cortex; secondary phloem consists of usual elements traversed by phloem rays, elements in the outer reigon form tangential bands of ceratenchyma, a number of concentric bands of fibres alternating with groups of sieve elements also present; fibres lignified having narrow lumen and pointed tips; phloem rays numerous and wavy, 1- 6 seriate, cells being raidally elongated and moderately thin-walled rosette crystals of calcium oxalate scattered throughout the secondary cortex, phloem parenchyma and ray cells; mucilage canals and tannin cells present in the parenchymatous cells of cortex.

Powder : Reddish-brown; shows fragments of cork cells, parenchymatous cells single or groups of thin-walled , oval to irregular, stone cells having striations with narrow lumen, measuring 13-33 µ in diameter rosette crystals of calcium oxalate, phloem fibres and numerous reddish-brown coloured masses and tannin cells.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 13 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 2 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 on silica gel "G' plate using Toluene: ethylaceatae (9:1) shows under U.V. (366 nm) one fluroscent zone at Rf. 0.59 (blue). On exposure to Iodine vapour four spots appear at Rf. 0.11, 0.44, 0.59 and 0.92 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110^0 C three spots appear at Rf. 0.44, 0.59 and 0.92 (all violet) Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Saponins, Tannins and Gums.
TEMPERAMENT	**:**	Hot$1^0$and Dry1^0
ACTION	**:**	Mohallil Warm, Dafe Jaryan.
THERAPEUTIC USES	**:**	Jaryan, Auram
DOSE	**:**	5 - 10 gm

SHEESHAM
(DRIED HEART WOOD)

The drug Sheesham consists of dried heart wood of *Dalbergia sissoo* Roxb. (Fam. Papilionaceae); a medium sized, deciduous tree, found in Western Himalayas upto 1220 m altitude, and from Sikkim to upper Assam, and extensively planted throughout the country.

OTHER NAMES:

Urdu	:	Sheesham
Arabic	:	Sasem
Persian	:	Sheesham
English	:	Sissoo Tree
Hindi	:	Seesam
Bengali	:	Shishu
Gujarati	:	Sisam
Kannad	:	Eragundimavu, Bindi
Tamil	:	Irupoolai
Malayalam	:	Irupoola
Marathi	:	Sisu, Shisav
Oriya	:	Sisu, Sinsapa
Punjabi	:	Sheesham
Telugu	:	Irugudu, Virugudu, Sissoo

DESCRIPTION:

Macroscopic: Drug consists of piece of wood of variablelength and widths , brown, very hard and strong; close-grained, annual ring not distinct, rays fine, pores uniformly distributed joined by wavy concentric bands; fracture hard and tough.

Microscopic: Hard wood shows well developed xylem, consisting of usual elements, vessels simple pitted, soltary or 2-3 in groups ,arranged in radial rings, a few contain reddish-brown content; parenchyma thick walled and paratracheal; medullary rays 1-3 cells wide; fibres abundant in numbers and present in groups alternating with the bands of xylem paencyma.

Powder: Brown; under microscope shows fibres, tracheids and parenchymatous cells.

IDENTITY, PURITY AND STRENGTH:

Identification: Fluorescence test on aqueous and alcoholic extracts

i) 5 g. extracted in 100 ml of water and filtered shows in day light – light brown colour; under UV light (366nm) greenish brown and UV light (254 nm) yellowish green

ii) 5 g. extracted in 100 ml of alcohol and filtered shows in day light – dark brown colour; under UV light (366nm) dark brown and UV light (254 nm) dark brown

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 0.1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 1 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 on Silica gel 'G' plate using Toluene: Ethylacetate (7 : 3) in visible light shows nine spots at Rf. 0.14, 0.19, 0.27,(all grey), 0.52,(yellow) 0.56, 0.62, 0.70, 0.75 and 0.86 (all grey). Under UV (366nm) five fluorescent zones appear at Rf 0.19 (yellowish blue), 0.27, 0.42 (both light blue), 0.52 and 0.70 (both blue). On spraying with 5% methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110^0C eleven spots appear at Rf 0.19 (orange), 0.27, 0.30 (both grey), 0.36 (yellowish grey), 0.47 (grey), 0.52 (greeen), 0.56 (grey), 0.62 (light green), 0.70(grey), 0.86(green) and 0.88 (grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil, Essential oil, Tannin and Flavonoids.
TEMPERAMENT	**:**	Hot2^0 and Dry2^0
ACTION	**:**	Musaffie Khoon**,** Mohazzile Badan, Qate Kirme Amaa, Mujaffif.
THERAPEUTIC USES	**:**	Fasaduldam, Deedane Ama.
DOSE	**:**	5 - 7 gm

SHIBT
(FRUITS)

The drug Shibt consists of dried ripe fruits of *Anethum graveolnes Linn, Syn. A. sowa Roxb. ex Flem.,Peucedanum graveolens (Linn) Benth & Hook* (Fam. Apiaceae); a tall, glabrous, aromatic herb found throughout tropical and sub-tropical regions of the country and cultivated.

OTHER NAMES:

Urdu	:	Shibt, Soya
Arabic	:	Shibt
Persian	:	Shibt
Hindi	:	Saya, sova
Bengali	:	Suva, Sulpha, Shulupa, Sowa
Gujarati	:	Suva
Kannad	:	Sabasige
Tamil	:	Satakuppa
Marathi	:	Badishep, shepa, Shepu
Punjabi	:	Soya

DESCRIPTION

Macroscopic : Fruits, dark brown, often stalk attached, broadly oval and compressed dorsally; mericarps usually separate and free, 4 mm long, 2-3 mm broad and 1 mm thick, glabrous, traversed, brown, filiform and incospicusous, 2 lateral prolonged into thin, yellowish membranous wings; odour, faintly aromatic resembling that of caraway, and a warm, slightly sharp taste.

Microscopic : **Fruit :** Pericarp shows epidermis of polygonal tabular cells haing thick outer wall and striated cuticle; mesocarp, parenchymatous, some cells sometimes with sinuous anticlinal walls; vittae, 4 on the dorsal valleculae and 2 on the commissural surface, extending the length of each mericarp with an endothelium of brown cells and containing volatile oil; dorsal costate three, one larger and the tow lateral broadly winged, each costae with vascular strands; endosperm much flattened and consists of thick-walled, cellulosic, parenchyma containing fixed oil and numerous aleurone grains upto 5 µ in diameter meter containing micro-rosette crystals of calcium oxalate; carpophore split, passing the apex into the raphe of each mericarp containing a vascular strand of sclerenchymatous fibres and spiral vessels.

Powder: Brown shows spiral vessels, micro-rosette crystals of calcium oxalate and oil globules, aleurone grains upto 5 µ in diameter meter.

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 1.5 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 15 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 the alcoholic extracts on Silical gel 'G' plate using Toluene shows on exposure to Iodine vapour two spots at Rf. 0.59 and 0.68 (all yellow). On spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate for 10 minutes at 105^0C three spots appear at Rf. 0.37 (pink) 0.59 (Blue) and 0.68 (violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential Oil
TEMPERAMENT	**:**	Hot3^0 and Dry3^0
ACTION	**:**	Musakkine Alam, Kasire Riyah, Munzij, Mohallile Waram, Mudirrre Baul wa Haiz, Muqai.
THERAPEUTIC USES	**:**	Wajaul Mafasil, Nafakhe Shikam, Wajaul Shikam, Qoolanj, Zofe Hazm, Ehtase Baul wa Haiz.
DOSE	**:**	2 - 3 gm
IMPORTANT FORMULATION	**:**	Jawarish Zarooni, Matbookh Mudirre Tams.

SHUKAI
(WHOLE PLANT)

The drug Shukai consists of dried whole plant of *Fagonia cretica* Linn. syn. *F. arabica* Linn. *F. bruguieri* DC. (Fam. Zygophyllaceae), a small spiny under shrub with stiff, more or less prostrate branches found in north-west India and Deccan.

OTHER NAMES:

Urdu	:	Dhamasa
Arabic	:	Shukai
English	:	Khorasan thorn
Hindi	:	Damahan, Dhamaasa, Hinguaa, Dhanhare
Bengali	:	Duralabha
Gujrati	:	Dhamaaso
Tamil	:	Tulganari
Malyalam	:	Kodittuv**a**
Marathi	:	Dhamaasaa
Punjabi	:	Dama, Dhamah, Dhamaha
Telugu	:	Chittigava, Gilaregati

DESCRIPTION:

Macroscopic: Root: Tap root externally brownish green, rough, with longitudinal striations, core yellowish-green; fracture, fibrous.

Stem: Stem pieces 0.5 to 1.5 cm thick, of variable lengths; young green, mature brown; spiny, two pairs of spines present at each node, spines sharp, slender, 1.5 to 2 cm in length; external surface of stem green, whitish brown when dry, striated; transversely smoothened surface showing a thin bark and prominent wood, bark peeling from stem; fracture short.

Leaf: Small, subsessile, linear, oblong, leaflets entire, green or blackish brown, 0.5 to 1.5 cm in length and 0.05 to 0.1 cm in width, without any prominent midrib region projected above the level of lamina.

Flower: Flowers small, pale rose or purple, pedicels slender, 6 to 12 mm long; sepals 3 to 4 mm long, ovate, aristate; petals twice as long as the sepals, spathulate, claw long; ovary hairy, style tapering.

Fruit: Pentagonous schizocarp composed of five compressed two valved cocci.

Microscopic : Root : T.S. shows outermost cork represented by 4 or 5 layers of small, narrow, tangentially elongated cells; phelloderm composed of 6 to 10 layers of somewhat tangentially elongated, thin walled parenchymatous cells, some cells having rhomboid crystals of calcium oxalate measuring 10 to 15 μ in length and 8 to 10 μ in width; outer part of secondary phloem characterised by the presence of abundant, but small patches of 2 or 3 thick walled phloem fibres; wood composed of vessels, xylem fibres and traversed by 1 to 3 seriate medullary rays; vessels arranged in singles or doubles; fibres long, thick walled with tapering ends and measuring upto 500 μ in length and about 25 μ in width.

Stem : T.S. shows more or less circular outline; single layered epidermis with thick cuticle; unicellular trichomes occasionally present; cortex consisting of 7 to 10 layers of parenchymatous cells showing large

patches of fibres; sclereids with narrow lumen occurring singly or in groups in the cortex, measuring upto 50 μ in diam.; several cortical cells contain tannins; secondary phloem consisting of thin walled cells; vascular cambium composed of 3 to 4 layers of thin walled tangentially elongated cells; secondary xylem composed of fibres, tracheids, vessels, xylem parenchyma; fibres long, thick walled with tapering ends and measuring 260 to 950 μ in length and upto 20 μ in width; medullary rays mostly uniseriate or sometimes biseriate; pith composed of large thin walled parenchymatous cells, some cells containing tannins; rhomboid crystals measuring 18 to 30 μ in length and 12 to 20 μ in width present in cortex and pith.

Leaf: Isobilateral; single layered epidermis consisting of mostly tangentially elongated cells covered with thick cuticle. In surface view both upper and lower epidermii show anomocytic type of stomata, epidermal cells polygonal in shape; 2 or 3 layered palisade cells present on both the sides, adjacent to the epidermis; vascular bundles show xylem towards lower side and phloem towards upper side; sclerenchyma tissue occur as a bundle cap just above the phloem; small lateral vascular bundles also present in lamina; vein-islet number 11 to14; stomatal index 16 to 17 on lower epidermis and 5 to 7 on upper epidermis; palisade ratio 2 or 3 on upper epidermis and 2 to 4 on lower epidermis.

Powder : Yellowish-white, bitter taste, showing groups of fibres, bordered pitted vessels, fragments of palisade tissue, sclereids, rhomboid crystals of calcium oxalate, cork cells, and unicellular glandular and nonglandular trichomes (both from fruit epicarp), epidermal cells (cubical, rectangular or polygonal) with slightly wavy walls and anomocytic stomata.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 10 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 0.4 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 5 percent, Appendix 2.2.6.
Water soluble extractive	:	Not less than 10 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of the alcoholic extract on silica gel 'G' plates (0.2 mm thick) using chloroform : methanol: acetic acid (70:30:0.2) shows under UV (254 nm) four spots at Rf. 0.14, 0.32, 0.46 (all violet) and 0.72 (yellowish green). Under UV (366nm) six fluorescent spots appear at Rf. 0.14, 0.32 (both brown), 0.39, 0.51, 0.61 and 0.72 (all pink). On exposure to iodine vapour nine spots appear at Rf. 0.14, 0.19, 0.28, 0.35 (all yellow), 0.46 (faint orange), 0.51, 0.61 and 0.72 (all yellow). On spraying with vanillin sulphuric acid reagent and heating the plate at 110°C for 10 min. ten spots appear at Rf. 0.06 (bluish grey), 0.14 (violet), 0.19 (brown), 0.28 (violet), 0.35 (brown), 0.39 (violet), 0.46 (brown), 0.51 (violet), 0.61 (brown) and 0.72 (violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alkaloids (Harmine); amino acids (alanine, glycine, leucine, arginine isoleucine, lysine, phenylalanine, proline, tyrosine and valline); terpenoids of oleanane group.
TEMPERAMENT	**:**	Hot1^0 and Dry1^0
ACTION	**:**	Muqawwie Meda wa Jigar, Dafe Humma, Mohallile Waram, Qabiz wa Mujaffif.
THERAPEUTIC USES	**:**	Amraze Meda wa Jigar, Humma, Warme Luhaat
DOSE	**:**	5 - 7 g powder.

TUKHME KHATMI
(Seed)

The drug Tukhm-e-khatmi, consist of dried seeds of *Althaea officinalis* Linn. (Fam. Malvaceae), a perennial, uniformly downy herb occurring in Kashmir region.

OTHER NAMES:

Urdu	:	Tukhm-e-Khatmi
Arabic	:	Bazre Khatmi
Persian	:	Tukhme Khatmi
English	:	Marsh Mallow
Hindi	:	Khatmi bija
Tamil	:	Khatmi
Marathi	:	Khatmi
Telugu	:	Khatmi

DESCRIPTION:

Macroscopic: The seeds are small to moderate size, approximately 6 mm, usually brownish-black, reniform, rugose, hairy at margins; become mucilagenous when soaked in water.

Microscopic: T.S. shows testa: an outer multicellular layer comprising of outer most thick walled epidermis with multicellular, 2 to 6 armed stellate and some unicellular hairs, longest being near the micropyle; this is followed by 4 to 10 layers of parenchymatous cells several with rosette crystals of calcium oxalate, interrupted by schizogenous mucilage canals; the inner epidermis of testa is also thick walled. Tegmen two layered; Outer tegmen*:* 4 to 6 cells deep, lignified 2 to 6 armed stellate hairs present also on it, this easily detached from the inner tegmen; Inner tegmen*:* 4 to 6 cells deep, the outer being a row of palisade-like malphighian cells followed by a slightly thick walled, non-lignified two layered hypodermis of cells with their inner periclinal walls concave (i); 2 to 3 layered parenchymatous mesophyll; the inner epidermis is a layer of thin walled cells with rod like lignified thickening scattered on the anticlinal walls; endosperm cells filled with starch grains which are polygonal to rounded, 5 to 20µm in size, hilum circular or showing a 2 to 5 rayed cleft, lamellae indistinct; ovule campylotropous; seeds of *Althaea rosea* do not show the type of hairs present in *A. officinalis,* but heavy mostly unicellular hairs.

Powder : Powder brownish-black in colour, odourless, mucilaginous and sweetish in taste; shows elongated thick walled ridged malphighian cells; in surface view they are hexagonal showing wall thickenings; patches of parenchyma with mucilage and starch grains, polygonal to rounded, 5 to 20 µm, hilum circular, or with a 2 to 5 rayed cleft, lamellae indistinct; rosette crystals of calcium oxalate and stellate hairs; a small amount of powder on microscopic slide turns maroon with 50 % H_2SO_4 and black with 1N-NaOH in amylacetate. When treated with 1% ruthenium red, powder becomes pink in colour showing the presence of mucilage.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total ash	:	Not more than 8 percent, Appendix 2.2.3.
Acid insoluble ash	:	Not more than 1.5 percent, Appendix 2.2.4.
Alcohol soluble extractive	:	Not less than 10 percent, Appendix 2.2.6.

Water-soluble extractive : Not less than 18 percent, 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 : methanol (85 : 15 : 0.5) shows under UV (366 nm) blue fluorescent at Rf. 0.18, 0.33 and 0.67. On spraying with Anisaldehyde-Sulphuric acid and heating the plate for ten minutes at 120^0C, spots appear at Rf. 0.10 (grey), 0.18 (grey), 0.32 (green), 0.37 (navy blue), 0.57 (greyish blue) and 0.67 (greyish blue). Appendix 2.2.10

CHEMISTRY CONSTITUENTS	**:**	Glucose, sucrose, galactose & mannose; linoleic acid; isobutylalcohol, limonene, phellandrene, γ-toluerldehyde, citral, terpeneol, β- sitosterol.
TEMPERAMENT	**:**	Moderate towards Coldness and Moistness
ACTION	**:**	Mohallil, Munaffise Balgham, Rade, Murakhhi, Munzij.
THERAPEUTIC USES	**:**	Wajaul Mafasil, Zatul Janab, Zatul Raiyya, Nazla wa Zukam, Sual
DOSE	**:**	5 - 7 g.
IMPORTANT FORMULATIONS	**:**	Laooq Khashkhas, Sharbat Zoofa, Sharbat Fariyaad Ras.

TURB
(SEED)

The drug Turb consists of dried seed of *Raphanus sativus* Linn. (Fam. Brassicaceae); an annual herb, cultivated throughout India, upto 3000 m in the Himalayas and other hilly regions, for its roots.

OTHER NAMES:

Urdu	:	Mooli
Arabic	:	Bazrul fazl
Persian	:	Tukhme-Turb
Hindi	:	Muli
Bengali	:	Mula
Gujarati	:	Mulo
Kannad	:	Moolangi, Moolaogi, Mullangi, Mugunigadde
Tamil	:	Mullangi, Mulakam, Mullangu, Millangi
Malayalam	:	Mullanki
Marathi	:	Mula
Orissa	:	Mula, Rakhyasmula
Punjabi	:	Moolak, Moolee, Moola
Telugu	:	Mullangi

DESCRIPTION:

Macroscopic : Seed reddish-brown, irregularly globose, sometimes flattened, 2-4 mm long and 2 mm. wide; surface generally smooth and sometimes wrinkled and grooved at' micropylar end; taste, oily.

Microscopic : Seed shows testa; consisting of single layer of nearly:rectangular cells, cov~ ered with thin cuticle, followed by a layer of radiameter lly elongated, reddish-brown columnar cells, and integument 2-3 layers of compressed, thin-walled, parenchymatous cells; cotyledons and embryo consist of oval to polygonal, thin-walled, parenchymatous cells containing aleurone grains and oil globules.

Powder: Brownish-yellow; shows fragments of testa with hexagonal, thin-walled epidermal cells in surface view; oval to polygonal, thin.walled, parenchymatous cells of embryo, neoil globules and aleurop.e grains present.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 5.5 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 4.5 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 11 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS	**:**	Fixed Oil and Volatile Oil
TEMPERAMENT	**:**	Hot3^0, Dry2^0
ACTION	**:**	**Externally**–Jali **Internally**–Muqi, Mudirre baul wa haiz, Kasire Riyah
THERAPEUTIC USES	**:**	Nafakhe Shikam, Ehtabase Haiz wa baul, Kalaf, Bars wa Bahaq.
DOSE	**:**	1-3
IMPORTANT FORMULATION	**:**	Raughan Turb, Majoon Piyaz etc.

TURB
(ROOT)

The drug Turb consists of fresh root of *Raphanus sativus* Linn. (Fam. Brassicaceae); an annual or biennial bristly herb, cultivated throughout the country upto an altitude of 3, 000 m in the Himalayas and other hilly regions.

OTHER NAMES:

Urdu	:	Muli
Arabic	:	Fazl
Persian	:	Turb
English	:	Radish
Hindi	:	Muli
Bengali	:	Mula
Gujarati	:	Mulo
Kannad	:	Moolangi
Tamil	:	Mullangi
Malayalam	:	Mullank
Marathi	:	Mula
Oriya	:	Mula, Rakhyasmula
Punjabi	:	Mulaka, Muli, Mula
Telugu	:	Mullangi

DESCRIPTION:

Macroscopic: Root fleshy, fusiform, cylindrical, having a few lateral fibrous roots, variable in size, usually 25-40 cm in length, sometime cultivated species 75-90 cm in length and 50-60 cm in girth; white in colour; taste, slightly or strongly pungent, rarely sweet.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 24 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not morethan 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 36 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not more than 33 per cent, Appendix 2.2.7.

T.L.C.:

T.L.C. of alcoholic extract of drug on Silica gel 'G' plate using Benzene: Ethylacetate (9:1) Under UV (366 nm) two fluorescent zones appear at Rf. 0.04 &0.09 (both blue). On exposure to Iodine vapour five spots appear at Rf. 0.04, 0.09, 0.34, 0.49 & 0.69 (all yello). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110^0C three spots appear at Rf. 0.04, 0.09 & 0.47 (all violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glucoside, Methylmercaptan and Volatile Oil.
TEMPERAMENT	**:**	Hot1^0 and Dry2^0
ACTION	**:**	Mulattif, Hazim, Kasire Riyah, Mudirre Baul, Mohallile warme Tihal.
THERAPEUTIC USES	**:**	Tabkheere Meda, Darde Gosh, Yarqan, Istisqa.
DOSE	**:**	1-2 NOS.
IMPORTANT FORMULATIONS	**:**	Raughan Turb, Majoon Piyaz, Majoon Murawwihul Arwah

TURBUD
(ROOT)

The drug Turbud consists of dried root of *Operculina turpethum* (Linn.) Silva Manso Syn. Ipomoea turpethum R. Br., (Fam.Convolvulaceae); a large perennial twiner with milky juice and fleshy roots found growing wild nearly throughout the country, ascending to 06 m, also occasionally grown in gardens; the roots being fleshy, care is taken in drying as they decay easily, roots therefore cut into pieces and the cut portions are exposed to sun for a day or so, after which it is finally dried in shade.

OTHER NAMES:

Urdu	:	Turbud, Nishoth
Arabic	:	Turbud
Persian	:	Turbud
Sanskriti	:	Syama, Tribhandi
Hindi	:	Nishothra
Bengali	:	Teudi, tvuri, Dhdhakalami
Gujarati	:	Kala Nasottara
Kannad	:	Vili tigade
Tamil	:	Karum sivadai
Malayalam	:	Trikolpokanna
Marathi	:	Nisottar
Orissa	:	Dudholomo
Punjabi	:	Nisoth
Telugu	:	Tella, Tegada

DESCRIPTION

Macroscopic : Roots occur in pieces, 1.5-15 cm long, 1-5 cm diameter usually unbranched, cylindrical elongated, bearing thin rootlets; thicker pieces, occasionally split and show central wood portion; surface dull grey, reddish-grey to light brown, showing deep furrows or longitudinal wrinkles giving a rope-like or columnar appearance; transversely cut surface shows thick, whitish bark and light yellow centre; fracture in bark short; in wood fibrous, odour indistinct; taste slightly acrid and nauseating when kept in mouth for some time.

Microscopic : Mature root shows thin cork, consisting of 3-5 rows of brown cells; secondary cortex 4-6 layered, composed of tangential elongated, thin-walled cells; some of the cortica1 cells become .thick-walled appearing as isolated, oval to' subrectangular l&-enchymatous cells having wide lumen; secretory cavities surrounded by bsidiameter ry cells and resin canals found scattered in secondary cortex; secondary Phloem, a wide zone, consisting of sieve elements ,and phloem parenchyma; vascular undles arranged in continuous and a discontinuous ring, traversed by uni and biseriate medullary rays; .numerous resin cells also seen in phloem in longitudinal rows; xylem shows 3-5 radiameter ting arms;small patches of intraxylary phloem often formed; xylem vessels in singles or 2-3 in groups, having simple pits on their walls; .calcium oxalate crystals as prisms and rosettes food scattered in cortex, phloem parenchyma, xylem parenchyma and medullary ray cells; starch grains, both simple and compound, simple ones elliptical to spherical with central cleft hilum, compound grains consisting of 2-4 components, size vary from 5-44 µ in diameter ., found scattered in cortex, phloem parenchyma, xylem parenchyma and medullary ray cells.

Powder : Greyish to light brown; shows parenchymatous cells, cellulosic fibres with pointed tips, vessels with simple pits, simple and compound starch grains elliptical to spherical with central cleft, measuring 5-44 J.1 hi diameter ., having 2-4 components, 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 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 10 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 on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows under DV (366 nm) three fluorescent zones at Rf. 0.08, 0.21 (both light blue) and 0.58 (blue). On exposure to Iodine vapour seven spots appear at Rf. 0.21, 0.41, 0.49, 0.58, 0.71, 0.90 and 0.97. (full yellow). On spraying with VanillinSulphuric acid reagent and heating the plate for ten minutes at 1100e seven spots appear at Rf. 0.21,0.41,0.49 (all light violet), 0.58, 0.70, 0.90 and 0.97 (all violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Resinous Glycosides
TEMPERAMENT	**:**	Hot3^0 and Dry2^0
ACTION	**:**	Mushile Balgham, Munaqqie Dimagh.
THERAPEUTIC USES	**:**	Istisqa, Wajaul Mafasil, Irqun Nasa, Laqwa, Falij, Sual.
DOSE	**:**	3 - 5 g
IMPORTANT FORMULATION	**:**	Itrifal Ustukhuddus.

WAJ TURKI
(RHIZOME)

The drug Waj Turki consists of dried rhizome plant of *Acorus calamus* Linn. (Fam. Araceae); a small semiaquatic herb, wild or cultivated throughout the country ascending upto 1800 m in the Himalyas.

OTHER NAMES:

Urdu	:	Wajae Turki
Arabic	:	Waja
Persian	:	Agre Turki
English	:	The Sweet Flag
Hindi	:	Bach, Gora-bach
Gujarati	:	Ghoduvaj, Ghodvach
Kannad	:	Baje, Narru Berua
Tamil	:	Vasambu, Pillai maruntho
Malayalam	:	Vayambu
Marathi	:	Vaca, Vekhanda
Punjabi	:	Varch, Ghodavaca
Telugu	:	Vasa

DESCRIPTION:

Macroscopic : Drug occurs in simple or rarely with thumb-like branches at nodes; sub-cylindrical to slightly flattened, somewhat tortuous or rarely straight, cut pieces of 1-5 cm long,k and 0.5-1.5 cm thick; upper side marked with alternately arranged, large, broadly, triangular, transverse leaf scars which almost encircle therhizome; at nodes leaf sheath mostly having an appearance present; lower side shows elevated tubercular spots of root scars; light-brown with reddish-tinge to pinkish externally, buff coloured internally; fracture, short; odour, aromatic; taste, pungent and bitter.

Microscopic : **Rhizome :** Shows single layered epidermis; cortex composed of spherical to oblong, thin-walled cells of various sizes, cells towards periphery, smaller, somewhat collenchymatous, more or less closely arranged cells towards inner side, rounded and form a network of chains of single row of cells, enclosing large air spaces, fibro-vascular bundles and secretory cells having light yellowish-brown contents, present in this region; endodermis distinct; stele composed of round, parenchymatous cells enclosing large air spaces similar to those of cortex and several concentric vascular bundles arranged in a ring towards endodermis, a few vascular bundles scattered in ground tissues; starch grains simple, spherical, measuring 3-6 µ in diameter ., present in cortex and ground tissue.

Powder: Buff coloured; shows fibres, reticulate, annular vessels and simple spherical starch grains, measuring 3-6 µ in diameter meter.

Observation of powder and its extracts on exposure under UV light:-

a. Powder as such : Yellowish-cream
b. Extracts in
    i. Petroleum ether : No change
    ii. Chloroform : Light green

iii. Methanol : Yellowish-green
iv. Benzene : No change

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 7 percent, 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 16 per cent, Appendix 2.2.7.
Volatile oil	:	Not less than 2 per cent, Appendix 2.2.10

T.L.C.:

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (9:1) shows two spots at Rf. 0.14 (violet) and 0.73 (violet) on spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 105^0 C. Appendix 2.2.10

CHEMICAL CONSTITUENTS : Volatile Oil (principal constituents of the Volatile oil are Asamyl alcohol, Eugenol and Asarone), also contains a bitter principle Acorin (Glucoside), Starch and Tannin.

TEMPERAMENT : Hot2^0 and Dry2^0

ACTION : Qato wa Mujaffife Balgham, Kasire Riyah, Munaqqie Dimagh, Mudirre Baul wa Haiz, Mulattif, Jali, Muqawwie Bah.

THERAPEUTIC USES : Nisyan, Khadar, Istirkha, Luknate Zaban, Junoon, Sara, Falij, Wabai Amraz, Ehtebase Haiz.

DOSE : 1 - 3 gm.

IMPORTANT FORMULATIONS : Majoon Nisyan, Mufarreh Kabir, Anqarooyae Kabir Angroya Sagheer.

ZARAWAND HINDI
(ROOT)

The drug Zarawand hindi consists of dried root of *Aristolochia indica* Linn. (Fam. Aristolochiaceae); a perennial shrubby twiner, found throughout the low hills and plains of India.

OTHER NAMES:

Urdu	:	Zarawand Hindi
Arabic	:	Zarawand Hindi
Persian	:	Zarawand Hindi
Hindi	:	Ishwri
Bengali	:	Isheri
Gujarati	:	Ruhimool, Iswarimool
Kannad	:	Iswari Beru, Toppalu
Tamil	:	Perumarundu, Ichchuramule
Malayalam	:	Karaleyan
Marathi	:	Sapsan
Orissa	:	Gopikaron
Telugu	:	Iswari, Nallaiswari

DESCRIPTION:

Macroscopic : Root considerably long, cylindrical, a few irregularly bent; 2-10 mm in diameter; surface almost smooth with fine longitudinal wrinkles and transverse cracks; external surface, light grayish-brown; innr whitish; fracture, short and splintery; odour, camphoraceous; taste strongly bitter.

Microscopic : Cork 8-10 layers, composed of tabular, thin-walled cells excepting the outer most layer, having thick-walled cells externally and filled with brownish content; cork cambium single layered; secondary cortex 15-17 layers of thin-walled , somewhat rounded and isodiametric cells in the outer region but tangentially elongated in the inner region; plenty of simple, round to oval starch grains measuring 5-18 µ in diameter., and compound starch grains having 2-4 components measuring 10-15 µ in diameter., and oil globules present in afew cells ; in the middle region stone cells round, rectangular, oval or elongated present in small irregular patches having simple pits and radiameter ting canals; centre occupied by exylem, split into strips of radiameter ting arms by wedge shaped masses of parenchyma; each cylem arm is capped by thin patches of phloem consisiting of sieve elements and phloem parenchyma, phloem fibres, and occasionally stone cells also found in this region; a ring of cambium present between phloem and xylem; xylem consists of large vessels, tracheids, fibres and parenchyma all being lignified; in oldedr roots, tyloses formation takes place in vessels; medullary rays 8-10 in number, multiseriate and diameter lating towards periphery and alternating with radiameter ting arms of wood; scattered group of stone cells present in a few wider rays ; micro-crystals with a few appearing as elongated small prisms and unaffected by acids, are parent in a few cortical and ray cells.

Powder : Brownish-yellow; fragments of cork cells, very few oval to rectangular, lignified, thick-walled stone cells haing distinct striations with narrow lumen, vessels with spiral thickening, non-lignified, thick-walled tracheids, numerous simple , round to oval, starch gains measuring 5-18 µ in diameter and compound grans having 2-4 components, measuring 10-15 µ in diameter ., a few crystals and oil globules.

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 2 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 alcoholic extract on Silical gel 'G'plate using Toluene: Ethylacetate (85:15) shows under UV (366 nm) four fluorescent zones at Rf. 0.21, 0.60 (both blue), 0.89 (red), 0.96 (blue). On exposure to Iodine vapour six spots appear at Rf. 0.11, 0.21, 0.50, 0.63, 0.96 and 0.98 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110^0 C three spots appear 0.14, 0.63 (both violet) and 0.96 (brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alakaloids, Essential Oils, Bitter Principles and Fixed Oil.
TEMPERAMENT	**:**	Hot2^0 and Dry3^0
ACTION	**:**	Mudirre Baul wa Haiz, Mohallil, Musakkin, Munaffis, Mushile Balgham, Qatile Kirm, Jali, Munbite Laham
THERAPEUTIC USES	**:**	Ehtabase Haiz, Tanqiae Raham, Ikhraje Janeen, Sual, Dama, Istirkhae Aasab, Wajaul Mafasil.
DOSE	**:**	3 - 5 gm.
IMPORTANT FORMULATION	**:**	Tiryaq Arba, Majoon Falasfa, Majoon Dabeedul Ward, Marham Qooba.

APPENDICES

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APPENDIX – 1

APPARATUS FOR TESTS AND ASSAYS

1.1.1 Nessler Cylinders

Nessler cylinder which are used for comparative tests are matched tubes of clear colorless glass with a uniform internal diameter and flat, transparent base. They comply with Indian standard 4161 –1967. They are transparent glasses 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 mm. The external height to the 50 ml mark of the cylinder used for a test must not vary by more than 1mm.

1.1.2 Sieves

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	13(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 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

Unless otherwise specified, thermometers suitable for pharmacopoeial tests conform to Indian Standard 4825-1968 and are standardized 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 standardized for total immersion or for partial immersion. Each thermometer should be employed according to the condition of immersion under which it was standardized. In the selection of the thermometer it is essential to consider the conditions under which it is to be used.

1.1.4 Volumetric Glasswares

Volumetric apparatus is normally calibrated at 27°C. However, the temperature generally specified for measurements of volume in the analytical operations of the pharmacopoeia, unless otherwise stated, is 25°C. This discrepancy is inconsequential as long as the room temperature in the laboratory is reasonably constant and is around 27°C.

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 Indian Standards Institution. The tolerances on capacity for volumetric flasks, pipettes and burettes, as laid down in the relevant Indian Standards, are set out in the following table.

Volumetric Flask : I.S. 915-1975

Nominal capacity, ml	5	10	25	50	100	250	500	1000
Tolerance, ±ml	0.02	0.02	0.03	0.04	0.06	0.1	0.15	0.2

One Mark Pipettes : I.S. 1117-1975

Nominal Capacity, ml	1	2	5	10	20	25	50	100
Tolerance, ±ml	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.06

Graduated Pipettes : I.S. 4162-1967

Nominal Capacity, ml	1	2	5	10	25
Subdivision, ml	0.01	0.02	0.05	0.10	0.2
Tolerance, ± ml	0.006	0.01	0.03	0.05	0.1

Burettes : I.S. 1997-1967

Nominal capacity, ml	10	25	50	10
Subdivision, ml	0.05	0.05	0.1	0.1
Tolerance, ±ml	0.01	0.03	0.05	0.1

1.1.5 Weights and Balances

Pharmacopoeial tests and assays require the use of analytical balances that vary in capacity, sensitivity, and reproducibility. The accuracy needed for weighing should indictate 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 a 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.

APPENDIX - 2

TESTING OF DRUGS

2.1. Systematic study of Crude Drugs

In the Indian systems of Medicine comprising of Unani, Ayurveda, and Siddha drugs of plant, animal and mineral origin are used in their natural or so called "Crude" forms singly or in their mixture or in combination to make a compound preparation or formulation. Nearly 90 per cent of the Crude Drugs are obtained from the plant sources while about 10 per cent of the drugs are derived from animal and mineral sources. The drugs of plant origin especially of herbaceous nature are frequently used as whole plant; otherwise their parts such as root, stem, leaf, flower, seed, fruit modifications of stem and root. Bark of a stem or root wood, and their exudates of gums etc. constitute single drugs in Indian Systems of Medicine. These vegetable drugs are either used in dried forms of some times as whole fresh or their juice. The study of these crude drugs made with a view to recognize them is called Pharmacognosy (Pharmaka = Drug; gignosco = to acquire knowledge of), meaning the knowledge ofr science of Drugs, In Pharmacognosy a complete and systematic study of a drug is done, which comprises of (I) origin, common names, scientific nomenclature and family, (ii) geographical source (and history), (iii) cultivation, collection, preservation and storage, (iv) Macroscopical, Microscopical and sensory (organoleptic) characters, (v) Chemical composition wherever possible, (vi) Identity, Purity, Strength and assay, (iv) substitute and adulterants etc. Such systematic study of a drug as complete as possible, is claimed to be the scientific or pharmacognostical evaluation.

As mentioned above each crude drug derived from the vegetable kingdom consists of a definite part of plant e.g., leaf, stem, fruit, seed, wood, bark, root etc. Morphological or Macroscopical details of the respective part are given by observing it with a naked eye or with the aid of a magnifying lens. In this description general conditions of the drug, size, shape, outer surface, inner surface etc. are referred to. Drugs can be identified with the aid of the above, only if they are available in entire condition. Sensory or organoleptic characters describe colour, odour, taste, consistency etc. The microscopic examination of different parts of the drug provides several diagnostic characters. In case of leaves, surface preparation and transverse section, preferably through midrib, are made and nature of epidermis, trichomes, stomata, arrangement of tissue like palisade cells, vascular bundles and nature of cell content are studied. Similarly in case of bark, root, rhizome and cular bundles and nature of cell content are studied. Similarly in case of bark, root, rhizome and wood, transverse and longitudinal sections are made and from characteristic arrangements of tissues of each drug and from diagnostic elements like stone cells, fibers, vessels etc. as also from the study of the cell deposits like crystals, starch etc. the drugs are identified. The studies of diagnostic elements are helpful especially when the drugs are in powdered condition and give clue in the identification of drugs. Linear measurements and other methods of quantitative microscopy give further aid in the identification of the drugs. The sections or the powdered drug samples are cleared by clearing agents mostly by chloral-hydrate solution, before mounting on the slide.

The basic chemical nature of cell-wall of almost all the plants is cellulosic. However, lignin, suberin, cutin or mucilage are deposited on the cellulose. Cellulose gives blue colour with chlorozinc-iodine solution of with cuoxam (Copper-oxide-ammonia) reagent. Lignin

present in the middle lamella and secondary cell-wall of many vessels, fibers and sclerieds gives red colour with phloroglucinol and concentrated hydrochloric acid. Suberin is present in cork and endodermis cells while cutin in the cuticle of leaf. Both are fatty in nature and when heated with Sudan Red-III give red colour.

Mucilage gives red colour with ruthenium red. The chemical constituents present in the drugs can be identified by chemical or microchemical tests e.g., Rhubarb rhizomes given with 5% potassium hydroxide red colour because of anthraquinone derivatives, strychnine present in Nux-vomica gives purplish-red colour with ammonium vanadate and concentrated suphuric acid.

Paper and Thin Layer Chromatography are now utilized in identification of drugs, their adulterant and their chemical constituents. Methods have been developed for quantitative estimation of the chemical constituents from paper and Thin Layer Chromatography (TLC).

2.1.1 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 a 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 and chloral hydrate*. Crush the material with scalpel and cover with cover slip before examining.

(ii) **Cut materials** - For examining cut leaves, herb 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 chloralydrate 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 Chloralhydrate 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***

General Microscopical examination of fruit and seed is not done. If required then take the specimens of 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 steam 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 can not 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 (0.6x0.5x1.5 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 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. Shapes 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 defatted and clarified as follows:

(i) Place 0.5-1g. 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 though 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 Indian Ink and examine it under a low power microscope or under dissecting microscope. Mucilage appears as colourless masses against the black back ground which spreads when slightly pressed with needle.

III Barks

a. Entire material

Prepare transverse of 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 water in a test tube for 1-3 minutes. Soft pieces are then straightened with a scalpel so as to have a exact transverse or longituinal 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-bi-chromate 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 prepare pressed specimen and immerse in *glycerol* 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 *phlorogucinol* 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

Generally anatomical examination of entire roots and rhizomes is not done but if required then 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 soften roots are straightened with 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 saffranine, examine the specimen under a dissecting microscope. For micro-chemical test the small and then sections are examined under microscope, as follows:

1. Starch - Starch is detected with iodine solution. If starch is present, 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 III, 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 of 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, anthrquinone derivatives, tannins, mucilage, etc.

2.1.2 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 ranuculaceous. The stomata is surrounded by a varying number of cells in no way differing from those of the epidermis generally.

2. Anisocytic (unequal-celled) - Previously known as cruciferous or solanacaceous. The stomata 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 stomata is accompanied by two subsidiary cells whose common wall is at right angles to the guard cells.

4. Paracytic (pareallel-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.

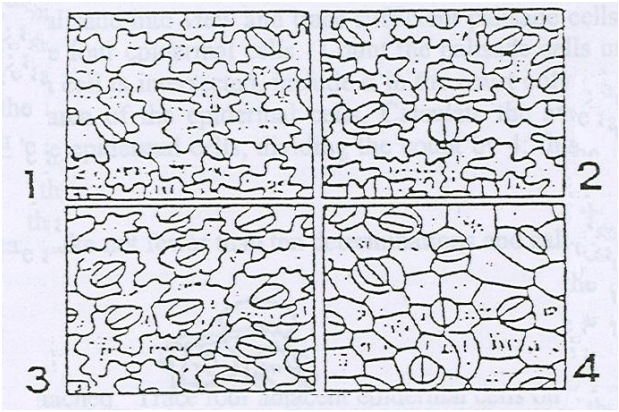

Fig. 1. Various types of stomata

2.1.3 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 5x5 mm in size in a test tube containing about 5 ml of *Choral hydrate solution* and heat in a boiling water 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 stomata. Calculate the result as follows:

$$\text{Stomatal index} = \frac{X \times 100}{E + S}$$

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.

For each sample of leaf make not fewer than ten determinations and calculate the average index.

2.1.4 Determination of Palisade Ratio

Palisade ratio is the average number of palisade cells under one epidermal cell.

Place leaf fragments of about 5 x 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 minute or until the fragment become transparent. Transfer a fragment to a microscopical Slide and prepare the amount, the upper epidermis uppermost, 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 court 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 cells, dividing the count by 4; this is the "Palisade ratio" (See figure 2).

For each sample of leaf make not fewer than ten determinations and calculate the average number.

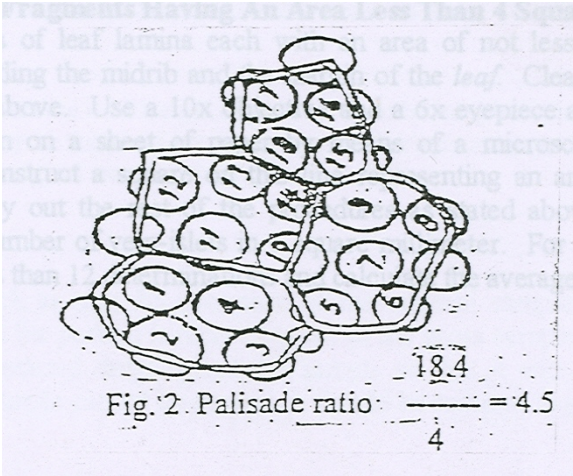

Figure 2

2.1.5 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 eyepiece. 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 vainlets 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 Millimetres - 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 1mm on a sheet of paper by means of a microscopical drawing apparatus and construct a square on this line representing an area of 1 square millimeter. Carry out the rest of the procedures as stated above. The result obtained is the number of vein-islets in 1 square millimeter. For each sample of leaf make not less than 12 determinations and calculate the average number.

2.2 Determination of Quantitative Data of Vegetable Drugs

2.2.1 Sampling of Vegetable Drugs

Original Samples:

(a) Samples of crude vegetable drugs in which the component parts are 1 cm or less in any dimension; and of powdered or ground drugs may be taken by means of sampling device that removes a core from the top to the bottom of the container. Not less than two cores are taken in opposite directions.

When the total weight of the drug to be sampled is less than 100kg, at least 250g are withdrawn to constitute an original sample.

When the total weight of the drug to be sampled is more than 100 kg, several samples are taken in the manner described, mixed and quartered, two of the diagonal quarters being rejected, and the remaining two quarters being combined and carefully mixed, and again subjected to quartering process in the same manner until each of the quarters weigh at least 125g; two such quarters then constitute an original sample.

(b) Samples of crude vegetable drugs in which the component part are over 1 cm in any dimension taken by hand.

When the total weight of the drug to be sampled is less than 100kg. samples are taken from different parts of the container or containers. Not less than 500g of samples so taken constitute an original sample.

When the total weight of the drug to be sampled is more than 100kg, several samples are taken in the manner described, mixed and quartered, two of the diagonal quarters being rejected, and the remaining two quarters being combined and carefully mixed, and again subjected to a quartering process in the same manner until each of the quarters weigh not less than 250g; two such quarters then constitute an original sample.

Note : -Where the total weight of crude drug to be sampled is less than 10kg, the proceeding methods may be followed but somewhat smaller quantities are to be withdrawn but in no case shall the original samples weight less than 125g.

Test Sample

Withdraw as much as may be necessary of the original sample by quartering, taking care to see that the portion is representative of the gross sample. In the case of ungrounded or unpowdered drugs, grind the sample so that it will pass through a No.22 sieve. If the sample cannot be ground, it should be reduced to as fine a state as possible. Mix by rolling it in paper or cloth, spread it out in a thin layer, and withdraw the portion for analysis.

2.2.2 Foreign Matter and Determination of Foreign Matter

A. *Foreign Matter*

Drugs should be free from moulds, insects, animal faecal matter and other contamination such as earth, stones and extraneous material. Any matter not covered by the description of the drug in the monograph shall be regarded as an non-extraneous foreign matter.

Foreign matter is material consisting of any or all of the following:

(1) In particular, parts of a organ or organs from which the drug is derived other than the parts named in the definition or for which a limit is prescribed in the individual monograph.

(2) Any organ or part of organ, other than those named in the definition and description.

The amount of foreign matter shall not be more than the percentage prescribed in the monograph.

B. Determination of Foreign Matter

Weigh 100-500 g of the drug sample to be examined, or the minimum quantity prescribed in the monograph, and spread it out in a thin layer. The foreign matter should be detected by inspection with the unaided eye or by the use of a lens (6x). Separate and weigh it and calculate the percentage present.

2.2.3 Determination of Total Ash

Incinerate about 2 to 3g accurately weighed of the ground drug in a tared platinum or silica dish at a temperature not exceeding 450°C 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°C.

Calculate the percentage of ash with reference to the air-dried drug.

2.2.4 Determination of Acid-insoluble Ash

Boil the ash obtained in (2.2.3) for 5 minutes with 25ml, of *dilute hydrochloric acid*; collect the insoluble matter in a Gooch crucible, or on an ashless filter paper, wash with hot water and ignite to constant weight. Calculate the percentage 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 temprature not exceeding 450°C. 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 Alcohol-soluble extractive

Macerate 5g of the air dried drug, coarsely powedered, with 100 ml of Ethyl alcohol of the specified strenght in a closed flask for twenty-four hours, shaking frequently during six hours and allowing 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°C to constant weight and weigh. Calculate the percentage of alcohol-soluble extractive with reference to the air-dried drug.

2.2.7 Determination of Water-soluble extractive

Proceed as directed for the determination of Alcohol-soluble extractive, using *chloroform water* instead of *ethanol.*

2.2.8 Determination of Ether-soluble extractive (Fixed Oil Content)

Transfer a suitable 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°C to 60°C) 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°C to constant weight. Calculate the percentage of ether-soluble extractive with reference to the air-dried drug.

2.2.9 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 10g. of drug (without preliminary drying) after accurately weighing (accurately weighed to within 0.01 g) it in a tared evaporating dish. For example, for underground or unpowdered drug, prepare about 10g, 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°C for 5 hours, and weigh. Continue the drying and weighing at one hour interval until difference between two successive weighings corresponds to not more than 0.25 per cent. Constant weight is reached when two consecutive weighting after drying for 30 minutes and cooling for 30 minutes in an desccator, show not more than 0.01g difference.

2.2.10 Thin Layer Chromatography

Preparation of chromatoplates

Unless otherwise specified in the monograph, the chromatoplates are prepared in the following manner. Prepare a suspension of the Silica gel-G, using a spreading device designed for the purpose, spread a uniform layer of the suspension 0.20 to 0.25 mm thick on flat glass plate 20 cm long. Allow the coated plates to dry in air, heat at 100^0 to 105^0C for at least one hour (except in the case of chromatoplates prepared with cellulose when ten minutes' heating is normally sufficient) and allow to cool protected from moisture. Store the chromatoplates protected form moisture and use within three days of preparation. At the time of use, re-dry the chromatoplates, if necessary.

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 one hour at room temperature.

Remove a narrow strip of the coating substance, about 5 mm wide, from the vertical sides of the chromatoplate. Apply the solutions being examined in the form of circular spots about 2 to 4 mm in diameter, 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 chromatoplate 15 cm, or the distance specified in the monograph, from the starting line. Allow the solvent to evaporate and place the chromatoplate in the tank, ensuring that it is as nearly vertical as possible and that the spots are above the level of the mobile phase. Close the tank and allow to stand at room temperature, unless otherwise stated in the monograph, until the mobile phase has ascended to the marked line. Remove the chromatoplate and dry

and visualize as directed in the monograph; where a spraying technique is prescribed it is essential that the reagent be evenly applied as a fine spray.

2.2.11 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°C±25°C 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 weighings do not differ by more than 0.5 mg.

2.2.12 Determination of Phenolics

Dissolve 5 gm of drug in water and filter. The filtrate is shaken with petroleum ether to remove greasy matter. It is precipitated with a saturated solution of lead acetate, digest for few minutes on water bath let the ppt. settle and filter. Dry the residue, then suspend it in alcohol and slightly warm on water bath and decompose by passing H_2S. The clear alcoholic solution is concentrated under reduced pressure. It is subjected to vacuum distillation 3 times, after adding fresh quantity of alcohol each time, to get rid of all the H_2S gas. The residue is transferred to a weighed petridish with alcohol and excess of alcohol evaporated on waterbath. The residue is dried at 105^0C till constant weight.

2.2.13 Determination of Volatile Oil

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 retuned 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. The 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.

(a) Distilling Flask – A spherical flsk, 1000 ml capacity with ground neck, taper of ground socket 1 in 10, internal diameter of larger end 34.35 to 34.65 mm.

(b) Still head – graduated measuring tube, and return flow tube made in one piece, in accordance with the following specifications. External diameter of the smaller end 31.0 to 31.2 mm. Minimum length of the ground zone – 34 mm.

Tube AC, length – 220 to 240 mm.
Internal diameter – 13 to 15 mm.

Bulb CD, length – 100 to 110 mm.

Internal diameter – 13 to 15 mm.

Spiral condenser – ground joint accurately fitting in the ground neck of the tube EG, taper 1 in 10.

Tube EG, length – 80 to 90 mm.

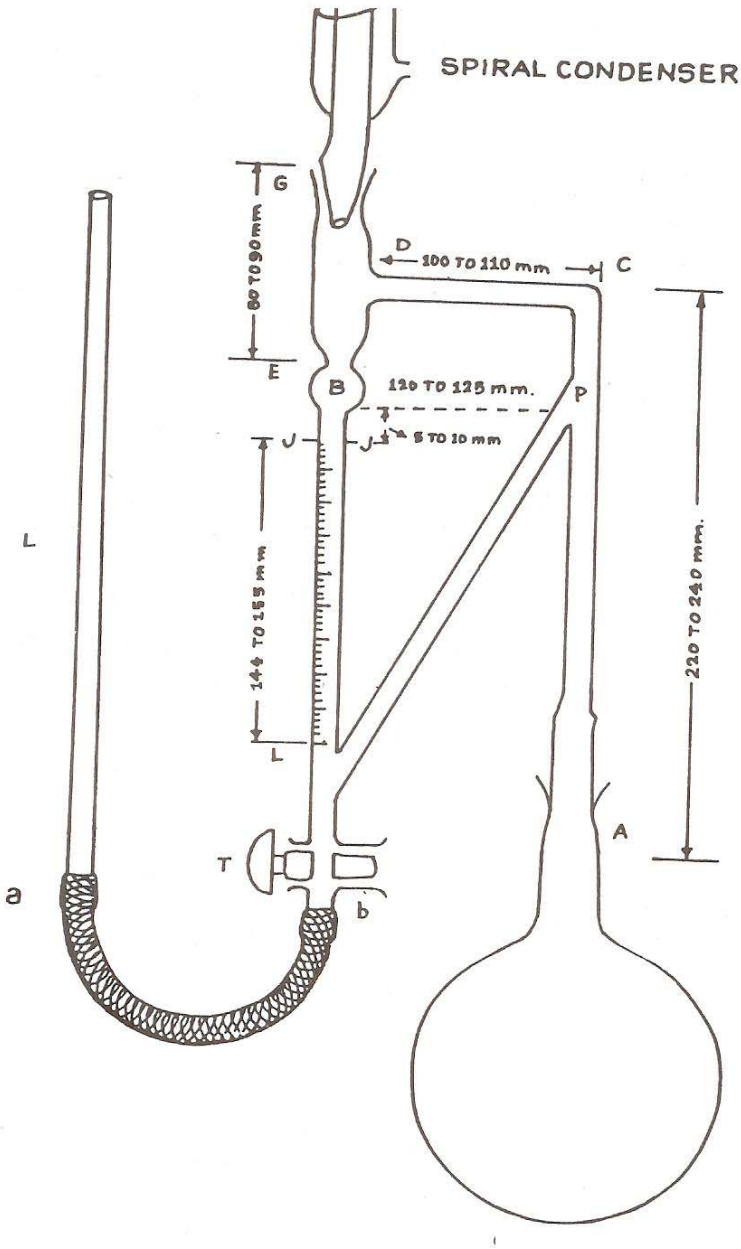

Fig. Apparatus for volatile oil determination

Internal diameter – 15 to 20 mm

The distance between B and P is 120 to 125 mm.

Junction P and the centre of the bulb B must be in the same horizontal plane.

Measuring tube JL – length of the graduated portion 144 to 155 mm capacity 2 millilitres graduated into fifths and fiftienths of a milliliter.

Tube PL – return flow tube – Internal diameter – 7 to 8 mm.

Leavelling tune I, length – 450 to 500 mm. Internal diameter 10 to 12 mm tapering at the lower end with a wide top (20 to 25 mm diameter).

Rubbing tubing a-b length 450 to 500 mm. Internal diameter 5 to 8 mm.

(c) Burner – A luminous Argand burner with chimney and sensitive regulative tap.

(d) Stand - A retort stand with asbestos covered ring and clamp carrying a piece of metal tubing connected by a short length of rubber tubing with the water inlet tube of the condenser jacket.

The Whole of the apparatus is effectively screened from draught.

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 earthern 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 heater 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 roatated 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 L1 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.

2.2.14 Estimation of Starch

Prepare 10% homogenate of the plant tissue in 80% 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% 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% phenol and 5 ml conc. H_2SO_4. Cool and then read the absorbance at 490 nm.

2.3 Limit Tests

2.3.1 Limit Test for Arsenic

In the limit test for arsenic, the amount of arsenic present is expressed as As.

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 sparing 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 a 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	0.132g
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 of dryness, add 50 ml of 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.

Citiric 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 percent w/w of HC1 and complying with the following additional tests:

A. Dilute 10 ml white sufficient water to produce 50 ml, add 5 ml of ammonium thiocyanate solution and stir immediately; no colour is produced.

B. 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 a 10 percent w/v in solution in water per liter 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, 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 400 papers is approximately equal numerically, to the weight in g per sq. mm.

Nitric acid AsT - Nitric acid which complies 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.

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 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.

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-grains 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 add 50 ml of water and 2 drops of stannous 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 the following additional tests:

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, nut 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 are added, and the prepared glass tube isj placed quickly in position. The action is allowed to proceed for fourty 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 operation 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.

NOTE: Mercuric 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.

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.

NOTES:(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 400 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, nut 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 that 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 add 10 ml of stannated hydrochloric acid AsT.

Boric acid - Dissolve 10 g with 2 g of citric acid AsT in 50 ml of 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 distil 29 ml; to the distillate add a few drops of bromine solution AsT. Add 2 ml of stannated hydrochloric acid AsT, heat under a reflex 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, 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 percent 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 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 solutions.

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 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 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 jot dryness on a waterbath to the residue add 1 ml of dilute hydrochloric acid Sp. and evaporate to dryness. Dissolve the residue in 2 ml of dilute acetic acid Sp. and sufficient water to produce 25 ml. Add 10 ml of hydrogen sulphide solution if

any darkening produced is not greater that in a blank solution containing 2 ml of dilute acetic acid Sp. 1 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 of the acid in a beaker to dryness on a water-bath. Dissolve the residue in 2 ml of dilute acid sp., dilute 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 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: One the day of use, dilute 10 ml of lead nitrate stock solution with water to 100 ml. Each ml of standard lead solution contains the equivalent of 10 mg of lead. A control comparison solution prepared with 2 ml of standard lead solution contains, when compared to a solution representing 1 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 *ammonium 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.

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 two drops of *sodium sulphide solution;* no darkening is produced.

Method A

Standard Solution : In 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 and 4, dilute with water to about 35 ml., and mix.

Test Solution : In 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 l the specified quantity of the substance being tested. Adjust with *dilute acetic acid Sp.* Or *dilute ammonia solution Sp.* To a pH between 3 and 4 *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. n*ot 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 the 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°C to 600°C 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 and 4. 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 : In 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 : In 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 29 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 0.02mg 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 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* 0.1ml 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 reagents 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 : Dissolved 2g of *potassium cyanide* in 15 ml of *strong ammonia solution* and dilute with *water* to 100 ml.

(2) Ammonia citrate solution Sp. : Dissolve 40g of *citric acid* in 90 ml of 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 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 u g of lead per ml.

(4) Dithizone extraction solution : Dissolve 30 mg of *diphenylthiocarbazone in 1000 ml of chloroform* and add 5 ml of *alchohol.* 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 20g 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. Extracts 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* unitl 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 *eithizone 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) Stadard dithizone solution : Dissolve 10 mg 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 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 5 ml of *ammonium citrate solution Sp.,* and 2 ml of *hydroxylamine hydrochloride solution Sp.,* (For the determination of lead in iron salts use 100 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 ammonia 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 and discard the chloforom layer. Add to the acid 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 shake 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 $BaC1_{2,}\,2H_2O$.

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 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.

APPENDIX 3

3.1 PHYSICAL TESTS AND DETERMINATIONS

3.1.1 Determination of Boiling or Distilling Range

The boiling range of a liquid is the temperature interval, corrected for a pressure of 760 torr within which the liquid or a specified fraction of the liquid, distils under the conditions specified in the test. The lower limit of the range is the temperature indicated by the thermometer when the first drop of condensate leaves the tip of the condenser, and the upper limit is the temperature at which the last drop evaporates from the lowest point in the distillation flask without taking into account any liquid remaining on the sides of the flask; it may also be the temperature observed when the proportion specified in the individual has been collected.

Apparatus -

Use an apparatus consisting of the following:

(i) Distilling flask: A round-bottom distilling flask of 200 ml capacity and having a total length of 17 to 19 cm and an inside neck diameter of 20 to 22 mm. Attached about midway on the neck approximately 12 cm from the bottom of the flask, is a side-arm 10 to 12 cm long and 5 mm in internal diameter which is at an angle of 70° to 75° with the lower portion of the neck.

(ii) Condenser: A straight glass condenser 55 to 60 cm long with a water-jacket about 40 cm long any other type of condenser having equivalent condensing capacity. The lower end of the condenser may be bent to provide a delivery tube, or it may be connected to a bent adaptor that serves as a delivery tube.

(iii) Receiver: A 100 ml cylinder, graduated in 1 ml sub-divisions.

(iv) Thermometer: An accurately standardised partial immersion thermometer having the smallest practical sub-divisions (not greater than 0.2°C). When placed in position, the steam is located in the centre of the neck and the top of the bulb is just below the bottom of the outlet to the side arm.

Method

If the liquid under examination distils below 80°C, cool it to between 10°C and 15°C before measuring the sample for distillation.

Assemble the apparatus, and place in the flask 100 ml of the liquid under examination, taking care not to allow any of the liquid to enter the side-arm. Insert the thermometer and seal the entire heating and flask assembly from external air currents. Add a few pieces of porous material and heat rapidly to boiling using a Bunsen burner an asbestos plate pierced by a hole 33 mm in diameter. Record the temperature at :h the first drop of distillate faJls into the cylinder, and adjust the rate of heating to in a regular distillation rate of 4 to 5 ml per minute. Record the temperature when the drop of liquid evaporates from the bottom of the flask or when the specified entage has distilled over. Correct the observed temperature readings for any variation le barometric pressure from the normal (760 torr)

using the following expression:

$t_4 = t_2 + k(a-b)$

where

t_4 = the corrected temperature
t_2 = the observed temperature
a = 760 (torr)
b = the Barometric pressure in torr at the time of determination
k = the correction factor indicated in the following table

Distillation range	k
Less than 100^0	0.040
100^0 to 140^0	0.045
140^0 to 190^0	0.050
190^0 to 240^0	0.055
More than 240^0	0.060

3.1.2 Determination of congealing range of temperature

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 se of a substance are in equilibrium.

The temperature at which a substance solidifies upon cooling is a useful Index of its purity of heat is liberated when solidification takes place.

The following method is applicable to substances that melt between 200 and 1500

Apparatus –

A test-tube about 25 mm in diameter and 150 mm long placed inside a test-tube about mm in diameter and 160 mm long; the inner tube is closed by a stopper that carries a stirrer and a thermometer (about 175 mm long and with 0.2 graduations) fixed, so that the b is about 15 mm above the bottom of the tube. The stirrer is made from a glass rod or suitable material formed at one end into a loop of about 18 mm overall diameter at It angle to the rod. The inner tube with its jacket is supported centrally in a l-liter beaker containing a suitable cooling liquid to within 20 mm of the top. A thermometer is ported in the cooling bath.

Method

Melt the substance, if solid, at a temperature not more than 20°C above its expected congealing point and pour it into the inner test-tube to 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 sample in the test-tube. Fill the bath to almost 20 mm from the tube with a suitable fluid at a temperature 4°C 'to 5°C below the expected congealing point. If the substance is a liquid at room temperature, carry out the determination using a bath temperature about 15°C below the expected congealing point. When the sample has cooled to

about 5°C 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. 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 or starts to rise slightly. Continue recording the temperature for atleast three minutes after the temperature again begins to fall after remaining constant.

The congealing point will be the average of not less than four consecutive readings that lie within range of 0.2°C.

3.1.3 Determination of pH Values

The pH value conventionally represents the acidity or alkalinity of an aqueous solution. In the pharmacopoeia, standards and limits on pH have been provided for these pharmacopoeial substances in which pH as a measure of the hydrogen activity is important from the stand point of stability or physiological suitability.

The measurement of pH is generally done with a suitable potentiometric meter known as the pH meter fitted with two electrodes, one constructed of glass and sensitive to hydrogenation activity and the other a calomel reference electrode. The determination is carried out at temperature of 254°C $\pm$ 2°C, unless otherwise specified in the individual monograph.

Apparatus - The pH value of a solution is determined potentiometrically by means of a glass electrode, a reference electrode and a pH meter either of the potentiometric or of the deflection type.

Operate the pH meter and electrode system according to the manufacturer's instructions. Calibrate the apparatus using buffer *solution D* as the primary standard, adjusting the meter to read the appropriate pH value given in the Table 1, corresponding to the temperature of the solution. Where provision is made for setting the scale, use a second reference buffer solution, either *buffer solution A, buffer solution E or buffer solution* G. In this case a check is carried out with a third reference buffer solution of intermediate pH, when the reading of the intermediate solution must not differ by more than 0.05 pH unit from the corresponding value indicated in the Table. Where there is no provision for setting the scale with a second reference buffer solution, checks should be made with two reference buffer solutions, the readings for which must not differ by more than 0.05 pH unit from the value corresponding to each solution

TABLE 1 - pH of Reference Solutions at various Temperatures.

Temperature	Buffer Solutions							
T^O	A	B	C	D	E	F	G	H
15	1.67	-	3.80	4.00	6.90	7.45	9.28	10.12
20	1.68	-	3.79	4.00	6.88	7.43	9.22	10.03
25	1.68	3.56	3.78	4.01	6.86	7.41	9.18	10.01
30	1.68	3.55	3.77	4.02	6.85	7.40	9.14	9.97
35	1.69	3.55	3.76	4.02	6.84	7.39	9.10	9.98
	+ 0.001	-0.001	-0.002	+0.001	-0.003	+0.003	-0.008	-0.009

$\Delta pH/\Delta t$

Reference buffer solutions

The following reference buffer solutions must be prepared using *carbon dioxide free water;* phthalate and phosphate salts should be dried at 110°C for two hours before use. Buffer solutions should be stored in bottles made of alkali-free glass, and must not be used later than three months after preparation.

1. **Buffer solution A:** Dissolve 12.71 g of *potassium tetraoxalate in sufficient carbon dioxide-free water* to produce 1000 ml.

2. **Buffer solution B :** A freshly prepared saturated solution, at 25°C, of *potassium hydrogen tartrate.*

3. **Buffer solution C :** Dissolve 11.51 g of *potassium dihydrogen citrate* in sufficient carbon dioxide free water to produce 1000 ml.

NOTE - This solution must be freshly prepared.

4. **Buffer solution D :** Dissolve 10.21 g of *potassium hydrogen phthalate* in sufficient *carbon dioxide free water* to produce 1000 ml.

5. **Buffer solution E :** Dissolve 3.40 g of *potassium dihydrogenphosphate* and 3.55 g of *anhydrous disodium hydrogen phosphate,* both previously dried at 110°C to 1300 for two hours, in sufficient *carbon dioxide-free water* to produce 1000 ml.

6. **Buffer solution F :** Dissolve 1.184 g of *potassium dihydrogen phosphate* and 4.303 g of *anhydrous disodium hydrogen phosphate,* both previously dried at 1100 to 130°C for two hours in sufficient *carbon dioxide-free water* to produce 1000 ml.

7. **Buffer solution G :** Dissolve 3.814 g of *borax in sufficient carbon dioxide-free water* to produce 1000 ml.

NOTE- This solution should be stored protected freshly carbon dioxide.

8. **Buffer solution H :** Dissolve 7.155 g of *sodium carbonate* and 2.10 g of *sodium bicarbonate* in sufficient *carbon dioxide-free water* to produce 1000 ml.

Method

Immerse the electrodes in the solution to be examined and measure the pH at the same temperature as for the standard solutions. At the end of a set of measurements, take a reading of the solution used to standardise the meter and electrodes. If the difference between this reading and the original value is greater than 0.05, the set of measurements must be repeated.

When measuring pH values above 10.0 ensure that the glass electrode is suitable for use under alkaline conditions. and apply any correction that is necessary.

All solutions of substances being examined must be prepared using *carbon dioxide free water.*

3.1.4 Determination of melting range of temperature

In this Pharmacopoeia, melting range or temperature of a substance is defined as those points of temperature within which, or the point at which, the substance begins to coalesce and is completely melted except as defined otherwise for certain substance. The following procedures are suitable for the various substances described in the Pharmacopoeia. Any other apparatus or method capable of the same accuracy may also be used. The accuracy should be checked frequently by the use of one of the following reference substances, that melts nearest to the melting range of the substance to be tested:

	Melting range
Venillin	81^0-83^0C
Acetanilide	114^0-116^0C
Phenacetin	134^0-136^0C
Sulphapyridine	164.5^0-166.5^0C
Sulphapyridine	191^0-193^0 C
Caffeine (dried at 100^0)	234^0-237^0 C

Unless otherwise specified in the individual monograph, Method I should be used.

Method I

Apparatus :

(a) A glass heating vessel of suitable construction and capacity containing one of the following or any other suitable bath liquid, to a height of not less than 14 cm.

(i) Water for temperatures upto 60°C
(ii) Glycerin for temperatures upto 150°C
(iii) Liquid paraffin for sufficiently high boiling range for temperatures upto 250°C
(iv) Sesame oil or a suitable grade of liquid silicone for temperatures upto 300°C

(b) A suitable stirring device, capable of rapidly mixing the liquids.

(c) An accurately standardised thermometer suitable for the substance under

examination (see Appendix 1.1.3). The thermometer must be positioned in the bath liquid to its specified immersion depth and yet leave the bulb at about 2 cm above the bottom of the bath.

(d) Thin-walled capillary glass tubes of hard glass, about 12 cm long, with a well thickness of 0.2 to O.3mm and an internal diameter of 0.8 to 1.1 mm. The tubes should preferably be kept sealed at both ends and cut as required.

(e) Source of heat (open flame or electric heater).

Procedure: Reduce the substance to a very fine powder and unless otherwise directed, dry it at a temperature considerably below its melting temperature or under pressure over a suitable desiccant for not less than. 16 hours. Introduce into a capillary glass tube, one end of which is sealed, a sufficient quantity of the dry powder to form a compact column about 3 mm high.

Heat the bath until the temperature is about 10°C below the expected melting point. Remove the thermometer and quickly attach the capillary tube to the thermometer by wetting both with a drop of the liquid of the bath or otherwise and adjust its height so that the closed end of the capillary is near the middle of the thermometer bulb. Replace the thermometer and continue the heating, with constant stirring, sufficiently to cause the temperature to rise at a rate of about 3°C per minute. When the temperature is about 3°C below the lower limit of the expected melting range, reduce the heating so that the temperature rises at a rate of about 1° to 2°C per minute. Continue the heating and note the temperature at which the column of the sample collapses definitely against the side of the tube at any point, when melting may be considered to have begun and note also the temperature at which the sample becomes liquid throughout as seen by the formation of a definite meniscus. The two temperatures fall within the limits of the melting range.

Method II

Apparatus: Use the apparatus described under Method I except that the glass capillary tube is open at both ends and has an internal diameter of 1.1 to 1.3 mm an external diameter of 1.4 to 1.3 mm and length of 50 to 60 mm.

Procedure: Rapidly melt the material to be tested, at a temperature not more than 10°C above the point of complete fusion. Draw it into a capillary tube to a depth of about 10 mm. Cool the charged tube at 10°C, or lower, for 24 hours, or in contact with ice for at least 2 hours. Attach the tube to the thermometer and adjust it so that the column of substance is in level with the thermometer bulb; suspend the thermometer in the heating vessel containing water at 15°C so that the lower end of the column of the substance is 30 mm below the surface of the water and heat the water with constant stirring so that the temperature rises at the rate of 1°C per minute the temperature at which the partly melted substance is observed to rise in the capillary tube is the melting temperature.

Method III

Apparatus:

(a) A glass boiling-tube, overall length, 110mm, internal diameter, 25 mm thermometer and with a grove cut in the side.

(b) A cork about 25 mm long to fit into the boiling-tube, bored with a central hole to fit the standard thermometer and with a grove cut in the side.

(c) A glass beaker, of such a size that when the apparatus is assembled, the boiling tube can be immersed vertically to two-thirds of its length in the water in the beaker with its lower end about 2.5 cm above the bottom of the beaker.

(d) A stirrer or any of the device which will ensure uniformity of the temperature throughout the water in the beaker.

(e) An accurately standardised thermometer suitable for the substances under examination (see Appendix 1.1.3).

(f) Suitable means of heating the water in the beaker.

Procedure: Melt a quantity of the substance slowly, while stirring, until it reaches a temperature of about 90°C. Cool and allow the temperature of the molten substance to drop to a temperature of 8° to 10°C above the expected melting point. Chill the bulb of the thermometer to 5°C, wipe it dry and while it is still cold, dip it in the molten substance so that the lower half of the bulb is submerged. Withdraw it immediately, and hold it vertically away from the heat until the wax surface dulls, then dip it for five minutes into a water-bath at a temperature not higher than 15°C,

Fit the thermometer through the bored cork into the boiling tube so that the lower part is 15 mm above the bottom of the tube. Suspend the tube in the beaker filled with water adjusted to about 15°C and raise the temperature of the bath at rate of 2°C per minute to 30°C, then adjust the rate to 1°C per minute and not the temperatures at which the first drop of melted substances leaves the thermometer. Repeat the determination twice on a freshly melted portion of the substance. If the three readings differ by less than 1°C, take the average of the three as the melting point. If they differ by more than 1°C, make two additional determinations and take the average of the five readings.

3.1.5 Optical rotation and specific optical rotation

Optical rotation '∝' is the property shown by certain substances of rotating the plane of polarisation of polarised light. Such substances are said to be optically active in the sense that they cause incident polarised light to emerge in a plane forming a measurable angle with the plane of the incident light. Where this effect is large enough for measurement, it may serve as the basis for identifying or assaying a substance.

The *optical rotation* of a substance is the angle through which the plane of polarisation is rotated when polarised light passes through the substance, if liquid, or a solution of the substance. Substances are described as dextro-rotatory or laevo-rotatory according to whether the plane of polarisation is rotated clockwise or anticlockwise, respectively, as determined by viewing towards the light source. *Dextro-rotation* is designated (+) and laevo-rotation is designated (-).

The *optical rotation,* unless otherwise specified, is measured at the wavelength of the D line of sodium (λ =589.3 μm) at 25°C, on a layer dim thick. It is expressed in degrees.

The *specific optical rotation* $(\propto)^{D^{25}}$ of a solid substance is the angle of rotation œ of

the plane of polarisation at the wavelength of the D line of sodium (λ -589.3 mm) measured at 25^0 C calculated with reference to 1.0 dm thick layer of the liquid, and divided by the specific gravity.

The *specific optical rotation* $(\propto)^{D25}$ of a liquid substance is the angle of rotation cc of the plane of polarisation at the wavelength of the D line of sodium measured at 25^0Cand calculated with reference to a layer 1.0 dm thick of a solution containing 1 g of the substance per ml. The specific optical rotation of a solid is always expressed with reference to a given solvent.

Apparatus

A commercial instrument constructed for use with a sodium lamp and capable of giving readings to the nearest 0.02^0 is suitable for most purposes. For certain applications, the use of a photo-electric polarimeter capable of taking measurements at the specified wave length may be necessary.

The accuracy and precision of optical rotation measurements can be increased if the following precautions are taken:

(a) The instrument must be in a good condition. Optical elements must be very clean and in exact alignment. The match point should be close to .the normal zero mark.

(b) The light source must be properly aligned with respect to the optical bench. It should be supplemented by a filtering system capable of isolating the D line from sodium light.

(c) Specific attention should be paid to temperature control of the solution and of the polarimeter.

(d) Differences between the initial readings or between observed and corrected optical rotation calculated as either specific optical or optical rotation should not be more than one fourth of the range specified in the monograph for the substance.

(e) Polarimeter tubes should be filled in such a way as to avoid air bubbles. Particular care is necessary for semi-micro or micro tubes.

(f) For tubes with removable end-plates fitted with gaskets and caps, tighten the end plates only enough to ensure a leak-proof seal between the end-plate and the body of the tube.

(g) For substances with low rotatory power, the end plates should be loosened and tightened again after each reading, in the measurement of both the rotation and the zero point.

(h) Liquids arid solutions of solids must be clear.

Calibration: The apparatus may be checked by using a solution of previously dried sucrose and measuring the optical rotation in a 2 dm tube at 25^0 and using the concentrations indicated below :

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

Method

For solids : Weigh accurately a suitable quantity of the substance being examined to give a solution of the strength specified in the monograph, and transfer to a volumetric flask by means of *water* or other solvent if specified. If a solvent is used, reserve a portion of it for the blank determination. Unless otherwise specified, adjust the contents of the flask to 25° by suspending the flask in a constant-temperature bath. Make up to volume with the solvent at 25°C and mix well. Transfer the solution to the polarimeter tube within 30 minutes from the time of the substances was dissolved and during this time interval maintain the solution at 25°C.

Determine the zero point of the polarimeter and then make five readings of the observed rotation of the test solution at 25°C. Take an equal number of readings in the same tube with the solvent in place of the test solution. The zero correction is the average of the blank readings, and is subtracted from the average observed rotation if the two figures are of the same sign or added if they are opposite in sign, to give the corrected observed rotation.

For liquids: Unless otherwise specified, adjust the temperature of the substance being examined to 25°C transfer to a polarimeter tube and proceed as described. For solids, beginning at the words "Determine the zero point…….. ".

Calculation - Calculate the specific optical rotation using the following formula, dextro-rotation and laevo-rotation being designated by (+) and (-) respectively :

$$\text{For liquid } (\propto)^{25}_{D} = \frac{\propto}{\frac{id}{25}}$$

$$\text{For solid } (\propto)^{25}_{D} = \frac{100 \propto}{lc}$$

Where

a = corrected observed rotation, in degrees, at 25°C
D = D line of sodium light (λ=589.3 mm)
l = length of the polarimeter tube in dm.
d25/25 specific gravity of the liquid or solution at 25°C
c = concentration of the substance in per. cent w/v

Note: THE REQUIREMENTS FOR OPTICAL ROTATION AND SPECIFIC OPTICAL ROTATION IN THE PHARMACOPOEIA APPLY TO THE DRIED, ANHYDROUS OR SOL VENT FREE MATERIAL.

3.1.6 Powder fineness

The degree of coarseness or fineness of a powder is expressed by reference to the nominal mesh aperture size of the sieves for measuring the size of the powders. For practical reasons, the use of sieves, Appendix 1.1.2 for measuring powder fineness for most pharmaceutical purposes, is convenient but device other than sieves must be employed for the measurement of particles less than 100 mm in nominal size.

The following terms are used in the description of powders:

Coarse powder : A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 1.70 mm and not more than 40 per cent through a sieve with a nominal mesh aperture of 355 μm.

Moderately coarse powder: A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 710 μm and not more than 40 per cent through a sieve with a nominal mesh aperture of 250 μm.

Moderately fine powder: A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 355 μm and not more than 40 per cent through a sieve with a nominal mesh aperture of 180 μm.

Fine powder: A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 180 μm.

Very fine powder: A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 125 μm.

When the fineness of a powder is described by means of a number, it is intended that all the particles of the powder shall pass through a *sieve* of which the nominal mesh aperture, in μm, is equal to that number.

When a batch of a vegetable drug is being ground and sifted, no portion of the drug shall be rejected but it is permissible except in the case of assays, to withhold the final tailings, if an approximately equal amount of tailings from a preceding batch of the same drug has been added before grinding.

Sieves: Sieves for testing powder fineness comply with the requirements stated under sieves, Appendix 1.1.2

Method

(1) For coarse and moderately coarse powders: Place 25 to 100 g of the powder being examined upon the appropriate sieve having a close fitting receiving pan and cover. Shake the sieve in a rotary horizontal direction and vertically by tapping on a hard surface for not less than twenty minutes or until shifting is practically complete. Weigh accurately the amount remaining on the sieve and in the receiving pan.

(2) For fine and very fine powder : Proceed as described under coarse and moderately coarse powders, except that the test sample should not exceed 25 g and except that the sieve is to be shaken for not less than thirty minutes, or until shifting is practically complete.

With oily or other powders which tend to clog the openings, carefully brush the screen at interval during siftings. Break up any lumps that may form. A mechanical sieve shaker which reproduces the circular and tapping motion given to sieves in hand sifting but has a uniform mechanical action may be employed

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NOTE- AVOID PROLONGED SHAKING THAT WOULD RESULT IN INCREASING THE FINENESS OF THE POWDER DURING THE TESTING

3.1.7 Refractive Index

The refractive index (n) 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 wavelength of the light used in its measurement.

Unless otherwise prescribed, the refractive index is measured at 25° (± 0.5) with reference to the wavelength of the $_D$ line of sodium (λ. = 589.3 mm). The temperature should be carefully adjusted and maintained since the refractive index varies significantly with temperature.

The Abbe 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°C or against the reference liquids given in the following Table:

TABLE

Reference Liquid	$n_D^{20^0}$ Temperature Co-efficient <n/<t
Carbon tetrachloride	1.4603 -0.00057
Toluene	1.4969 -0.00056
a-Methylnaphthalene	1.6176 -0.00048

References 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°C is 1.3325.

3.1.8 Weight Per Milliliter and Specific Gravity

Weight Per Milliliter - The weight per milliliter of a liquid is the weight in g of ml of liquid when weighed in air at 25°C, unless otherwise specified.

Method - Select a thoroughly clean and dry pycnometer. Calibrated the pyconometer by filling it with recently boiled and cooled *water* at 25°C and weighing the contents. Assuming that the weight of 1 ml of *water* at 25°C 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°C and fill the pycnometer with it. Adjust the temperature of the filled pycnometer to 25°C, 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.

Specific Gravity - The specific gravity of a liquid is the weight of a given volume of the liquid at 25°C (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°C unless otherwise directed in the individual monograph.

APPENDIX - 4

4.1 REAGENTS AND SOLUTIONS

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, xN - Solutions of any normality xN may be prepared by diluting 60 x ml of *glacial acetic acid* to 1000 ml *water.*

Acetic Acid, Dilute - Contains approximately 6 per cent w/w of $C_2H_4O_2$. Dilute 57 ml of *glacial acetic acid* to 1000 ml with water.

Acetic Acid Glacial - CH_3 COOH=60.05.

Contains not less than 99.0 per cent w/w of $C_2H_2O_2$. About 17.5 N in strength.

Descriptions - At a temperature above its freezing point a clear colourless liquid, odour, pungent and charactrtistic; crystallises when cooled to about 10 and does not completely re melt until warmed to about 15°C.

Solubility - Miscible with water, with alcohol, with glycerin and with most fixed and volatile oils.

Boiling Range - Between 117°C and 119°C , Appendix 3.1.1

Congealing Temperature - Not lower than 14.8°C, Appendix 3.1.2

Wt. per ml - At 25 about 1.047g. Appendix 3.1.8

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 add water to make 25°C 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, Appendix 2.3.6

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 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°C and add 1 ml of freshly prepared

potassium iodine solution and titrate the liberated iodine with 0.1 N sodium thiosulphate, using starch solution as indicator. Not less than 1 ml of 0.1 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 Oxidasable 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 permaganate; the pink colour does not entirely disappear within half a minute.

Non-Volatile Mater - Leaves not more than 0.01 per cent w/w of residue when evaporated to dryness and dried to constant weight at 105°C.

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 15 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; $(CH_3)_2$ CO=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 per cent distils between 55.5°C and 57°C, Appendix 3.1.1

Acidity- 10 ml diluted with 10 ml of freshly boiled and cooled water; does not require for neutralisation more than 0.2ml of 0.1 N sodium hydroxide, using phenolphathalein solution as indicator.

Alkalinity - 10 ml diluted with 10 ml of freshly boiled and cooled water, is not alkaline to litmus solution.

Methyl Alcohol- Dilute 10ml with water to 100ml to 1 ml of the solution add 1 ml of water and 2ml of potassium permaganate and phosphoric acid solution. Allow to stand for ten minutes and add 2ml 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°C and 30°C 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 add dried to constant weight at 105°C, leaves not more than 0.01 per cent w/v of 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, burining readily volatilised even at low temperature, and boils at abut 78°C, 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.

Solubility - Miscible in all proportions with water, with chloroform and with solvent ether.

Acidity or Alkalinity - To 20ml add five drops of phenolphithalein solution; the solution remains colourless and requires not more than 2 ml of 0.1 N sodium hydroxide to produce a pink colour.

Specific Gravity - Between 0.8084 and 0.8104 at 25°C ; Appendix 3.1.8

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°C for thirty minutes; the solution remains clear.

Methanol - To one drop add one drop 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 permaganate 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°C 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°C and then add from a carefully cleaned pipette 0.1 ml of 0.1 *N Potassium permaganate*. Mix at once by inverting the stoppered cylinder and allow ato stnd at 15°C 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 *hydroxyl amine 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 stored the green colour. To 50 ml of this solution add 25ml of the *alcohol* and heat on a water bath for ten minutes in a loosely stoppered flask. Cool, transfer to a Nessler cylinder, and titrate with 0.05 *N sodium hydroxide* unitl 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.

Fuse Oil Constituents - Mix 10 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 105°C 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".

Dilute alcohols - Alcohol diluted with water to produce Dilute Alcohols. They are prepared as described below:

Alcohol **-** (90 per cent).
Dilute 947 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C, 0.863 to 0.865, Appendix - 3.1.8
Alcohol (60 per cent).
Dilute 623 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C, 0.863 to 0.865, Appendix - 3.1.8
Alcohol (50 per cent).
Dilute 623 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56° C/15.56°C , 0.913 to 0.914, Appendix - 3.1.8
Alcohol (50 per cent).
Dilute 526 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C, 0.934 to 0.935, Appendix - 3.1.8
Alcohol (25 per cent).
Dilute 263 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C , 0.9705 to 0.9713, Appendix 3.1.8
Alcohol (20 per cent).
Dilute 210 ml of alcohol to 1000 ml with water.

Alcohol, Aldehyde-free - Alcohol which complies with the following additional test :

Aldehyde - To 25ml, contained in a 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 an ion exchange resin for thirty minutes and filter.

Ammonia, xN – solution of any normality xN may be prepared by diluting 75 xml of strong *ammonia solution* to 1000 ml with water.

Ammonia - Ammonium chloride Solution, Strong - Dissolve 67.5g of *ammonium chloride* in 710 ml of strong *ammonia solution* and add sufficient water to produce 1000 ml.

Ammonia Solution, Dilute - Contain approximately 10 per cent w/w of NH .

Dilute 425 ml of strong *ammonia solution* to 1000 ml with water.

Wt. per ml - At 25°C, about 0.960 g. Appendix - 3.1.8.

Storage - Dilute Ammonia Solution should be kept in a well-closed container, in a cool place.

Ammonia Solution 2 per cent - Ammonia Solution 2 per cent is the ammonia solution strong diluted with purified water to contain 2 per cent v/v of Ammonia solution strong.

Ammonia Solution, Strong - Contains 25 per cent w/w of NH (limit , 24.5 to 25.5). About 13.5N in strength.

Description - Clear, colourless liquid; odour, strongly pungent and characteristic.

Solubility - Miscible with *water* in all proportions.

Wt. per ml - At 25°C, about 0.91g, Appendix 3.1.8.

Heavy Metals - Evaporates 5 ml to dryness on a water-bath. To the residue, add 1 ml of *dilute hydrochloric acid* and evaporate to dryness. Dissolve the residue in 2 ml of dilute *acetic acid* and add *water* to make 24 ml; the limit of heavy metals is 15 parts per million, Appendix 2.3.3.

Iron - Evaporate 40ml on a water-bath to about 10ml. The solution complies with the limit test for iron, Appendix 2.3.4.

Chloride - Evaporate 40 ml on water-bath to about 5ml. The solution complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - Evaporate 20ml on a water-bath to about 5 ml. The solution complies with the *limit test for sulphate*; Appendix 2.3.6

Tarry Matter - Dilute 5 ml with 10 ml of water, mix with 6g of powdered *citric acid* in a small flask, and rotate until dissolved; no tarry or unpleasant odour is perceptible.

Non-Volatile Residue - Evaporate 50ml to dryness in a tared porcelain dish and dry to constant weight at 105 not more than 5 mg of residue remains.

Assay - Weight accurately about 3g in flask containing 50ml of *N Sulphuric acid* and titrate the excess of acid with *N sodium hydroxide*, using *methly red solution* as indicator. Each ml of *N sulphuric acid* is equivalent to 0.01703 g of NH_3.

Storage - Preserve Strong Ammonia Solution in a well-closed container, in a cool place.

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 pH 10.00 - Ammonia Buffer Solution. Dissolve 5.4g of *ammonium chloride* in 70ml of 5 *N ammonia* and dilute with *water* to 100 ml.

Ammonium Chloride - NH_4 CI=53.49.

Description - Colourless crystals or white crystalline powder; odourless; taste, saline.

Solubility - Freely soluble in *water*, sparingly soluble in *alcohol*.

Arsenic - Not more than 4 parts per million.

Heavy Metals - Not more than 10 parts per million, determined by Method A, on 2.0g dissolved in 25ml of water, Appendix 2.3.3.

Barium - Dissolve 0.5 g in 10ml of *water* and add 1 ml of *dilute sulphuric acid*; no turbidity is produced within two hours.

Sulphate - 2g complies with the limit test for sulphates, Appendix 2.2.7.

Thiocyanate - Acidity 10ml of a 10 per cent w/v solution with *hydrochloric acid* and add a few drops of *ferric chloride solution*; no red colour is produced.

Sulphated Ash - Not more than 0.1 per cent, Appendix 2.2.11

Assay - Weigh accurately about 0.1g. dissolve in 20 ml of *water* and add a mixture of 5ml of *formaladehyde solution,* previously neutralised to *dilute phenolphtale in solution* and 20ml of *water.* After two minutes, titrate slowly with 0.1 *N sodium hydroxide*, using a further

0.2 ml of *dilute phenolphthale in solution*. Each ml. of 0.1 *N sodium hydroxide* is equivalent to 0.005349g of NH_4CI.

Storage - Store in tightly closed container.

Ammonium Chloride Solution - A 10 per cent w/v solution of *ammonium chlorid*e in water.

Ammonium Citrate Solution - Dissolve with cooling, 500g *citric acid* in a mixture of 200ml of *water* and 200ml of 13.5 *M ammonia*, filter and dilute with *water* to 1000ml.

Ammonium Nitrate - $NH_4NO_3 = 80.04$.

Description - Colourless crystals.

Solubility - Freely soluble in water.

Acidity - A solution in water is slightly acid to litmus solution.

Chloride - 3.5g complies with the limit test for chloride Appendix 2.3.2.

Sulphate - 5g complies with the limit test for sulphates, Appendix 2.3.6

Sulphated Ash - Not more than 0.05 per cent, Appendix 2.2.11

Ammonium Oxalate - $(CO_2NH_4)_2H_2O = 142.11$.

Description - Colourless crystals.

Solubility - Soluble in water.

Chloride - 2g, with an additional 20 ml of *dilute nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - Dissolve 1 g in 50ml of water, add 2.5 ml of *hydrochloric acid* and 1 ml of *barium chloride solution* and allow to stand for one hour; no turbidity or precipitate is produced.

Sulphated Ash - Not more than 0.005 per cent, Appendix - 2.2.11

Ammonium oxalate solution - A 2.5 per cent w/v solution of *ammonium oxalate* in water.

Ammonium Phosphate - $(NH_4)_2\ HPO_4$

Description - White crystals or granules.

Solubility - Very soluble in water; insoluble in alcohol.

Reaction - 1g dissolved in 100 ml of *carbon dioxide-free water* has a reaction of about pH8.0, using solution of cresol red as indicator.

Iron - 2g complies with the limit test for iron, Appendix 2.3.4.

Chloride - 2g with an additional 3.5ml of nitric acid complies with the limit test for chlorides appendix 2.3.2.

Sulphate - 2.5g with an additional 4ml of *hydrochloric acid*, complies with the limit test for sulphate, appendix 2.3.6

Ammonium Phosphate, Solution - A 10 per cent w/v solution of *ammonium phosphate* in water.

Ammonium Thiocyanate - NH_4SCN = 76.12.

Description - Colourless crystal.

Solubility - Very soluble in water, forming a clear solution, add 1g 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 0.2ml of 0.01 *N hydrochloric acid* in the same manner.

Sulphated Ash - Moisten 1g with *sulphuric acid* and ignite gently, again moisten with *sulphuric acid* and ignite; the residue weighs not more than 2.0mg.

Ammonium Thiocyanate, 0.1N - NH_4SCN=76.12; 7.612g in 1000ml. Dissolve about 8g of *ammonium thiocyanate* in 1000ml of water and standardize the solution as follows:

Pipette 30ml of standardized 0.1 *N silver nitrate* into a glass stoppered flask, dilute with 50ml of *water* than add 2ml of *nitric acid* and 2ml of *ferric ammonium sulphate solution* and titrate with the *ammonium thiocyanate solution* to the first appearance of a red brown colour. Each ml of 0.1 *N Silver nitrate* is equivalent to 0.007612g of NH_4SCN.

Ammonium thiocyanate solution - A 10.0 per cent w/v solution of *ammonium thiocyanate solution.*

Arsenic Trioxide - $As_2 O_3$ =197.82. Contains not less than 99.8 per cent of As_2O_3

Description - Heavy White Powder.

Solubility - Sparingly soluble in water; more readily soluble in water on the addition of *hydrochloric acid*, or solutions of *alkali hydroxides* or *carbonates.*

Arsenious Sulphide - Weigh acccurately 0.50g and dissolve in 10ml of *dilute ammonia solution*; forms a clear colourless solution which, when diluted with an equal volume of water and acidified with *hydrochloric acid*, does not become yellow.

Non-Volatile Matter - Leaves not mere than 0.1 per cent of residue when valatilised.

Assay - Weigh accurately about 0.2 g and dissolve in 20ml of boiling water and 5ml of *N sodium hydroxide*, cool, add 5ml of *N hydrochloric acid* and 3 g of *sodium bicarbonate*, and titrate with 0.1 *N iodine*. Each ml of 0.1 *N iodine* is equivalent to 0.004946 g of As_2O_3.

Barium Chloride - $BaC1_2$, $2H_2O$=244.27.

Description - Colourless crystals.

Solubility - Freely soluble in water.

Lead - Dissolve 1g in 40ml of recelty boiled and cooled water, add 5 ml of *lead-free acetic acid*, render alkaline with *lead-free ammonia solution* and add 2 drops of *lead-free sodium sulphide solution;* not more than a slight colour is produced.

Nitrate - Dissolve 1g in 10ml of *water,* add 1ml of *indigo carmine solution* and 10 ml of *nitrogen free sulphuric acid* and heat to boiling; the blue colour does not entirely disappear.

Barium Chloride Solution - A 10 per cent w/v solution of *barium chloride* in water.

Bismuth Oxynitrate : Bismuth Oxide Nitrate contains 70 to 74 per cent of Bi.

Description - White, micro crystalline powder.

Solubility - Practically insoluble in *water* in *alcohol*; freely soluble in *dilute nitric acid and* in *dilute hydrochloric acid.*

Assay - Weigh accurately about 1g and dissolve in a mixture of 20ml of *glycerin* and 20 ml of *water*. Add 0.1g of *sulphuric acid* and *titrate* with 0.05 *M disodium ethylene diamine tetra acetate*,using *catechol violet solution* as indicator. Each ml of 0.05 *M disodium ethylene diamine tetra acetate* is equivalent to 0.01045 g of Bi.

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 per cent of $Na_2B_4O_7 10H_2O$.

Description - Transparent, colourless crystals, or a white, crystalline powder, colourless, taste saline and alkaline, Effloreces in dry air, and, on ignition, loses all its water of crystallisation.

Solubility - Soluble in *water*, practically insoluble in *alcohol*.

Alkalinity - A solution if alkaline to *litmus solution*.

Heavy Metals - Dissolve 1g in 16ml of *water* and 6ml of *N hydrochloric acid* and add *water* to make 25ml; the limit of heavy metals is 20 parts per million, Appendix 2.3.3.

Iron - 0.5g complies with the *limit test for iron*. Appendix 2.3.4.

Chlorides - 1g complies with the *limit test of 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 75ml 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 $Na_2 B_4 O_7 . 10.H_2 O$.

Storage - Preserve Borax in well-closed container.

Boric Acid - $H_3 BO_3 = 61.83$.

Description - Colourless plates or white crystals or white crystallin powder, greasy to the touch; odourless; taste, slightly acid and bitter with a sweetish after taste.

Solubility - Soluble in *water* and in *alcohle*: freely soluble in boiling *water*, in boiling alchole and in *glycerin*.

Sulphate - Boil 3 g with 30ml of water and 1 ml of *hydrochloric acid*, cool and filter; 25ml of the filtrate complies with the *limit test for sulphates*, Appendix 2.3.6

Arsenic - Not more than 10 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 20 parts per million, determined by Method A on a solution obtained by dissolving 1.0g in 2ml of *dilute acetic acid* and sufficient *water* to produce 25ml, Appendix 2.3.3.

Assay - Weigh accurately about 2 g, and dissolve in a mixture of 50ml of *water* and 100ml of *glycerine* previously neutralized to *phenolphthalein solution*. Titrate with *N Sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *N Sodium hydroxide* is equivalent to 0.06183 g of $H_3 BO_3$.

Storage - Store in well-closed container.

Labelling - The label on the container states "Not for internal use".

Boric acid Solution - Dissolve 5 g of *boric acid* in a mixute of 20ml of *water* and 20ml of *absolute ethanol* and dilute with *absolute ethanol* to 250 ml.

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. Coool, add one drop of *liquified 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 30g of *potassium bromide* in sufficient *water* to produce 100ml.

Bromocresol Purple - 4,4 - (3H-2, Benzoxathiol -3-ylidene)bis (2,6- dibromoo-cresol) SS-dioxide; $C_{21}H_{14}Br_2$ O_4 S = 540.2.

Gives a yellow colour in moderately acid solutions, and a bluish-voilet in weakly acid and alkaline solutions. (pH range, 2.8 to 4.6).

Bromophenol purple solution - Warm 0.1g of *bromophenol purple* with 5.0 ml of ethnol (90 %) until dissolve, at 100 ml of ethnol (20%), 3.7 ml of 0.5 m *M Sodium hydroxide* and sufficient ethnol (20 per cent) to produce 250 ml.

Complies with following test:

Sensitivity - A mixture of 0.2 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.05 ml of 0.2 *M Sodium hydroxide VS* has been added in bluish violet. Not more than 0.20 ml of 0.2 *M hydrochloric acid V*S is required to change the colour to yellow.

Bromothymol Blue – 4,4' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-6 dibromothymol) SS-dioxide $C_{19}H_{19}$ Br_4 O_5 S=670.

Gives a yellow colour in moderately acid solution and a bluish violet in weakly acid and alkaline solutions (pH range, 2.8 to 4.6).

Bromothymol blue solution - Warm 0.1g of *bromothymol blue* with 3.0 ml of 0.05 *N Sodium hydroxide* and 5 ml of *alcohol* (90 per cent); after solution is effected add sufficient *alcohol* (20 per cent) to produce 250 ml.

Complies with the following tests:

Sensitivity - A mixture of 0.5 ml of the solution and 20 ml of *carbon dioxide - free water* to which 0.05 ml of 0.1 *N hydrocholoric acid* has been added is yellow. Not more than 0.10 ml of 0.1 *N Sodium hydroxide* is required to change the colour to bluish violet.

Bromothymol Blue - 6,6' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-bromothymol) SS-dioxide $C_{19}H_{19}Br_4O_5S$=624.

Gives a yellow colour in weakly acid solutions and a blue colour in weakly alkaline solutions. Neutrality is indicated by a green colour (pH range, 6.0 to 7.6).

Bromothymol blue solution - Warm 0.1g of *bromothymol blue* with 3.2 ml of 0.05 *N Sodium hydroxide* and 5 ml of *alcohol* (90 per cent); after solution is effected add sufficient *alcohol* (20 per cent) to produce 250 ml.

Complies with the following tests:

Sensitivity - A mixture of 0.3 ml of the solution and 100ml of *carbon dioxide - free water* is yellow. Not more than 0.10 ml of 0.2 *N Sodium hydroxide* is required to change the colour to blue.

Cadmium Iodide - CdI_2 = 366.23.

Description - Pearly white flakes or a crystalline powder.

Solubility - Freely soluble in water.

Iodate - Dissolve 0.2 g in 10 ml of *water*, and add 0.5g of *citric acid* and 1 ml of *starch solution* no blue colour is produced.

Cadmium Iodide Solution - A 5.0 per w/v solution of *cadmium iodide* in water.

Calcium Carbonate - $CaCO_3$ = 100.1

Analytical reagent grade of commerce.

Calcium Chlordie - $CaCI_2H_2O$=147.0
Analytical reagent grade of commerce.

Calcium Chloride Solution - A 10 per cent w/v solution of calcium chloride in water.

Calcium Hydroxide - $Ca(OH)_2$ = 74.09.
Analytical reagent grade of commercie.

Calcium Hydroxide Solution - Shake 10g of Calcium hydroxide repeatedly with 1000 ml of water and allow to stand until clear.

Calcium Sulphate - $CaSO_4, 2H_2O$ = 172.17.

Description - White powder.

Solubility - Slightly soluble in *water*.

Chloride - Boil 5 g with 50ml of *water* and filter while hot. The filtrate, after cooling, complies with the *limit test for chlorides*, Appendix 2.3.2.

Acid-Insoluble Matter - Boil 2 g with 100 ml. of *N hydrochloric acid*, and then with *water* dry, ignite, and weigh; the residue weighs not more than 2 mg.

Alkalinity - Biol 1 g with 50 ml of *water*, cool, and titrate with 0.1 *N hydrochloric acid*, using *bromothymol blue solution* as indicator; not more than 0.3 ml. of 0.1 *N hydrochloric acid* is required.

Carbonate - Boil 1 g with 10 ml of *water* and add 1 ml of *hydrochloric acid* no carbon dioxide is evolved.

Residue on Ignition - When ignited, leaves not less than 78.5 per cent and not more than 80.0 per cent residue.

Camphore - $C_{10}H_{16}O$ = 152.23.

Camphor is a ketone, obtained from *Cinnamonum camphora* (Linn.) Nees. and Eberm. (Fam. Lauraceae) and *Ocimum kilimandscharicum* Guerke (Fam. Labiatae) (Natural Camphor) or produced synthetically (Synthetic Camphor). It contains not less than 96.0 per cent of $C_{10}H_{16}O$.

Description - Colourless or white crystals, granules or crystalline masses or colourless to white translucent tough masses; odour, penetrating and characteristic; taste, pungent, aromatic, and followed by a sensation of cold. Readily pulverisable in the presence of a little *alcohol chloroform*, or *solvent ether.*

Solubility - Slightly soluble in *water*; very soluble in *alcohol*, in *chloroform* and in *solvent ether* freely soluble in fixed oils and in volatile oils.

Melting Range - 174°C to 179°C , Appendix 3.1.4

Specific Optical Rotation - + 41° to + 43°, determined in a 10 per cent w/v solution of Natural Camphor in alcohol, Appendix 3.1.5 Synthetic Camphor is the optically inactive, racemic form.

Water - A 10 per cent w/v solution in *light petroleum* (boiling range 40°C to 60°C) is clear.

Non-Volatile Matter - Leaves not more than 0.05 per cent of residue when volatilized at 105°C.

Assay - Weigh accurately about 0.2g and dissolve in 25 ml of *aldehyde-free alcohol*, in a 300ml flask. Slowly add while stirring 75 ml of *dinitrophenylhydrazine solution* and

heat on a water-bath for four hours under a reflux condenser. Remove the alcohol by distillation, allow to cool, dilute to 200ml with a 2 per cent v/v solution of *sulphuric acid* in water. Set aside for twenty-four hours, filter in a tared Gooch crucible, and wash the precipitate with successive quantities of 10 mlof cold *water* unitl the washings are neutral of *litmus paper*. Dry to constant weight at 80°C and weigh. Each g of precipitate is equivalent to 0.458g of $C_{10}H_{16}O$.

Storage - Preserve Camphor in a well-closed container in a cool place.

Canada balsam reagent - General reagent grade of commerce.

Carbon Dioxide - CO_2 = 44.01.
Commercially available carbon dioxide.

Carbon Disulphide - CS_2 = 76.14.

Description - Clear, almost colourless, flammable liquid.

Distillation Range - Not less than 95 per cent distils between 46°C 47°C Appendix 3.1.1

Wt. per ml. - At 25°C, about 1.263 g. Appendix 3.1.8

Non-Volatile Matter - When evaporated to dryness on a water bath, and dried to constant weight at 105°C, leaves not more than 0.005 per cent w/v of residue.

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°C and 77°C, Appendix 3.1.1

Wt. per ml. - At 20°C, 1.592 to 1.595g, Appendix 3.1.8.

Chloride - Free Acid - Shake 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 Chloride - 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 required 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 not more than 0.002 per cent w/v of residue.

Caustic Alkali Solution, 5 per cent

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 Power - Add 0.10 g to 550 ml of a 0.006 per cent w/v solution of *bromophenol blue* in *ethanol* (20 per cent) contained in a 200 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 CCI_3 $CH(OH)_2$ Mol Wt. 165.40.

Description - Colourless, transparent crystals, odour, pungent but no 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 1g 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 crystallin precipitate is produced and no smell of iodoform is perceptible.

Chloride : 3g 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 mixute to stand for two minutes, and then titrate with *N sulphuric acid* using *phenophthalien solution* as indicator. Titrate the neutralised liquid with 0.1 *N silver nitrate* using potassium *chromate solution* as indicator. Add two-fifteenth of the solution 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 0.1654g of C_2 H_2 $C1_3$ O_2.

Storage - Store in tightly closed, light resistant container in a cool place.

Chloral Hydrate Solution - Dissolve 20g 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 used 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.

Chlorinated Lime - Bleaching Powder.
Contains not less than 3.0 per cent of available chlorine.

Description - Dry dull white powder, odour, characteristic.
On expose to air it becomes moist and gradually decomposes.

Solubility - Slightly soluble in *water* and in *alcohol*.

Stability - Losses not more than 3.0 per cent of its available chlorine by weight when heated to 100 for two hours (The available chlorine is determined by the Assay described below).

Assay - Weigh accurately about 4 g. triturate in a mortar with successive small quantities of *water* and transfer to a 1000ml flask. Add sufficient water to produce 1000 ml and shake thoroughly. To 100 ml of this suspension add 3 g of *potassium iodide* dissolved in 100ml of *water*, acidify with 5 ml of *acetic acid* and titrate the liberated iodine with 0.1 *N sodium thiosulphate*. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.003545 g of available chlorine.

Storage - Preserve in a well-closed container.

Chlorinated Lime Solution - Mix 100g of *chlorinated lime* with 1000 ml of *water* transfer the mixture to a stoppered bottle; set aside for three hours, shaking occasionally; filter through calico.

Chlorinated Lime Solution must be recently prepared.

Chloroform - $CHC1_3$ = 119.38.

Description - Colourless, 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 1.478g. Appendix 3.1.8.

Boiling Range : A variable fraction, not exceeding 5 per cent v/v, destils below 60 and the remainder distils between 50°C to 62°C , Appendix 3.1.1

Acidity : Shake 10 ml with 20 ml of freshly boiled and cooled *water* for three minutes, and allow is separate. To a 5 ml portion of the aqueous layer add 0.1 ml of *litmus*

solution; the colour produced to 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*; not 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 the 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 vessel, previously mixed with *sulphuric acid* add 15 ml of *sulphuric acid* and four drops of *formaldehyde solution*, shake the mixture frequently during half an hour and set aside for further half an hour, the vessel 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 unpleasant odour. Add a further 10 ml of water and 0.2 ml of *silver nitrate solution*; no opalescence is produced. Foreign Chlorine Compounds : Shake 15 ml of the chloroform layer obtained in the test for foreign organic matter with 30 ml of water in a stoppered bottle for three minutes and allow separation to take place; to the aqueous layer add 0.2ml of *silver nitrate solution* and set aside in the dark for five minutes; no opalescence is produce.

Foreign Odour - Allow 10 ml of evaporate from a large piece of filter paper placed on a warm plate; no foreign colour is detectable at any stage of the evaporation.

Non volatile matter - Not more than 0.004 per cent w/v determined on 25ml by evaporation and drying at 105°C

Storage - Store in tightly-closed , glass-stoppered, light-resistant bottles.

NOTE : Care should be taken not to vaporise chloroform in the presence of a flame because of the production of harmful gases.

Chloroform Water

Chloroform	-	2.5 ml.
Purified Water	-	Sufficient to produce 1000 ml.

Dissolve the *chloroform* in the purified *water* by shaking.

Chromic-sulphuric Acid Mixture - A saturated solution of Chromium trioxide in *sulphuric acid*.

Chromium Trioxide - $Cr\ O_3$ = 99.99.
Analytical reagent grade.

Chromotropic Acid - $C_{10}H_8O_8S_2 2H_2O$=356.32.

Description - White to brownish powder. It is usually available as its sodium salt, $C_{10}H_8O_8S_2Na_2$, which is yellow to light brown in colour.

Solubility - Soluble in water; sodium salt is freely soluble in water.

Sensitivity - Dilute exactly 0.5ml of *formaldehyade solution* with water to make 1000ml. dissolve 5mg of *chromotropic acid* or its sodium salt, in a 10ml of a mixture of 9 ml of *suphuric acid* and 4 ml of water. Add 5ml of this solution to 0.2 ml of the *formaldehyde solution*, and heat for 10 minutes at 60 a violet colour is produced.

Chromotropic acid solution - Dissolve 5 mg of *chromotropic acid sodium* salt in 10 ml of a mixture of 9 ml of *sulphuric acid* and 4 ml of water.

Citric Acid - $C_6F_8O_7 7H_2$,O = 210.1

Colourless, translucent crystals, or a white, crystalline powder, slightly hygroscopic in moist air and slightly efflorescent in warm dry air; odourless, taste, strongly acid.

Analytical reagent grade.

Citric Acid, iron free - Citric acid which complies following additional test :

Dissolve 0.5 g in 40 ml of *water*, add 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.

Copper Acetate - $Cu\ (C_2H_3O_2)\ \ H_2O$ = 199.65.
Contains not less than 98.0 per cent of $C_4\ H_6\ O_4\ Cu\ H_2\ O$

Description - Blue-green crystals or powder, having a faint odour of acetic acid.
Solubility - Soluble in *water*, yielding a clear solution.

Chloride - 3g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 3g complies with the *limit test for Sulphates*. Appendix 2.3.6

Assay - Weigh accurately about 0.8 g and dissolve in 50 ml of *water*, add 2 ml of *acetic acid* and 3 g of *potassium iodide*, with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator, until only a faint blue colour remains; add 2 g of *potassium thiocyanate* and continue the titration until the blue colour disappears. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.01997 g of $C_4\ H_6\ O_4\ Cu\ H_2\ O$

Copper Acetate, Solution - 0.5 per cent w/v of copper acetate in water.

Cooper Sulphate - $Cu\ SO_4\ \ 5H_2\ O = 249.68$.

Contains not less than 98.5 per cent and not more than the equivalent to 101.0 per cent of $Cu\ SO_4\ \ 5H_2\ O$

Description - Blue triclinic prisms or a blue, cystalline powder.

Solubility - Soluble in water, very soluble in boiling *water*, almost insoluble in *alcohol*; very slowly soluble in *glycerin*.

Acidity and Clarity of Solution - 1g. 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 5g. add 25ml 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 be *acid solutions* add dilute *ammonia solution* till the precipitation is complete; filter and wash the residue after ignition weighs not more than 6 mg.

Copper Sulphate, Anhydrous - $CuSo_4 = 159.6$.
Prepared by heating copper sulphate to constant weight at about 230°C.

Copper Sulphate Solution - A 10 per cent w/v solution of *copper sulphate* in *water*.

Catechol Violet - 4,4' - (3H-2,I-Benzoxathil-3-ylidene) dipyrocatechol' SS-dioxide.

Gives a blue colour with bismuth ions in moderately acid solution. When metal ion are absent, for example, in the presence of an excess of *disodium ehylene diamine tetra acetate*, the solution if yellow.

Catechol Violet Solution - Dissolve 0.1 g of *catechol violet* in 100 ml of *water*.

Cresol Red - 4,4' – (3H-2 1-benzoxathiol-3 ylidone) di-o-cresol SS-dioxide; $C_{12}H_{18}O_5S$ =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 (pH ranges, 0.2 to 1.8 and 7.2 to 8.8).

Cresol Red Solution - Warm 50 mg 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.

Complies with the following test.

Sensitivity - A mixture of 0.1 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.15 ml of 0.02 *M Sodium hyderoxide* 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.

Dimethyl Yellow - CI 11020; 4 - Dimethyl aminoagolenzone;
$C_{14}\ H_{15}\ N_3$ = 225.3

Gives a red colour in moderately acid alcoholic solutions, and a yellow colour in weakly acid and alkaline solution (pH range, 2.8 to 4.6).

Complies with the following test :

Dimethyl Yellow Solution- A 0.2 per cent w/v solution of *dimethyl yellow* in *alcohol* (90 per cent).

Sensitivity - A solution containing 2 g of *ammonium chloride* in 25 ml of *carbon dioxide-free water* to which is added 0.1 ml of the *dimethyl yellow solution*, is yellow, Not more than 0.10 ml of 0.1 *N hydrochloric acid* is required to change the colour to red.

Dinitrophenyl Hydrazine - 2,4 - Dinitrophenyl hydrazine; $(NO_2)_2\ C_6\ H_3$, NH NH_2 = 198.14.

Description - Orange-red crystals or a crystalline powder.

Solubility - Practicaly insoluble in *water* slightly soluble in *alcohol*.

Clafity and Colour or Solution - 0.5 g yields a clear yellow solution on heating with a mixture of 25 ml of water and 25 ml of *hydrochloric acid*.

Melting Range - 197°C to 200°C , with decomposition Appendix 3.1.4.

Sulphated Ash - Not more than 0.5 per cent, Appendix 2.3.6

Dinitrophenyl Hydrazine Solution - Dissolve 1.5 gm of *dinitrophenyl hydrazine* in 20 ml of *sulphuric acid* (50 per cent v/v/). Dilute to 100 ml with *water* and filter.

Dinitrophenyl hydrazine solution must be freshly prepared.

Diphenyl Benzidine - ($C_6\ H_5$, NH. $C_6\ H_4$) = 336.42.

Description - White of faintly Grey coloured, crystalline powder.

Melting Range - 246°C to 250°C . Appendix 3.1.4.

Nitrate - Dissolve 8 mg in a cooled mixture of 45 ml of *nitrogen free sulphuric acid* and 5 ml of *water*, the solution is colourless or not more than very pale blue.

Sulphated Ash- Not more than 0.1 per cent, Appendix 2.3.6

Diphenly Carbazide - 1,5 - Diphenyl Carbazide : C_6 H_5 NH. $NH)_2$ CO = 242.27.

Description - White crystalline powder which gradually acquires a pink tint on exposure to air.

Solubility - Practically insoluble in water; soluble in alcohol.

Diphenyl Carbazine Solution - A 0.2 per cent w/v solution of *diphenyl Carbazide* in a mixture of 10 ml of *glacial acetic acid* and 99 ml of *alcohol* (90 per cent).

Diphenyl Thiocarbazone - Dithizone : 1.5 - Diphenylthio Carbazone; C_6 H_5 N NCS, NH NH C_6 H_5 - 256.32.

Description - Almost black powder.

Solubility - Practically insoluble in *water*; soluble in *chloroform* in *carbon tetrachloride* and in other organic solvents, yielding solutions of an intense green colour.

Lead - Shake 5 ml of 0.1 per cent w/v solution in *chloroform* with a mixture of 5 ml of water, 2 ml of *lead free potassium cyanide solution*, and 5 ml of *strong ammonia solution*; the chloroform layer may remain yellow but has no red tint.

Sulphated Ash - Not more than 0.5 per cent. Appendix 2.3.6

Disodium Ethylene Diamine Tetra Acetate - (Disodium Acetate) C_{10} H_{14} N_2 Na_2 O_8, $2H_2$ O = 372.2.

Analytical reagent grade.

Dragendorff 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.*

Eosin - CI 45380; Acid Red 87; Tetrabromo flurescein Disodium Salt; C_{20} H_6 O_5 Br_4 Na_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 - Dissolves 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 per cent, calculate with reference to the substance dried at 110°C for two hours. Appendix 2.3.6

Eosin Solution - A 0.5 per cent w/v solution of *eosin* in *water*.

Eriochrome Black T - CI 14645 ; Mordant Black 11; Sodium 2 (1-hydroxy-2-naphthylazo) 5=nitro-2-naphtol-4-sulphonate; C_{20} H_{12} N_3 NaO_7 S = 461.38.

Brownish black powder having a faint, metallic sheen soluble in alcohol, in methyl alcohol and in hot water.

Ether, Diethyl Ether - $(C_2 H_5)_2 O = 74.12$.

Analytical reagent grade.

A volatile, highly flammable, colourless liquid, boilding point, about 34 ; weight per ml about 0.71 g.

Warning - It is dangerous to distil or evaporate ether to dryness unless precautions have been taken to remove peroxides.

Ethyl Acetate - $C_2 H_2 OH = 46.07$.

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 . 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 $C_2 H_5 OH$.

Identification - Acidity of Alkalinity : Clarity of solution; Methanol: Foreign organic substances; Isopropyl alcohol and butyl alcohol; Aledehydes and ketones; Fuse Oil constitutents; Non-volatile matter; complies with the requirements described under Alcohol.

Specific Gravity - Between 0.7871 and 0.7902, at 25°C , Appendix 3.1.8.

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".

Ferric Ammonium Sulphate - Ferric Alum, $Fe(NH_4)(SO_4)_2 12H_2 O = 482.18$.

Contains not less than 99 per cent and not more than the equivalent of 101 per cent of $Fe(NH_4)(SO_4)_7 12 H_2O$.

Description - Pale violet crystals, or a nearly colourless crystalline powder.

Solubility - Soluble in *water*, yielding a clear yellow or brown solution.

Ferrous Ion - Dissolve 1 g in 50 ml of *water*, add 1 ml of *dilute hydrochloric acid* and ml of *potassium ferricyanide solution*; no green or blue colour is produced.

ASSAY - Weigh accurately about 2g, dissolve in 10 ml of *dilute hydrochloric acid* and dilute to 50 ml with water, add 3 g of *potassium iodide*, allow to stand for ten minutes titrate the liberated iodine with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of titration Each ml of 0.1 *N Sodium thiosulphate* is equivalent to 0.04822 g of Fe (NH_4) $(SO_4)_2$ 12 H_2 O.

Ferric Ammonium Sulphate - 0.1 N Fe $NH_4(SO_4)_2$ 12 H_2O = 482.18; 48.22g in 1000ml.

Dissolve 50g of *ferric-ammonium sulphate* in a mixture of 300ml of *water* and 6ml of *sulphuric acid.* Dilute with water to 1000ml , and mix. Standardize the solution as follows:-

Measure accurately about 30 ml of the solution into a glass-stoppered flask, add 5ml of *hydrochloric acid,* mix, and add a solution of 3g of *potassium iodide* in 10 ml of water. Insert the stopper, allow to stand for ten minutes in the dark, then titrate the liberated *iodine* with standardized 0.1 *N Sodium thiosulphate*, adding 3 ml of *starch solution* as the end-point is approached. Perform a blank determination and make any necessary correction. Each ml of 0.1 *N Sodium thiosulphate* is equivalent to 0.04822 g of Fe (NH_4) $(SO_4)_2$ 12 H_2 O.

NOTE - Store 0.1 N Ferric Ammonium Sulphate in tightly-closed, light resistant containers.

Ferric Chloride - Anhydrous Ferric Chloride; Ferric Chloride ; $FeC1_3$ = 162.22

Description - Greenish-black crystals or a crystalline powder, free from the orange colour of the hydrated salt, which is readily acquired by exposure to atmospheric moisture.

Solubility - Soluble in water, yielding an orange coloured opalescent solution.

Ferrous Salts - Dissolve 2 g in 100 ml of water, add 2 ml of *phosphoric acid* and titrate with 0.1 *N potassium permanganate* until a pink colour is produced, no more than 0.1 ml is required.

Free Chloride - Dissolve 5 g in 10 ml of *water* and boil the solution; no blue colour is produced on a starch iodide paper exposed to the vapours.

Ferric Chlordie Solution - Contains not less than 14.25 per cent and not more than 15.75 per cent w/v of $FeC1_3$.

Description - Clear, Yellowish-brown liquid.

Assay - Dilute 2 ml with 20 ml of *water*, add 1 ml of *sulphuric acid* and 0.1 *N potassium permanganate* drop by drop unitl a pink colour persists for five seconds. Add 15 ml of *hydrochloric acid* and 2 g of *potassium iodide*, allow to stand for three minutes, and titrate with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of titration. Each ml of 01. *N Sodium thiosulphate* is equivalent to 0.01622g of $FeC1_3$.

Ferrous Sulphate - $FeSO_4\ 7H_2O = 278.0$

Description - Transparent, green crystals, or a pale bluish-green, crystalline powder; odourless; taste, metallic and astringent, Eflorescent in dry air. On exposure to moist air, the crystals rapidly oxidise and become coated with brownish yellow basic ferrous sulphate.

Solubility - Freely soluble in water, very soluble in boiling water, practically insoluble in alcohol.

pH - Between 3 and 4, determined in a 5 per cent w/v solution, Appendix 3.1.3.

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Copper, Zinc And Lead - Dissolve 8 g in 40 ml of *hydrochloric acid*. Add 10 ml of *nitric acid* and 15 ml of *water*, boil gently for five minutes and cool. Shake with four quantities, each of 30 ml of *solvent ether* and discard the ether. Heat the acid solution on a water-bath to remove dissolved ether, cool and add sufficient *water* to produce 100 ml (solution A).

Copper - To 10 ml of solution A obtained in the test for Copper, Zinc and Lead, add1 g of *citric acid*, make alkaline with *dilute ammonia solution* and add 25ml of *water* and 5 ml of *sodium diethyldithiocarbamate*.

Ferrous Sulphate Solution - A 2 per cent w/v solution of *ferrous sulphate* in freshly boiled and cooled water.

Ferrous Sulphate Solution must be freshly prepared.

Ferrous Sulphate Solution, Acid - A 0.45 per cent w/v solution of *ferrous sulphate* in freshly boiled and cooled *water* containing 0.5 ml of *hydrochloric acid.*

Formaldehyde Solution - Formalin ; HCHO = 30.03.

Formalidehyde Solution is a solution of *formaldehyde* in *water* with *methyl alcohol* added to prevent plymerisation. It contains not less than 34.0 per cent w/w/ and not more than 38 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 solution* as indicator; not more than 5 ml of 1 *N sodium hydroxide* is required.

Wt. per ml. - At 20°C, 1.079 g. Appendix 3.1.8.

Assay - Weigh accurately about 3 g and add to a mixture of 25 ml of *hydrogen peroxide solution* and 50 ml of *N sodium hydroxide*, warm on a water bath until effervescence ceases and titrate the exces of alkali with *N sulphuric acid* using *phenolphthalein solution* as indicator. Repat 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_2 O.

Storage - Preserve Formaldehyde Solution in a well-closed container preferably at a temperature not below 15°C.

Formaldehyde Solution, Dilute.

Dilute 34 ml of *formaldehyde solution* with sufficient water to produce 100 ml.

Glycerin - C_3 H_8 O_3 =82.09.

Description - Clear, colourless liquid of syrupy consistancy; 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 phenolphthalin solution*; not more than 0.2ml of 0.1 *N sodium hydroxide* is required to produce a pink colour.

Wt. per ml. - Between 1.252 g and 1.257g, Appendix-3.1.8, corresponding to between 98 per cent and 100 per cent w/w of C_3 H_8 O_3 .

Refractive Index - Between 1.470 and 1.474 determined at 20°C. Appendix 3.1.7

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Copper - To 10 ml add 30 ml of *water*, add 1 ml of *dilute hydrochloric acid,* add 10 ml of *hydrogen sulphide solution;* no colour is produced.

Iron - 10g 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 4g in 2 ml of 0.1 *N hydrochloric acid* and sufficient *water* to produce 25ml. 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 not 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 1.6ml of 0.1 *N potassium permaganate* 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 *coppr 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 g with 50 ml of freshly boiled *water* and 50.0 ml of 0.5 *N sodium hydroxide*, boil the mixute for five minutes. Cool, add a few drops of *phenolphthalein solution* and *nitrate* 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 2.2.11

Storage - Store in tightly-closed containers.

Glycerin Solution - Dilute 33 ml of *glycerin* to 100 ml with water and add a samll piece of camphor or liquid phenol.

Hexamine $(CH_2)_6\ N_4$ = 140.2
Analytical reagent grade.

Hydrazine Hydrate - $NH_2\ NH_2\ H_2\ O$ =50.06.
Analytical reagent grade.
A colourless liquid with an ammonical odour; weight per ml. about 1.03 g.

Hydrochloric Acid - HC1=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 *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 2.3.6

Free Chlorine - Dilute 5 ml with 10 ml of freshly boiled and cooled *water*, add 1 ml of *potassium 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 percent, Appendix 2.2.11

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 0.0364 g of HCI.

Storage - Store in glass- stoppered containers at a temperature not exceeding 30^0

Hydrochloric Acid, x N - Solution of nay normality x N may be prepared by diluting 84Xml of *hydrochloric acid* to 1000 ml with *water*.

Hydrochloric Acid - (1 percent w/v).

Dilute 1 g of *hydrochloric acid* to 100 ml with *water*.

Dilute Hydrochloric Acid

Description - Colourless liquid.

Arsenic Heavy Metals - *Bromide 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: HCI=36.46
36.46 g in 1000 ml

Dilute 85 ml of *hydrochloric acid* with *water* to 1000 ml and standardize the solution as follows:

Weigh accurately about 1.5 g of *anhydrous sodium carbonate* P.S., previous 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* and *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 percent 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 percent w/v of H_2O_2 ; weigh per ml. about 1.02 g.

Hydrogen Sulphide- H_2S=34.08

Use laboratory cylindergrade, or prepared the gas by action of *hydrochloric acid*, diluted with an equal volume of *water*, on iron sulphide, the resulting gas is washed by passing it through *water*.

A colourless, poisonous gas, which a characteristic unpleasant odour.

Hydrogen Sulphide Solution – A recently prepared, saturated solution of hydrogen sulphide in water at 20^0.

Hydrogen Sulphide solution contains about 0.45 percent w/v of H_2s.

Hydroxylamine Hydrochloride; Hydroxylamonium Chloride:- $NH_2.OH,HC1$ = 69.49.

Contains not less than 97.0 percent w/w of $NH_2.OH,HC1$

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 a 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 percent, Appendix 2.2.11

Assay – Weigh accurately about 0.1 g and dissolve in 20 ml of *water*, add 5 g of *ferric ammonium sulphate* dissolved 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 $NH_2OH.HC1$.

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.

* **Indigo Carmine** C1 730 15; $C_{16}H_8N_2Na_2O_8S_2$=466.4

Analytical regent grade.

A deep blue powder, or blur granules with a coppery lustre.

Indigo Carmine Solution – To a mixture of 10 ml of *hydrochloric acid* and 990 ml of a 20 percent w/v solution of *sulphuric acid* in *water*, add sufficient indigo carmine to produce a solution which complies with the following test.

Add 10 ml to a solution 1.0 mg of *potassium nitrate* in 10 ml of *water*, add rapidly, 20 ml of *sulphuric acid* and heat to boiling; the blue colour is just discharged in one minute.

***Indian ink –** General purpose grade:
Iodine : I_2 = 253.8

Description - Heavy, bluish-black, brittle, rhombic prisms or plates with a metallic lustre; odour characteristic; volatile at ordinary temperatures.

SOLUBILITY - Very slightly soluble in *water*; soluble in *alcohol* freely soluble in *carbon disulphide* and *in chloroform in solvent ether*; *in carbon tetrachloride* and in concentrated aquous solutions of iodides.

Chloride Bromide - Triturate 3.5 g thoroughly with 35 ml of *water*, filter and decolorise the filtrate by the addition of a little *zinc powder*. To 25 ml of the filtrate so obtained, add 5 ml of *dilute ammonia solution*, and then 5 ml of *silver nitrate solution* added gradually, filter; dilute the filtrate to 50 ml, and acidify gradually with 4 ml of *nitric acid*; the opalescence in the *limit test for chloride*, Appendix 2.3.2.

Cyanides - To 5 ml of the filtrate obtained in the test for *Chloride and bromide* add a few drops of *ferrous sulphate solution* and 1 ml of *sodium hydroxide solution*, warm gently and acidify with *hydrochloric acid*, no blue or green colour is produced.

Non-Volatile Matter - Leaves not more than 0.1 percent as residue when volatilized on a water-bath.

Assay - Weigh accurately about 0.5 g and dissolve in a solution of 1 g of *potassium iodide* in 5 ml of *water*. Dilute to 250 ml with *water*, add 1 ml of *dilute acetic acid*, and titrate with 0.1N *sodium thiosulphate*, using starch solution as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.01269 g of 1.

Storage - Store in glass-stoppered bottles or in glass or earthern-ware containers with well-waxed bungs.

Iodine, 0.IN: I=126.90; 12.69 g in 1000 ml

Dissolve about 14 g of *iodine* in a solution of 36 g of *potassium iodide* in 100 ml of water, add three drops of *hydrochloric acid*. dilute with water to 100 ml and standardize the solution as follows.

Weigh accurately about 0.15 g of *arsenic trioxide* P.S., previously dried at 1050 for one hour, and dissolve in 20 ml of *N sodium hydroxide* by warming, if necessary. Dilute with 40 ml of *water*, add two drops of *methyl orange solution* and follow with *dilute hydrochloric acid* until the yellow colour is changed to pink. Then add 2 g of *sodium bicarbonate*, dilute with 50 ml of water, and add 3 ml of *starch solution*, slowly add the *iodine solution* from a burette until a permanent blue colour is produced. Each 0.004946 g of *arsenic trioxide* is equivalent to 1 ml of 0.1 N iodine.

Iodine solution- Dissolve 2.0 g of *iodine* and 3 g of *potassium iodide* in *water* to produce 100 ml.

Kieselguhr- A natural diatomaceous earth, purified by heating with dilute hydrochloric acid, washing with water and drying.

Lactic Acid - $CH_3CHOH.COOH$-90.08
Analytical reagent grade of commerce

Lactophenol – Dissolve 20 g *phenol* in a mixture of 20 g of *lactic acid*, 40 g of *glycerol,* and 20 ml of *water.*

Lead Acctate - Sugar of lead; $(CH_3CO_2)_2Pb$, $3H_2O$=379.33

Contains not less than 99.5 percent and not more than the equivalent of 104.5 percent of $C_4H_6O_4Pb,3H_20$.

Description - Small, white, transparent, monoclinic prisms, or heavy, crystalline bases; odour, acetous, taste, sweet and astringent. Efflorescent in warm air. Becomes basic when heated.

Solubility - Freely soluble in *water*, and in *glycerin*; sparingly soluble in *alcohol.*

Water Insoluble Matter - Dissolve 1 g in 10 ml of recently boiled and cooled *water* solution is produced which is at most faintly opalescent and becomes clear on the addition of one drop of *acetic acid*.

Chloride - 1 g complies with the *limit test for chlorides*. Appendix 2.3.2.

Copper, Iron, Silver and Zinc – Dissolve 0.5 g in 10 ml of *water*, add 2 ml of *dilute sulphuric acid*, allow to stand for thirty minutes, and filter, to the filtrate add an excess of potassium ferrocyanide solution no precipitate or colour is produced.

Assay - Weigh accurately about 0.8 g and dissolve in a mixture of 100 ml of *water* and 2 ml of *acetic acid*, add 5 g of hexamine, and titrate with 0.05 *M disodium ethylenediaminetertraacetate,* using 0.2 ml of *xylenol orange solution* as indicator, until the solution becomes pale bright yellow. Each ml of 0.05 *M disodium ethylenediaminetertraacetate* is equivalent to 0.01897 g of $C_4H_6O_4Pb,3H_20$.

Storage - Preserve lead acetate in a well closed container.

Lead acetate solution- A 10 percent w/v solution of *lead acetate in carbon dioxide-free water.*

Lead nitrate: $Pb(NO_3)_2$=331.21

Contains not less than 99 percent of $Pb(NO_3)_2$

Description- Colourless or white crystals, or a white crystalline powder.

Solubility - Soluble in *water*, forming a clear, colourless solution.

Assay - Weigh accurately about 0.3 g and dissolve in 150 ml of *water*, add 5 ml of *dilute acetic acid*, heat to boiling, add a slight excess of *potassium chromate* solution, and boil gently until the precipitate becomes granular; collect the precipitate in a Gooch crucible, wash it with hot *water*, and dry to constant weight at 120^0 each g of residue is equivalent to 1.025 g of $Pb(NO_3)_2$.

Lead solution standard - See limit test for heavy metals. Appendix, 2.3.3.

Liquid paraffin- General reagent grade.

Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility -Practically insoluble in water, and in alcohol, soluble in chloroform, in solvent either and in volatile oils.

Wt. per ml. - At 25^0C, 0.860 to 0.904 g Appendix 3.1.8

Litmus- Fragments of blue pigment prepared from various species of *Rocella lacanora* or other lichens. It has a characteristic odour.

Partly soluble in water and in alcohol. Gives a red colour with acids and a blue colour with alkalies ($_{P}$H range, 5.0 to 8.0).

Litmus solution - Boil 25 g of coarsely powered litmus with 100 ml of *alcohol* (90 percent) under a reflux condenser for one hour, and pour away the clear liquid; repeat this operation using two successive quantities, each of 75 ml, of *alcohol* (90 percent). Digest the extracted litmus with 250 ml of water.

Litmus paper, blue - Boil 10 parts of coarsely powdered litmus under reflux for one hour with 100 parts of *alcohol*, decant the *alcohol* and discard. Add to the residue a mixture of 45 parts of alcohol and 55 parts of water. After two days decant the clear liquid. Impregnate the strips of filter paper with the extract and allow to dry the paper complies with the following test.

Sensitivity - Immerse a strip measuring 10 mmX60 mm in 100 ml of a mixture of 10 ml of 0.02 *N hydrochloric acid* and 90 ml of *water*. On shaking the paper turns red within forty five seconds.

Liquid paraffin- General reagent grade.

Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility - Practically insoluble in *water*, and in *alcohol*, soluble in *chloroform*, in *solvent ether* and in volatile oils.

Wt. per ml - At 25^{0}, 0.860 to 0.904 g Appendix 3.1.8

Litmus paper, red - To the extract obtained in the preparation of blue litmus paper add 2 *N hydrochloric acid* drop-wise until the blue colour becomes red. Impregnate strips of filter paper with the solution and allow to dry.

The paper complies with the following test:

Sensitivity- Immerse a strip measuring 10 mmX60mm in 100 ml of 0.002 *N Sodium hydroxide*. On shaking the paper turns blue within forty-five minutes.

Magenta Basic: CI 42510: Funchsin; Rosaniline hydro-chloride; $[(H_2NC_6H_4)_2C{:}C_6H_3(CH_3){:}\ NH_2{+}]CI$=337.85

The hydrochloride of rosaniline of such a purity that when used in the preparation of Decolourised solution of Magenta, a nearly colourless solution is obtained.

Description - Dark red powder, or green crystals with a metallic lustre.

Solubility - Soluble in *water*, giving a deep reddish-purple solution.

Sulphated Ash - Not more than 5 percent, Appendix 2.3.6

Magenta solution, Decolorized- Dissolve 1 g of *basic magnenta* in 600 ml of *water* and cool in an ice-bath; add 20 g of *sodium sulphite* dissolved in 100 ml of *water*; cool in an ice-bath and add, slowly with constant stirring, 10 ml of *hydrochloric acid*; dilute with *water* to 1000 ml.

If the resulting solution of turbid, it should be filtered and if brown in colour, it should be shaken with sufficient *decolourising charcoal* (0.2 to 0.3 g) to render it colourless and then filtered immediately. Occasionally it is necessary to add 2 to 3 ml of *hydrochloric acid*, followed by shaking, to remove the little residual pink colour. The solution resulting from any of the foregoing modifications should be slowed to stand over-night before use.

Decolourised Magenta Solution should be protected from light.

Magnesium Carbonate - Light hydrated basic grade of commerce containing 42 to 45 percent of MgO and complying with the following test.

Ammonia - Dissolve 0.50 g in 4 ml of 2 *M hydrochloric acid*, boil to remove *carbon dioxide,* and dilute with *water* to 95 ml. Add 5 ml of 5 *M Sodium hydroxide* and allow to stand for one hour. Dilute 40 ml of the clear liquid to 50 ml with water and add 2 ml of *alkaline potassium-mercuric iodide solution.* Any yellow colour produced is not deeper than that produced by adding 2 ml of *alkaline potassium mercuric iodide solution* to a mixture of 44 ml of water, 2 ml of *ammonium chloride solution*, 2 ml of 2 *M hydrochloric acid*, and 2 ml of 5 *M sodium hydroxide*.

Magnesium Sulphate: $MgSO_4$. $7H_2O$-246.47

Description - Colourless, crystals, usually needle-like, odourless, taste, cool, saline and bitter. Efflorescence in warm dry air.

Solubility - Freely soluble in *water*; sparingly soluble in *alcohol*. Dissolves slowly in *glycerin*.

Acidity Or Alkalinity - 1 g dissolved in 10 ml of water is neutral to *litmus solution.*

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Iron - 2 g dissolved in 20 ml of *water* complies with the *limit test for iron*, Appendix 2.3.4.

Heavy Metals - Not more than 10 parts per million, determined by method A on a solution prepared by dissolving 2 g in 10 ml of *water*, 2 ml of *dilute acetic acid* and sufficient water to make 25 ml. Appendix 2.3.3.

Zinc - Dissolve 2 g in 20 ml of *water* and acidity with 1 ml of *acetic acid.* No turbidity is produced immediately on the addition of few drops of *potassium ferrocyanide solution.*

Chloride - 1 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Loss on Ignition : Between 48 percent and 52 percent determined on 1 g by drying in an oven at 105^0 for two hours and igniting to constant weight at 400^0.

Assay - Weigh accurately about 0.3 g and dissolve in 50 ml of *water*. Add 10 ml of *strong ammonia-ammonium chloride solution*, and titrate with 0.05 *M disodium ethylenediaminetertraacetate* using 0.1 g of *mordant black II mixture as indicator*, until the pink colour is discharged from the blue. Each ml of 0.05 *M disodium ethylenediaminetertraacetate* is equivalent to 0.00602 g of $MgSO_4$.

Storage - Store in well-closed container.

Magnesum Sulphate - $MgSO_4$. $7H_2O$ -246.8

Analytical reagent grade of commerce.

Magnesium Sulphate, Dried, $MgSO_4$aq

Dried, general reagent grade of commerce.

Magnesium sulphate solution, ammonical - Dissolve 20 g of *magnesium sulphate* and 20 g of *ammonium chloride* in 80 ml of *water,* and add 42 ml of 5 *M ammonia*. Allow to stand for a few days in a well-closed container; decant and filter.

Mercuric chloride: $HgCI_2$=271.50

Contains not less than 99.5 percent of $HgCI_2$;

Description - Heavy, colourless are white, crystalline masses, or a white crystalline a powder.

Solubility - Soluble in *water*; freely soluble in *alcohol*.

Non-Volatile Matter - When volatilized, leaves not more than 0.1 percent 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 $HgCI_2$.

Mercuric chloride, 0.02 M

Dissolve 54.30 g of *mercuric chloride* in sufficient *water* to produce 1000 ml.

Mercuric chloride solution - A 5 percent w/v solution of *mercuric chloride* in *water*.

Mercuric oxide, Yellow: HgO = 216.59.

Contains not less than 99 percent of HgO, calculated with reference to the substance dried at 105^0 for one hour.

Description - Orange-yellow, heavy, amorphous powder; odourless, stable in air but becomes discoloured on exposure to light.

Solubility - Practically insoluble in *water* and in *alcohol*; freely soluble in dilute *hydrochloric acid* and in *dilute nitric acid*, forming colourless solutions.

Acidity for Alkalinity - Shake 1 g with 5 ml of *water* and allow to settle; the supernatant liquid is neutral to *litmus solution*.

Mercurous Salts - A solution of 0.5 g in 25 ml of *dilute hydrochloric acid* is not more than slightly turbid.

Chloride - To 0.2 g add 1g of *zinc powder* and 10 ml of *water*. Shake occasionally during ten minutes and filter; the solution complies with the *limit test for chlorides*; Appendix 2.3.2.

Sulphated Ash - When moistened with *sulphuric acid* in a silica dish and heated strongly to constant weight, leaves not more than 0.5 percent of residue.

Assay - Weigh accurately about 0.4 g dissolve in 5 ml of *nitric acid* and 10 ml of *water* and dilute with *water* to 150 ml. Titrate with 0.1 *N ammonium thiocyanate*, using *ferric ammonium sulphate solution* as indicator. Carry out the titration at a temperature not above 20^0. Each ml of 0.1 *N ammonium thiocyante* is equivalent to 0.01083 g of HgO.

Storage - Preserve yellow mercuric oxide in well-closed container, protected from light.

Mercuric Potassium Iodide

See Potassio-Mercuric iodide solution.

Mercuric Sulphate - Mercury (II) Sulphate $HgSO_4$=296.68

Contains not less than 99 percent of $HgSO_4$.

Description - A white; crystalline powder, Hydrolysis in water.

Solubility - Soluble in *dilute sulphuric acid.*

Chloride - Dissolve 2 g in a mixture of *dilute sulphuric acid* and 10 ml of *water*. Add 2 g of *zinc powder*, shake frequently for five minutes and filter. The filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Nitrate - Dissolve 0.40 g in a mixture of 9 ml of *water* and 1 ml of *dilute sulphuric acid*, add 1 ml of indigo carmine solution and 10 ml of *nitrogen free sulphuric acid* and heat to boiling, the blue colour is not entirely discharged.

Assay- Dissolve 0.6 g in a mixture of 10 ml of *dilute nitric acid* and 40 ml of *water*. Titrate with 0.1 *N ammonium thiocyanate*, using *ferric ammonium sulphate solution* as indicate. Each ml of 0.1 *N ammonium thiocyanate* is equivalent to 0.01483 g of $HgSO_4$.

Mercury Sulphate Solution - Mix 5 g of *yellow mercuric oxide* with 40 ml of *water*, and while stirring add 20 ml of *sulphuric acid*, and 40 ml of *water*, and stir until completely dissolved.

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 25^0C, not more than 0.791, Appendix 3.1.8.

Distillation Range - Not less than 95 percent distils between 64.5^0C and 65.5^0C, Appendix 3.1.1.

Refractive Index - At 20^0C, 1.328 to 1.329, Appendix 3.1.7

Acetone - Place I ml in a *Nessler Cylinder*, add 19 ml of *water*, 2 ml of a 1 percent w/v solution of 2-*nitrobenzaldehyde* in *alcohol* (50 percent), 1 ml of 30 percent w/v solution 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 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 require.

Non-Volatile Matter - When evaporated on a water-bath and dried to constant weight at 105^0, leaves not more than 0.005 percent w/v of residue.

Mythyl alcohol, dehydrated - Methyl alcohol which complies with the following additional requirements. *Water* -Not more than 0.1 percent w/w.

Methylene Blue- $C_{16}H_{18}ClN_3S$, $3H_2O$. Tetramethylthionine chloride.

A dark green or bronze crystalline powder, freely soluble in water, soluble in alcohol.

Loss on drying: Not less than 18 percent and not more than 22 percent, determined by drying in an oven at 100^0 C to 105^0C.

Methylene Blue Solution - Dissolve 0.18 g of *methylene blue* in 100 ml of *water*. To 75 ml of this solution, add 5 ml of 0.1 *N sodium hydroxide* and 20 ml of *water*.

Methyl Orange - Sodium-p-dimethylamineazobenzene sulphate, $C_{14}H_{14}O_3N_3$ Sna.

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 of freshly boiled and cooled water is yellow. Not more than 0.1 of 0.1 N hydrochloric acid is required to change the colour to red.

Colour change: pH 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: pH 4.4(red) to pH 6.0 (yellow).

Molish's Reagent - Prepared two solutions in separate bottles, with ground glass stoppers:

A. Dissolve 2 g of ∞–naphthol in 95 percent *alcohol* and made upto 10 ml with alcohol (∞-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.

Mordant Black II - See Eriochrome black T.

Mordant Balck II Mixture - *Mordant black mixture.*

A mixture of 0.2 part of mordant black 11 with 100 parts of sodium chloride. Mordant Black II Mixture should be recently prepared.

∞-**Naphthol**: I-Naphthol; $C_{10}H_7OH$=144.17

Description - Colourless or white crystals or a white, crystalline powder; odour, characteristic.

Solubility - Freely soluble in alcohol yielding not more than slightly opalescent, colourless or almost colourless solution, with no pink tint.

Melting Range - 90^0C to 96^0 C, Appendix 3.1.4.

Sulphated Ash - Not more than 0.05 percent, Appendix 2.2.11
∞-**Nephthol Solution -** I-Naphthol solution.

Dissolve 1 g of ∞-naphthol in a solution of 6 g of *sodium hydroxide* and 16 g of *anhydrous sodium carbonate* in 100 ml of water.

∞- naphthnol solution must be prepared immediately before use.

I-Naphthylamine - $C_{10}H_9N$=143.2-Analytical reagent grade.
Almost colourless crystals, or a white crystalline powder; melting point, about 50^0.

Naphthylamine-Sulphanilic Acid Reagent - Immediately before use mix equal volumes of solutions A and B prepared as follows.

Solution A - Dissolve 0.5 g of *sulphanilic acid* in 30 ml of 6 M *acetic acid* and dilute to 150 ml with water.
Solution B - Dissolve 0.15 g of *I-naphthylamine* in 30 ml of 6M *acetic acid* and dilute to 150 ml with water.

Nitric Acid - Contains 70 percent w/w of HNO_3 (limits, 69 to 71). About 16 N in strength.

Description - Clear, colourless, fuming liquid.

Wt. per ml. - At 20^0 C, 1.41 to 1.42 g, Appendix 3.1.8.

Copper and Zinc - Dilute I 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 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 neutralized with *dilute ammonia solution*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 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 2.3.6

Sulphated Ash - Not more than 0.01 percent w/w, Appendix 2.2.11

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 of HNO_3.

Nitric Acid, XN - 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 percent w/w of HNO_3. Dilute 106 ml of *nitric acid* to 1000 ml with *water*.

2-Nitrobenzaldehyde - 0-Nitrobenzaldehyde $NO_2C_6H_4CHO$=151.12

Description - Yellow needles, odour, resembling that of benzaldehyde.

Solubility - Soluble in *alcohol.*

Melting range - 40^0Cto 45^0C Appendix 3.1.4.

Sulphated Ash - Not more than 0.1 percent, Appendix 2.2.11

Oxalic Acid - $(CO_2H)_2$, $2H_2O$=126.07.

Contains not less than 99.5 percent of $C_2H_2O_4$, $2H_2O$, as determined by both parts of the Assay.

Description - Colourless crystals.

Solubility - Soluble in *water* and in *alcohol.*

Chloride - To 1 g dissolved in 20 ml of *water* add 5 ml of *dilute nitric acid* and 1drop of *silver nitrate solution*; no turbidity is produced.

Sulphated Ash - Not more than 0.05 percent, Appendix 2.2.11

Assay - (A) Weigh accurately about 3 g and dissolve in 50 ml of *carbon dioxide* free *water* and titrate with *N sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *N sodium hydroxide* is equivalent ot 0.06304 g of $C_2H_2O_4$, $2H_2O$.

(B) Weigh accurately about 3 g dissolve in *water*, and add sufficient *water* to produce 250 ml. To 25 ml of this solution add 5 ml of *sulphuric acid* previously diluted with a little *water*, and titrate at a temperature of about 70^0 with 0.1 *N potassium permanganate*. Each ml of 0.1 *N potassium permanganate* is equivalent to 0.006303 g of $C_2H_2O_4$, $2H_2O$.

Oxalic Acid, O.IN - $H_2C_2O_4$, $2H_2O$=1,6,07, 6.303 g in 100 ml.

Dissolve 6.65 g of oxalic acid in sufficient water to produce 1000 ml and standardize the solution as follows:

Pipette 30 ml of the solution into a beaker, add 150 ml of *water*, 7 ml of *sulphuric acid* and heat to about 70^0C. Add slowly from a burette freshly standardized 0.1 *N potassium permanganate* with constant stirring, until a pale-pink colour, which persists for fifteen seconds, is produced. The temperature at the conclusion of the titration should not be less than 60^0C. Each ml 0.1 *N Potassium permanganate* is equivalent to 0.006303 g of $H_2C_2O_4$, $2H_2O$.

Petroleum light - Petroleum Spirit

Description - Colourless, very volatile, highly flammable liquids 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, 30^0Cto 40^0C)
Wt. per ml. - At 20^0C, 0,620 to 0.630 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 40^0 Cto 60^0 C)
Wt. per ml. - At 20^0C, 0,630 to 0.650 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 60^0C to 80^0 C).
Wt. per ml. - At 20^0 C, 0,670 to 0.690 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 80^0 C to 100^0 C).
Wt. per ml. - At 20^0 C, 0,700 to 0.720 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 100^0 C to 120^0 C).
Wt. per ml. - At 20^0 C, 0,720 to 0.740 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 120^0 C to 160^0 C).
Wt. per ml. - At 20^0 C, about 0.75g, Appendix 3.1.8

Non-Volatile Matter- When evaporated on a water-bath and dried at 105^0, leaves not more than 0.002 percent w/v of residue.

Phenacetin, $C_{10}H_{13}O_2N$=179.2

Analytical reagent grade.

White, glistening, crystalline seeds, or a fine white, crystalline powder; odourless; taste, slightly bitter

Melting range - 134^0 C to 136^0 C

Phenol - C_6H_5OH=94.11.
Analytical reagent grade.

Caustic, deliquescent crystals with a characteristic odour; freezing point, about 41^0 C.

Phenol Liquified - General reagent grade

A solution in water containing about 80 percent w/w of C_6H_6O.

Phenol Red - $C_{19}H_{14}O_5S$. Phenolsulphonphthalein.

A light to dark red crystalline powder, very slightly soluble in water, slightly soluble in alcohol soluble in dilute alkaline solutions.

Phenol Red Solution - Dissolve 0.01 g of *phenol red* in 2.82 ml of o.1 *N sodium hydroxide* and 20 ml of *alcohol* and dilute to 100 ml with *water.* Test for sensitivity: A mixture of 0.1 ml of the *phenol red solution* in 100 ml of freshly boiled and cooled water is yellow. Not more than 0.1 ml of 0.02 *N sodium hydroxide* is required change the colour to red-violet.

Colour change- pH 6.8 (yellow) to pH 8.4 (red-violet).

Phenolphthalein - $C_{20}H_{14}O_4$.

A white to yellowish-white powder, practically insoluble in *water*, soluble in alcohole.

Phenolphthalein Solution –Disolve, 0.10g 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- pH 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 110^0C for one hour, 215^0C to 219^0C, Appendix 3.1.4.

Sulphated Ash - Not more than 0.1 percent, Appendix 2.2.11

Phloroglucinol Solution of - A I percent w/v solution of *phloroglucinol* in *alcohol* (90 percent).

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*.

Hypophosphorous and Phosphorous Acids - To 0.5 ml add 10 ml of water and 2 ml of *silver nitrate solution* and heat on a water-bath for five minutes; the solution shows no change in appearance.

Alkali Phosphates - To 1 ml in a graduated cylinder add 6 ml of *solvent ether* and 2 ml of *alcohol*; no turbidity is produced.

Chloride - 1 ml complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 0.5 ml complies with the *limit test for sulphate*, Appendix 2.3.6

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 10 parts per million, determined by Method A on a solution prepared by diluting 1.2 ml with 10 ml of *water*, neutralizing with *dilute ammonia solution*, adding sufficient *dilute acetic acid* to render the solution acidic and finally diluting to 25 ml with water, Appendix 2.3.3.

Iron - 0.1 ml complies with the limit test for iron, Appendix 2.3.4.

Aluminium and Calcium - To 1 ml add 10 ml of water and 8 ml of *dilute ammonia solution* the solution remains clear.

Assay - Weigh accurately about 1 g and mix with a solution of 10 g of *sodium chloride* in 30 ml of water. Titrate with *N sodium hydroxide*, using *phenolphthalein* solution as indicator. Each ml of N sodium hydroxide is equivalent to 0.049 g of H_3PH_4.

Storage - Store in a well-closed glass containers.

Phosphoric Acid, xN

Solutions of any normality, xN may be prepared by diluting 49Xg of *phosphoric acid* with water to 1000 ml.

Phosphoric Acid, Dilute
Contains approximately 10 percent w/v of H_3PO_4.
Dilute 69 ml of *phosphoric acid* to 1000 ml with water.

Piperazine Hydrate - $C_4H_{10}N_2$, $6H_2O$=194.2.
General reagent grade of commerce.
Colourless, glossy, deliquescent crystals, melting point, about 44^0.

Potassium Antimonate - KSb_{03}, $3H_2O$=262.90
Contains not less than 40 percent of Sb.

Description - White, crystalline powder.

Solubility - White, crystalline Sparingly soluble in *water* very slowly soluble in cold, but rapidly soluble on boiling.

Assay - Weigh accurately about 0.3 g, and dissolve in 100 ml of water, add 2 ml of dilute hydrochloric acid, and pass in *hydrogen sulphide* until the antimony is completely precipitated. Add 2 ml of *hydrochloric acid* and again pass in *hydrogen sulphide*. Boil, filter, was the precipitate with hot water saturated with *hydrogen sulphide*, and dissolve the precipitate in 25 ml of *hydrochloric acid*. Boil to remove *hydrogen sulphide*, and dilute to 50 ml with *water*. Add 2 g *of sodium potassium tartrate*, neutralize carefully with *sodium carbonate*, add 2 g sodium bicarbonate, and titrate with 0.1 *N iodine*, using *starch solution* as indicator. Each ml of 0.1 *N iodine* is equivalent to 0.006088 g Sb.

Potassium Antimonate Solution - Boil 2 g of *potassium antimonate* with 95 ml of *water* until dissolved. Cool rapidly and add 50 ml of *potassium hydroxide solution* and 5 ml of *N sodium hydroxide*. Allow to stand twenty-four hours, filter and add sufficient water to produce 150 ml.

Sensitivity to Sodium - To 10 ml add 7 ml of 0.1 *M sodium chloride*, a white, crystalline precipitate is formed within fifteen minutes.

Potassium Antimonate Solution should be freshly prepared.

Potassium Bisulphate - Potassium Hydrogen Sulphate; $KHSO_4$=136.16.

Contains not less than 98.0 percent and not more than the equivalent of 102 percent of $KHSO_4$.

Description - Fused, white lumps, hygroscopic.

Solubility - Very soluble in *water*, giving an acid solution.

Iron - 2 g complies with the *limit test for iron*, Appendix 2.3.4.

Assay - Weigh accurately about 4.5 g, dissolve in 50 ml of *water* and titrate with *N sodium hydroxide* using *methyl red solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.1362 g of $KHSO_4$.

Potassium Bromate - $KbrO_3$=167.00

Contains not less than 99.8 percent of $KbrO_3$, calculated with reference to the substance dried to constant weight at 105^0C.

Description - White, crystalline powder.

Solubility - Soluble in *water*, freely soluble in boiling *water*, almost insoluble in *alcohol*.

Acidity or Alkalinity - A 5 percent w/v solution in *water* is clear and colourless and neutral to *litmus solution*.

Sodium - A warm 10 percent w/v solution in *water*, tested on platinum wire, imparts no distinct yellow colour to a colourless flame.

Bromide - To 20 ml of a 5 percent w/v solution in *water*, add 1 ml of 0.1 N *sulphuric acid*: no yellow colour develops within one minute, comparison being made with a control solution to which no acid has been added.

Sulphate - 1 g complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1 g, dissolve in *water* and dilute to 250 ml. To 25 ml of this solution add 3 g of *potassium iodide* and 10 ml of *hydrochloric acid*, dilute with 100 ml of water and titrate with 0.1 *N sodium thiosulphate*, using starch solution as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.002783 g of $KBrO_3$.

Potassium Bromide - Kbr=119.0.
Analytical reagent grade.

Potassium Bromide - 0.001 N.
Dissolve 0.1190 g of *potassium bromide* in sufficient *water* to produce 1000 ml.

Potassium Carbonate - K_2CO_3=138.21.
Contains not less than 98 percent of K_2CO_3.

Description - White, granular powder, hygroscopic.

Solubility - Very soluble in water, forming a clear solution.

Iron - 1 g with the addition of 1.5 ml of *hydrochloric acid*, complies with the *limit test for iron*, Appendix 2.3.4.

Chloride - 1 g with the addition of 5 ml of *nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 1 g, with the addition of 5 ml of *hydrochloric acid*, complies with the *limit test for sulphates*, Appendix 2.3.6

Chromium - To 25 ml of a 2 percent w/v solution in *water*, add about 0.2 g of *sodium peroxide* and boil gently for five minutes, cool, acidify with dilute sulphuric acid and add 2 drops of *diphenylcarbazide solution*; no violet colour is produced.

Assay - Weigh accurately about 3 g, dissolve in 50 ml of *water*, and titrate with *N hydrochloric* acid using *bromophenol blue solution* as indicator. At the first colour change, boil the solution, cool, and complete the titration. Each ml of *N hydrochloric acid* is equivalent to 0.06911 g of K_2CO_3.

Potassium Carbonate, Anhydrous - Potassium carbonate dried at 135^0C for two hours spread in a thin layer and then cooled in a desiccator.

Potassium Chlorate - $KC10_3$=122.55.
Contains not less than 99 percent of $KC10_3$.

Description - White powder or colourless crystals. In admixture with organic or readily oxidisable substances, it is liable to explode if heated or subjected to percussion or trituration.

Solubility - Soluble in *water*, and in *glycerin*, practically insoluble in alcohol.

Lead - Not more than 10 parts per million, Appendix 2.3.5.

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 sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 0.3 g and dissolve in 10 ml of *water* in a stoppered-flask, add 1 g of *sodium nitrate*, dissolved in 10 ml *water* and then 20 ml of *nitric acid*; stopper the flask and allow to stand for ten minutes; add 100 ml of water and sufficient *potassium permanganate* solution to produce a permanent pink colour; decolorise by the addition of trace of *ferrous sulphate* and add 0.1 g of *urea*. Add 30 ml of 0.1 *N silver nitrate*, filter, wash with water and titrate the filtrate and washing with 0.1 *N ammonium thiocyanate* using *ferric ammonium sulphate solution* as indicator. Each ml of 0.1 *N silver nitrate* is equivalent to 0.01226 g of $KC10_3$.

Potassium Chloride - KC1=74.55
Analytical reagent grade.

Potassium Chromate - K_2CrO_4=194.2
Analytical reagent grade.

Potassium Chromate Solution - A 5 percent w/v solution of potassium chromate.

Gives a red precipitate with *silver nitrate* in neutral solutions.

Potassium Cupri-Tartrate Solution - Cupric Tatrate Alkaline Solution: Fehling's Solution.

A. **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.
B. **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 Cyanide - KCN=65.12.

Contains not less than 95 percent of KCN.

Description - White, crystalline powder, gradually decomposing on exposure to air.

Solubility - Readily soluble in *water*, forming a clear, colourless solution.

Heavy Metals - To 20 ml of a 5 percent w/v solution in *water*, add 10 ml of *hydrogen sulphide solution*; no darkening is produced immediately or on the addition of 5 ml of *dilute hydrochloric acid.*

Assay - Weigh accurately about 0.5 g and dissolve in 50 ml of *water*, add 5 ml of *dilute ammonia solution* and 1 drop of *potassium iodide solution*; titrate with 0.1 *N silver nitrate* until a faint permanent turbidity appears. Each ml of 0.1 *N silver nitrate* is equivalent to 0.01302 g of KCN.

Potassium Cyanide Solution - A 10 percent w/v solution of *potassium cyanide* in *water*.

Potassium Cyanide Solution, Lead-free - Weigh accurately about 10 g of *potassium cyanide* and dissolve in 90 ml of water, add 2 ml of *hydrogen peroxide solution*, allow to stand for twenty-four hours, and make up to 100 ml with *water*. It complies with the following tests:

Mix 2 ml with 5 ml of *lead-free ammonia solution* and 40 ml of water, and add 5 ml of standard lead solution; no darkening is produced.

Potassium Dichromate - $K_2Cr_2O_7$=294.18.

Contains not less than 99.8 percent of $K_2Cr_2O_7$.

Description - Orange-red crystals or a crystalline powder.

Solubility - Soluble in *water*.

Chloride - To 20 ml of a 5 percent w/v solution in *water* and 10 ml *nitric acid*, warm to about 50^0C 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 percent 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* P.S. previously powdered and dried at 20^0 for four hours and dissolve in sufficient *water* to produce 1000 ml.

Potassium Dihydrogen Phosphate - KH_2PO_4=136.1

Analytical reagent grade of commerce.

Potassium Ferricyanide - $K_3Fe(CN)_6$=329.25

Contains not less than 99 percent of $K_3Fe(CN)_6$.

Description - Ruby-red crystals.

Solubility - Very soluble in *water*.

Ferrocyanide - Rapidly wash 1 g with *water*, then dissolve in 100 ml of water and add 1 drop of *ferric ammonium sulphate solution*; no blue colour is produced.

Assay - Weigh accurately about 1 g and dissolve in 50 ml of *water* add 5 g of *potassium iodide* and 3 g of *zinc sulphate*, and titrate the liberated iodine with 0.1 N *sodium thiosulphate*, using *starch solution*, added towards the end of the titration, as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.03293 g of $K_3Fe(CN)_6$.

Potassium Ferricyanide Solution - Wash about 1 g of potassium ferricyanide crystals with a little water, and dissolve the washed crystals in 100 ml of water.

Potassium Ferricyanide solution must be freshly prepared.

Potassium Ferrocyanide - $K_4Fe(CN)_6, 3H_2O$=422.39

Contains not less than 99 percent of $K_4Fe(CN)_6, 3H_2O$.

Description - Yellow, crystalline powder.

Solubility: Soluble in water.

Acidity or Alkalinity: A 10 percent w/v solution in *water* is neutral to litmus paper.

Assay: Weigh accurately about 1 g 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 percent 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 percent and not more than the equivalent of 100.1 percent of $C_8H_5O_4K$ calculated with reference to the substance dried at 110^0C for one hour.

Description: White, crystalline powder.

Solubility: Slowly soluble in *water*, forming clear, colourless solution.

Acidity: A 2 percent w/v solution in *carbon dioxide-free water* gives with *bromophenol blue solution* the grey colour indicative of pH 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 percent of total alkali, calculated as KOH and not more than 4 percent of K_2CO_3.

Description - Dry, white sticks, pellets or fused 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 *ethy 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 percent 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 addition 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 percent w/v solution add 1 ml of water, 1.5 ml of *alcohol*, and 3 ml of *potassium anti-monate 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 is 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, xN

Solution of any normality, xN, 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 aquous solution of *potassium hydroxide* containing 5 percent w/v of total alkali, calculate 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 Iodate - KIO_3=214.0

Analytical reagent grade.

Potassium Iodate Solution - A 1 percent w/v solution of potassium iodate in water.

Potassium Iodate, 0.05M: KIO_3=214.00; 10.70 g in 1000 ml.

Weigh accurately 10.700 g of *potassium iodate* P.S., previously dried at 110^0 to constant weight, in sufficient water to produce 1000 ml.

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 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 nay 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 *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 percent w/v solution of *potassium iodide* in *water*.

Potassium Indobismuthate Solution - Dissolve 100 g of tartaric acid in 400 ml of *water* and add 8.5 g of *bismuth oxynitrate*. Shake during one hour, add 200 ml of a 40 percent w/v solution of potassium iodide, and shake well. Allow to stand for twenty four hours and filter.

Potassium Iodobismuthate Solution, Dilute - Dissolve 100 g of *tartaric acid* in 500 ml of *water* and add 50 ml of *potassium iodobismuthate solution*.

Potassium Mercuri-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 Mercuri-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 Nitrate - KNO_3=101.1
Analytical reagent grade.

Potassium Permanganate - KM_nO_4=158.03
Anti-infective (topical)

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 2.3.6

Assay - Weigh accurately about 0.8 g, dissolve in *water* and dilute to 250 ml. Titrate with this solution 25 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 KM_nO_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 percent w/v solution of potassium permanganate in water.

Potassium permanganate 0.1 N Solution - 1158.03; 3.161 g in 1000 ml.

Dissolve about 3..3 g of *potassium permanganate* in 1000 ml of *water*, heat on water-bath for one hour and allow to stand for two days. Filter through glass wool and standardize the solution as follows:-

To an accurately measure 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 standardized 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 KM_nO_4.

Potassium Tetraoxalate - $KH_3 (C_2O_4) 2H_2O$=254.2

Analytical reagent grade of commerce.

Potassium thiocyanate - KCNS=97.18

Analytical reagent grade.

Purified water - H_2O=18.02

Description - Clear, colourless liquid, odourless, tasteless.

Purified water is prepared 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, Appendix 3.1.3.

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.

Sulphate - To 10 ml add 0.1 ml of *dilute hydrochloric acid* and 0.1 ml of *barium chloride solution*: the solution remains clear for an hour.

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 mercuri-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 mercuri-iodide solution* to a solution containing 2.5 ml of *dilute ammonium chloride solution* (Nessler's) and 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 pH 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.

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 percent w/v determined on 100 ml by evaporating on a water bath and drying in an oven at 105^0C for one hour.

Storage - Store in tightly-closed containers.

Resorcional - Benzene-1, 3 diol; $C_6H_4(OH)_2$=110.1
Analytical reagent grade.
Colourless crystals or crystalline powder, melting point about 111^0C.

Resorcinol Solution - Shake 0.2 g of resorcinol with 100 ml of toluene until saturated and decant.

Safranine - CI 50240: Basic red 2
Microscopical staining grade.
A reddish-brown powder.

Safranine Solution - Saturated solution of *Safranine O* in *ethanol* (70 percent).
Seasame oil

Description - A pale yellow oil.

Solubility - Slightly soluble in alcohol; miscible with *chloroform*, with solvent *ether with light petroleum* (b.p. 40^0C to 60^0C) and with carbon disulpide.

Refractive Index - At 40^0C, 1.4650 to 1.4665, Appendix 3.1.7

Wt. per ml. - At 25^0C, 0.916 to 0.921 g; Appendix 3.1.8

Storage - Preserve seasame oil in a well-closed container protected from light, and avoid exposure to excessive heat.

Silver Carbonate - $Ag_2\ CO_3$=214

Prepared from *silver nitrate* and soluble *carbonate solution*. Light yellow powder when freshly precipitated, but becomes darker on drying and on exposure to light.

Silica Gel - Partially dehydrated, polymerized, colloidal silicic acid containing cobalt chloride as an indicator.

Description - Blue granules, becoming pink when the moisture absorption capacity is exhausted.

Silica Gel absorbs about 30 percent of its weight of water at 20^0 C. Its absorptive capacity may be regenerated by heating at 150^0 C for two hours.

Silver Nitrate - $AgNO_3$=169.87

Description - Colourless crystals or white crystalline powder; odourless, taste, bitter and metallic.

Solubility - Very soluble in *water*, sparingly soluble in *alcohol*; slightly soluble in *solvent ether*.

Clarity and colour of solution - A solution of 2 g in 20 ml of water is clear and colourless.

Bismuth, copper and lead - To a solution of 1 g in 5 ml of *water*, add a slight excess of *dilute ammonia solution*: the mixture remains clear and colourless.

Foreign substances - To 30 ml of a 4 percent w/v solution add 7.5 ml of 2N *hydrochloric acid*, shake vigorously, filter and evaporate 10 ml of the filtrate to dryness on a water-bath; the residue weighs not more than 1 mg.

Assay - Weigh accurately about 0.5 g and dissolve in 50 ml of water, add 2 ml of nitric acid, and titrate with 0.1 *N ammonium thiocyanate*, using ferric *ammonium sulphate solution* as indicator. Each ml 0.1 *N ammonium thiocyanate* is equivalent to 0.01699 g of $AgNO_3$.

Storage - Store in tightly-closed, light-resistant containers.

Silver Nitrate Solution - A freshly prepared 5 percent w/v solution of silver nitrate in water.

Silver Nitrate - 0.1N: $AgNO_3$=169.87; 16.99 g in 1000 ml. Dissolve about 17 g in sufficient *water* to produce 1000 ml and standardize the solution as follows.

Weigh accurately about 0.1 g of *sodium chloride* P.S. previously dried at 110^0C 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 - pH of a freshly prepared 5 percent w/v solution in *carbon dioxide-free water*, not more than 8.6, Appendix 3.1.3.

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 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 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 solution* 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 percent w/v *solution of sodium bicarbonate* in water.

Sodium Bisulphite - Consists of *sodium bisulphite* ($NaHSO_3$) and *sodium metabisulphite* ($Na_2S_2O_3$) in varying proportions. If yields not less than 58.5 percent and not more than 67.4 percent of SO_2.

Description - White or yellowish-white crystals or granular powder, odour of sulphur dioxide. It is unstable in air.

Solubility - Freely soluble in *water*, slightly soluble in *alcohol*.

Assay - Weigh accurately about 0.2 g and transfer to a glass-stoppered flask and 50 ml of 0.1 *N iodine* and insert the stopper of the flask. Allow to stand for five minutes, add 1 ml of *hydrochloric acid*, and titrate the excess of iodine with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of the titration. Each ml of 0.1 *N iodine* is equivalent to 0.003203 g of SO_2.

Storage: Preserve *Sodium Bisulphite* in tightly-closed containers in a cool place.

Sodium Bisulphite Solution - Dissolve 10 g of sodium bisulphite in sufficient *water* to make 30 ml.

Sodium Bisulphite Solution must be freshly prepared.

Sodium Carbonate - Na_2CO_3. $10H_2O$=286.2

Analytical reagent grade.

Sodium Chloride - NaCI=58.44

Analytical reagent grade.

Sodium Cobaltinitrite - $Na_2CO(NO_2)_6$=403.94

Description - An orange-yellow powder.

Solubility - Readily soluble in *water*, forming a clear orange-red solution.

Potassium - Dissolve 3 g in 10 ml of *water*, add the solution to a mixture of 5 ml of water and 2 ml of dilute *acetic acid*, and allow to stand for one hour; no precipitate is produced.

Sodium Cobaltinitrite Solution - A 30 percent w/v solution of *sodium cobaltinitrite in water*.

Sodium Diethyldithiocarbamate - $(C_2H_5)_2$, N. CS.SNa, $3H_2O$=225.30

Description - White or colourless crystals.

Solubility - Readily soluble in water, yielding a colourless solution.

Sensitivity - Add 10 ml of a 0.1 percent w/v solution to 50 ml of *water* containing 0.002 mg of copper previously made alkaline with *dilute ammonia solution*. A yellowish-brown colour should be apparent in the solution when compared with a blank test containing no copper.

Sodium Diethyldithiocarbamate Solution - A 0.1 percent w/v solution of *sodium diethyldithiocarbamate* in *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 percent 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. on 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 percent w/v solution with *acetic acid* and add 3 drops of *sodium cobaltinitrite solution*, no precipitate 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.

Sulphate - 1g 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, xN - Solutions of any normality, xN may be prepared by dissolving 40 xg of *sodium hydroxide* in *water* and diluting to 1000 ml.

Sodium Hydroxide Solution - A 20 percent w/v solution of *sodium hydroxide* in *water*.

Sodium Hydroxide Solution, Dilute

A 5 percent w/v solution of sodium hydroxide in water.

Sodium Nitrite - $NaNO_2$-69.00, Analytical reagent grade.

Sodium Nitroprusside - (Sodium penta cyano nitrosyl ferrate (iii) dihydrate; $Na_2[Fe(CN)_5(NO)]$, $2H_2O$=298.0

Analytical reagent grade of commerce.

Sodium Peroxide - Na_2O_2=77.98

Analytical grade reagent.

Sodium Potassium Tartrate: Rochelle Salt COONa.CH(OH). CH(OH), COOK, $4H_2O$=282.17

Contains not less than 99 percent and not more than the equivalent of 104 percent of $C_4H_4O_6Kna$, $4H_2O$.

Description - Colourless crystals or a white, crystalline powder; odourless, taste saline and cooling. As 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 neutralization 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 sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 2 g and heat until carbonized, 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 Sulphide - Na_2Saq.

Analytical reagent grade. Deliquescent, crystalline masses turning yellow on storage.

Sodium Sulphide Solution - Dissolve with heating, 12 g of *sodium sulphide* in a mixture of 10 ml of *water* and 25 ml of *glycerol* cool and dilute to 100 ml with the same mixture.

Sodium Sulphite, Anhydrous: Na_2SO_3=126.06

Description - Small crystals or powder.

Solubility - Freely soluble in *water*, soluble in *glycerin*; almost insoluble in *alcohol*.

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 33^0C.

Solubility - Very soluble in *water*; insoluble in *alcohol*.

pH - Between 6.0 and 8.4, determined in a 10 percent w/v solution, Appendix.3.1.3

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. on 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 2 N *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*, drop wise until a very faint-persistent yellow colour is produced; the resulting solution complies with the *limit test for sulphates*, Appendix 2.3.6

Sulphide - Dissolve 1 g in 10 ml water and 10 ml of a freshly prepared 5 percent 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 N 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_2 S_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. Standardize the solution as follows:

Dissolve 0.3 g of *potassium bromate* P.S. 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-standardize 0.1 *sodium thiosulphate* frequently.

Stannous Chloride - $SnCl_2$, $2H_2O$=225.63

Contains not less than 97 percent of $SnCl_2$, $2H_2O$.

Description - Colourless crystals.

Solubility - Soluble in *dilute hydrochloric acid.*

Arsenic - Dissolve 5 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 g in 10 ml of *hydrochloric acid*.

Sulphate - 5 g, with the addition of 2 ml of *dilute hydrochloric acid*, complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1 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:

2 Dissolve 330 g of *stannous chloride* in 100 ml of *hydrochloric acid* and add sufficient *water* to produce 1000 ml.

3 Dilute 60 ml of *hydrochloric acid* with 20 ml of *water*, add 20 g of tin and heat gently until gas ceased 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 faintly acid to litmus paper.

Sensitivity - Mix 1 g with a little cold *water* and add 200 ml of *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 percent, Appendix 2.2.3.

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.

Sudan Red G - Cl 26100; Sudan III; Solvent Red 23; 1-(4-phenylazophenylazo)-2-naphthol; $C_{22}H_{16}N_4O$=352.40

Description: Reddish-brown powder.

Solubility - Insoluble in *water*; soluble in *chloroform*, in glacial acetic acid; moderately soluble in *alcohol*, in solvent *ether* and in *acetone*.

Sulphamic Acid - NH_2SO_3H=97.09.

Contains not less than 98 percent of H_3NO_3S.

Description - White crystals or a white crystalline powder.

Solubility - Readily soluble in *water*.

Melting Rang - 203^0C to 205^0C, with decomposition, Appendix 3.1.4.

Sulphuric Acid - H_2SO_4=98.08

When no molarity is indicated use analytical reagent grade of commerce containing about 98 percent 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 x ml of sulphuric acid to an equal volume of water and diluting with water to 1000 ml.

Solution of sulphuric acid contain about 10 percent w/v of H_2SO_4.

Sulphuric Acid, Dilute: Contains approximately 10 percent 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 percent w/w of H_2SO_4 and compiles 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.

Tartaric Acid - $(CHOH.COOH)_2$=150.1

Analytical reagent grade.

Thioglycollic Acid Mercapto Acetic Acid - HS. CH_2. COOH=92.11.

Contains not less than 89 percent 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 unpleasant.

Iron - Mix 0.1 ml with 50 ml of *water* and render alkaline with *strong ammonia solution*; no pink colour is produced.

Assay - (1) 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 $C_2H_4O_2S$.

(2) To the above neutralized solution add 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 $C_2H_4O_2S$.

Thymol-2-Isoprophy-5-Methyl phenol; $C_{10}H_{14}O$=150.2

General reagent grade.

Colourless crystals with an aromatic odour; freezing point not below 49^0C.

ThymolBlue-6,6'-(3H-2,1Benzoxathil-3-ylidene)dithymolSS-dioxide; $C_{27}H_{30}O_5S$=466.6.

Gives a red colour in strongly acid solutions a yellow colour in weakly acid and weakly alkaline solutions, and a blue colour is more strongly alkaline solutions (pH range, 1.2 to 2.8 and 2.0 to 9.6).

Thymol Blue Solution - Warm 0.1 g of *thymol blue* with 4.3 ml or 0.05 M sodium hydroxide and 5 ml of *ethanol* (90 percent); after solution is effected add sufficient *ethanol* (20 percent) to produce 250 ml.

Complies with the following test:

Sensitivity - A mixture of 0.1 ml and 100 ml of Carbon dioxide-free water to which 0.2 ml of 0.02 *N sodium hydroxide* has been added is blue. Not more than 0.1 ml of 0.2 *N hydrochloric acid* is required to change the colour to yellow.

Titanous Chloride Solution - General reagent grade of commerce containing about 15 percent w/v $TiC1_3$.

Weight per ml, about 1.2 g.

Dull purplish liquid with a strongly acid reaction.

Titanous Chloride - 0.1N: $TiC1_3$=154.26; 15.43g in 1000 ml.

Add 103 ml of *titanous chloride solution* to 100 ml of *hydrochloric acid*, dilute to 1000 ml with recently boiled and cooled water, and mix, standardize, immediately before use, as follows:

Place an accurately measured volume of about 30 ml of standardized 0.1 *N ferric ammonium sulphate* in a flask and pass in a rapid stream of *carbon dioxide* until all the air has been removed. Add the *titanous chloride solution* from a burette and in an atmosphere of *carbon dioxide* until near the calculated endpoint then add 5 ml of ammonium thiocyanate solution, and continue the titration until the solution is colourless. Each ml of 0.1*N ferric ammonium sulphate* is equivalent to 0.01543 g of $TiC1_3$.

Water - See purified water.

Water Ammonia-free - Water which complies with the following additional test.

To 50 ml add 2 ml of *alkaline potassium mercuri-iodide solution* (Nessler's reagent); no colour is produced.

Water, Carbon Dioxide-free - Water which has been boiled vigorously for a few minutes and protected from the atmosphere during cooling and storage.

Xylenol orange - [3H-2, 1-Benzoxathiol-3-ylidene bis (6-hydroxy-5-methyl-m-phenylene) methyl-lenenitril] tetra acetic acid SS-dioxode ($C_{31}H_{32}O_2O_{13}S$) or its tetra sodium salt.

Gives a violet colour with mercury, lead zinc and contain other metal ions in acid solution. When metal ion are abscent, for example in the presence of an excess of disodium ethylene diamine tetraacetate, this solution is yellow.

Xylenol Orange Solution - Shake 0.1 g of *xylenol orange* with 100 ml of water and filter, if necessary.

Zinc, Granulated - Zn=65.38.

Analytical reagent grade of commerce.

Zinc Powder - Zn=65.38.

Analytical reagent grade of commerce.

Zinc Sulphate - $ZnSO_4$, $7H_2O$=287.6.

Analytical reagent grade of commerce.

APPENDIX 5

5.1 GENERAL INFORMATION

5.1.1 Definition and Method of Preparing of Joshanda or Decoction

Joshanda is the decoction obtained by boiling Coarse powder of drugs in proportion of 4,8,16 times of water reduced to one fourth and strained in cloth.

5.1.2 Tasfia (Decontamination)

Tasfia is a process of decontamination with specified drugs for removal of impurities and potentiation of drugs. The process of Tasfia may be divided under the following processes:

1. Daq-wa-Sahaq;
2. Ghasl-e-Adviyah and
3. Tasweel-e-Adviyah.

1. Daq-Wa-Sahaq (Pounding and Grinding)

In the preparation of many compound formulations, single drugs are used in the form of coarse of fine powder. The process of powdering, by pounding or grinding, is called Daq-was-Sahaq (Kootna-aur-Peesna).

Drugs are generally powdered in a mortar and pestle, made of stone, iron, wood, porcelain or glass. Sometimes, they are rubbed on a sil-batta (flat grinding stone). Some drugs are pounded only in an iron or stone mortar. In large scale manufacture of drugs, pulverizing machines are now used.

(i) Powdering of hard drugs

Tough, hard or fibrous drugs are first dried in shade, Sun or over low fire to evaporate their moisture contents and pounded in an iron mortar. Initially, gentle pounding is employed to avoid drug pieces being scattered outside the mortar. When the drugs are initially broken into small pieces by gentlre pounding, vigorous pounding is then employed till they are finely powdered. The powder is sieved through sieves of the prescribed meshes. The coarse particles left in the sieve are again pounded and resieved. The remaining pieces of drugs which can no longer be pounded are ground on a sil-batta with a little water to form a fine paste which is then dried and ground to powder form in a porcelain or glass mortar.

(ii) Powdering of Nuts and Dry Fruits

Kernels of Nuts and Dry fruits are ground only on a sil-batta or in a Kharal. The powder of these drugs is not sieved.

(iii) Powdering of precious stones and minerals

Precious stones and minerals are first ground in an iron mortar or Kharal of hard stone and then sieved through sieves of 100 Mesh. The sieved powder is put in the same mortar or Kharal and ground with Arq-e-Gulab for three hours till the Arq is completely absorbed. The powder is then tested between the fingers for its fineness. If coarseness is still felt, more Arq-e-Gulab is added and ground till the coarseness disappears. The fine powder is then sieved through a piece of fine muslin cloth.

(iv) Powder of Mushk, Ambar, etc.

Drugs like Mushk, Ambar, Jund-e-Badastar, etc., are ground either dried or with a suitable Arq or Raughan and then used as required in the respective formula.

(v) Powdering of Zafran, Kafoor, etc.

Drugs like Zafran, Kafoor are ground only in a dry mortar (Kharal), with slow and light movements of the pestle to avoid sticking of the drug with the mortar. It is also ground with a few drops of alcohol. Lastly, these drugs are added to the powder of other drugs and mixed well in a mortar.

(vi) Powdering of Toxic Drugs

Poisonous or Toxic drugs are first purified or detoxicated (mudabbar) and then ground to fine powder. Kuchla (Nux-Vomica), besides being toxic (poisonous), is also very hard and difficult to powder. It is, therefore, ground immediately when it is soft. In case it gets hard on drying, it is powdered by frying in Raughan Zard or any other suitable oil by which the drug is cripsed.

(vii) Powdering of Abresham

Silk Cocoons (Abresham) are cut into small pieces and roasted in an iron pan over low fire, care being taken to ensure that they are not burnt. It is then ground in a mortar and pestle to fine powder form.

(viii) Powdering of moist and resinous drugs

Drugs like Afyun, Ushaq, Muqil, Anardana, Narjeel Daryaee, etc. are first dried over a low fire to evaporate the moisture content, care being taken to ensure that they are not burnt. They are then powdered.

(ix) Powdering of Khurma Khushk

In case of Khurma Khushk (Dry Date) the seeds are first removed and then dried over a low fire in a frying pan before powdering. In some formulations, dates (Khurma Khushk) are soaked in the prescribed liquids. In such cases they are ground on sil-batta, with a little water to form a fine paste and then mixed with other drugs coming in the respective formula.

(x) Powdering of Mastagi

Mastagi is powdered in a porcelain mortar by slow and light motion. It is also dissolved in any oil over a low fire and added to the other drugs in the formula.

(xi) Powdering of Abrak

The layers of Abrak are first separated by pounding in an iron mortar. The small pieces of Abrak are kept in a bag of thick cloth along with small pebbles, Cowrie shells, Data seeds or Dhan (Paddy) and tied. The bag is then dipped in hot water and rubbed vigorously with both hands. Small particles of Abrak are then squeezed out of the bag. The process of dipping the bag in hot water and rubbing is repeated till all the particles of Abrak are squeezed out of the bag. The particles of Abrak are allowed to settle down at the bottom of the vessel and the water is decanted. The Abrak particles are removed and then allowed to dry. The dry particles are called Abrak Mahloob.

(xii) Powdering of Tukhm-e-Imli

Tukhm-e-Imli is soaked in water for four to five days. The brownish outer covering (testa) of the seeds is removed and the seed are ground to powder. The outer covering can also be removed by roasting the seeds.

(xiii) Powdering of Sang-e-Surma

Sang-e-Surma is ground in a mortar and pestle (Kharal). The process of powdering is continued till the shine of the particles disappears and the powder is tested between the fingers for its fineness. If it is still coarse then the process is repeated till the highest degree of fineness is obtained. Similarly, all other drugs which are to be applied in the eyes are ground to the highest degree of fineness for which it is sieved through a piece of silk cloth to obtain the finest quality of Surma.

2. Ghasl-e-Adviyah (Cleaning of Drugs)

In order to prepare the drugs of moderate properties and action the drugs of plant, animal and mineral origin are washed with special method. This special method of washing is called Ghasl-e-Adviyah. The drugs which undergo this process are suffixed with the term Maghsool (washed) in respective formulae. A few of the drugs which are processed by this method are described below.

(i) Aahak (Choona)

Aahak (edible lime) is soaked in a large quantity of water, stirred well and allowed to settle down at the bottom. After settling down of the particles of Choona the water is decanted. Fresh water is again added to the sediment and stirred well. The process of addition of water to fine particles of Choona and decantation is repeated 7 to 8 times and the fine particles of the Choona are collected tin the end. The product thus obtained is called Choona Maghsool or Aahak Maghsool.

(ii) Hajriyat

Precious stones, like Shadjanj Adsi, Lajward, etc., are used after they are purified. The stone is ground to fine powder. Sufficient quantity of water is then added to be powder, stireed and allowed to settle down. The finer particles of the stone still suspended in the water will come out when decanted. The coarse particles will settle down at the bottom. These coarse particles are removed the ground till all the particles pass through the process of decantation. The decanted water is left undistrubed so that the finest particles are settled down at the botoom. Water is then removed and the particles when dried are finely powdered.

The drugs treated by the above method are called "Maghsool" viz. Shadnaj Adsi Maghsool, Sang-e-Surma Maghsool and Lajward Maghsool.

(iii) Raughan Zard or Ghee

Ghee is taken in a tin-coated metallic plate or Kansa (a metallic alloy) plate and water is poured over it. The Ghee is then rubbed with the hands for five minutes and the watery part is decanted. This process is repeated many times as indicated in the particular formula to obtain the Raughan Zard Maghsool.

(iv) Luk

First of all the visible impurities are removed from Luk. 30 gms. of Luk is finely powedered and ground in the decoction prepared by 15 gms. each of Rewand Chini and Izkhar Makki. The mixture is sieved through a piece of clean fine cloth, and when the fine particles of Luk settle down in the decoction, it is then decanted and the fine a particles of Luk are washed with water and dried to obtain the Luk Maghsool.

3. **Tasweel-e-Adviyah (Sieving)**

Sieves of different meshes are used in the process of powdering the drugs. Each sieve has a particular mesh number. The mesh number depends on the number of holes in the mesh in an area of 2.5 sq.cm. (1 square inch). If there are 20 holes, the mesh number is 40, if there are 30 holes, the mesh number is 60, for 50 holes the mesh number is 100. If coarse powder is required then sieve number 40 is used. For fine powders, sieves of highest number are used. Sieve of 100 mesh gives the finest powder. Powders are also sieved through a piece of muslin or thin silk cloth when the highest degree of fineness is required as in the case of preparation of Surma.

Joshandas (Decoctions) and Sharbats (Syrups) are filtered through a piece of clean thick cloth. Joshanda prepared for Sharbats are filtered through cotton pads to ensure a greater degree of homogenity and purity of the end product. Uniformly thick layers of cotton wool or double layered flannel cloth is spread over the sieve and the decoction is passed slowly through it. When a small quantity of fluid drug is required to be filtered, then a filter paper or a flannel cloth is used. The pulpy drugs like Maweez Munaqqa, Anjeer etc., are first cleaned by washing and then soaked in water and boiled till they become a soft mass. They

are then removed from the water, allowed to cool, squeezed and the pulp is sieved through a metallic sieve or a piece of cloth.

Turanjabeen is first socked or boiled in water. When dissolved completely the solution is filtered through a piece of clean fine cloth and kept in a vessel to allow the impurities to settle down. The solution is then decanted into another container without disturbing the sediments.

5.1.3 Tadbir-e-Adviyah (Detoxification of Drugs)

Some of the plant, animal and mineral origin drugs are naturally toxic in their properties and actions. Therefore, these drugs before making the medicines are detoxicated or purified in order to enhance their therapeutic action and reduce their toxicity. The process of detoxification of the drug is called Tadbir-e-Adviyah and the drugs which undergo this process are suffixed with the term "Musaffa". Different processes of detoxification are employed for different drugs. Details of these processes for a few important drugs are described below. These should be referred along with the process prescribed in the original texts.

(i) Afyun

Dissolve Afyun in Arq-e-Gulab and filter it. The filtrate is heated till it became thick for making the Habb (Pills).

(ii) Sibr (Aloe)

Keep sibr in Apple or Bahi or Shalgham, cover it by the process of Kapoorti, heat it, till it turn brown. Now take out the elva, dry it and use.

(iii) Bhang

Soak the Bhang in Arq-e-Ajwain and dry it. Now keep it in an earthen pot, heat it to roast.

(iv) Zeera Siyah

Dip Zeera Siyah is sirka (the level of sirka should be 2 inch above the level of Zeera Siyah) for three days. After three days, Zeera Siyah is taken out and dry it to use.

(v) Rasaut

Rasaut is cut into small pieces and soaked in Araq-e-Gulab for 24 hours. It is then stirred well and sieved through a clean piece of fine cloth into a big cylindrical glass jar and the sediments are allowed to settle down. The liquid is then decanted into another vessel without disturbing the sediment and boiled till it becomes a thick mass. The purified Rasaut is called Rasaut Musaffa.

(vi) Anzaroot

Anzaroot powder is mixed with Mother's Milk or Donkey's milk to form a paste. The paste is smeared over a piece of Jhao wood (Tamarix wood) and dried directly over a charcoal fire.

(vii) Bhilawan

After removing the cap (thalamus) of the Bhilawan fruits, the juicy contents (Asal-e-Bhilawan) are squeezed out completely with the help of a red hot tongs. Thereafter, Bhilawan fruits are boiled in fresh water at least for three times. Lastly, the fruits are boiled in milk, washed with water and dried. Precaution must be taken not to touch the juice with hands as the juice is toxic.

(viii) Habb-us-Salateen (Jamalgota)

25 grams of the kernels of Jamalgota is tied in a cloth bag and boiled in one litre of Cow's milk giving sufficient time till the milk becomes dense. When cooled, the kernels are taken out from the bag and the embryo part (pitta) of the seeds is removed to obtain jamalgota Mudabbar.

(ix) Chaksu

Chaksu is kept in a cloth bag and tied from the mouth. It is then soaked in a vessel of water containing Badiyan (Fennel) equal tohalf the weight of Chaksu or Barg-e-Neem Taza (fresh Neem leaves) equal in weight of Chaksu. The water is boiled for half an ahour and then the cloth bag is removed and allowed to cool. Chaksu is then removed from the bag and rubbed between the palms to remove the outer coverings to get Chaksu Mudabbar.

(x) Azaraqi

70 grams of Azaraqi is buried in Peeli Matti (yellow clay) and water is poured over it daily for ten days. The Azaraqi is then removed and washed. The outer covering (testa) is peeled off with knofe and the cotyledons of Azaraqi are separated after removing the embryo part (pitta). Only the healthy Azaraqi is sorted out for use. It is then washed with hot water and tied in a clean cloth bag. The bag is immersed in a vessel containing two litres of milk. The milk is then boiled till it evaporates, care being taken that the bag does not touch the bottom of the vessel. Thereafter, Azaraqi is removed from the bag and washed with water to obtain Azaraqi Mudabbar.

(xi) Kibreet (Gandhak)

One part of Gandhak Amlasar and two parts of Raughan (Ghee) are taken in a Kadeha (laddle) and kept on a low fire. When Gandhak is melted, four parts of the milk is added. This process is repeated at least three times changing the fresh Ghee and Milk each time to obtain Gandhak Mudabbar.

(xii) Samm-ul-Far (Sankhiya)

Fine powder of Sankhiya is immersed in sufficient quantity of fresh Aab-e-Leemu (Lemon juice) and ground in a mortar of China clay or glass till the juice is completely absorbed. This process is repeated seven times to obtain Samm-ul-Far or Sankhiya Mudabbar.

(xiii) Shingraf

Shingraf is ground with fresh Aab-e-Leemu (Lemon Juice) till it is absorbed and a fine powder is obtained. This process is repeated three times to obtain Shingraf Mudabbar.

(xiv) Seemab

There are three following methods of purifying Seemab :

A. Seemab is ground with half burnt brick pieces for 12 hours. It is then washed with water and Seemab is separated. The whole process is repeated three times.
B. Seemab is kept in a four layered thick cloth bag (50 count) and squeezed out by pressing with hands. This process is repeated till the blackish tinge of Seemab is completely disappeared.
C. Seemab is ground with Turmeric Powder as long as the powder does not change its original colour. The resultant product is called Seemab Mudabbar.

(xv) Khabs-ul-Hadeed

A. Small pieces of Khabs-ul-Hadeeb are heated red hot in Charcoal fire and then immersed in Aab-e-Tirphala or Sirka Naishakar (Sugarcane Vinegar) by holding each piece with a tongs. The whole process is repeated seven times.
B. In this process Khabs-ul-Hadeeb is ground to powder form and kept immersed in Sirka Naishakar (Sugarcane Vinegar) or Sharab-e-Angoori (Brandy). The level of either of the two should be 5 cms. above the level of the powder. After 14 days, the Sirka Naishakar or Sharab-e-Angoori is decanted, the powder is dried and fried in Raughan-e-Badam.

(xvi) Beesh (Bachnak or Meetha Telia)

30gms. of Beesh is cut into small pieces, tied in a bag of clean fine cloth and dipped in a vessel containing milk so that the bag is completely immersed without touching the bottom. When the milk is completely evaporated, the pieces of Beesh are removed and washed well with water to obtain Beesh Mudabbar.

(xvii) Hartal

Juice of 5 Kg. of Petha (White Gourd Melon) is taken and kept in a vessel. Sixty grams of Hartal (small pieces) is put in clean, soft cloth bag and immersed in Petha juice without touching the bottom of the vessel and boiled. When the Petha juice is completely evaporated the Hartal pieces are removed and washed with water thoroughly to obtain purified Hartal or Hartal Mudabbar.

(xviii) Sang-e-Surma

There are four following methods of purifying Sang-e-Surma:

(i) A piece of Sang-e-Surma is covered with the goat's fat and kept on a low fire till all the fat is completely burnt into fumes. The pieces of Sang-e-Surma is then removed from the fire with a tongs and immersed in Araq-e-Gulab or ice water. The whole process is repeated three times.
(ii) A piece of Sang-e-Surma is immersed in Araq-e-Gulab or Araq-e-Badiyan and heated till the Araq evaporates. This process is repeated seven times.
(iii) Sang-e-Surma is immersed in Aab-e-Triphala and boiled for 12 hours.
(iv) Sang-e-Surma is kept immersed in rain water (Aab-e-Baran) for 21 days.

(xix) Ajwayin and Zeera

Either of the above drugs are soaked in Sirka Naishakar (Sugarcane Vinegar) for 72 hours. The level of sugarcane vinegar in the container should be 5 cms. above the level of the drug. The drug is then removed and allowed to dry and then roasted over a low fire before use. Besides purifying, Sirka naishakar (Sugarcane Vinegar) also enhances the efficacy of the drug.

5.1.4 Neem-Kob (Bruising)

Neem-Kob is the process by which hard and fibrous drugs (roots, stems, seeds etc.) are crushed to small pieces in an iron mortar and softened in order to obtain the maximum efficacy, when used in the preparation made by the process of decoction or infusions. The word "Neem Kofta" is suffixed to the name of the drug in the recipe/formula which has to undergo this process.

5.1.5 Tahmiz-o-Biryan-e-Adviyah (Roasting or Parching)

(a) Tahmiz (Roasting or Parching with a medium)

Tahmiz is a process in which the drugs like Chana (Gram), Jau (Barley) etc., are roasted with some medium e.g. when Chana or Jau is roasted with sand til they get swelled.

(b) Biryan (Roasting or Parching without medium)

In the process of Biryan, drugs are parched or roasted without medium e.g. drugs like Shibb-e-Yamani, Tankar, Tootiya-e-Sabz, etc. are directly put over fire in any vessel or frying pan and roasted.

5.1.6 Tarviq-e-Adviyah

In this process the juice of the fresh herb is poured in a tin-coated vessel and heated over low fire till a green froth appears on the surface. The juice is then slowly sieved through a piece of fine cloth leaving behind the froth on the surface of the cloth. The watery juice thus obtained is called Aab-e-Murawwaq.

In case of dry herbs, a decoction is first made to which a small quantity of fresh Lemon or Alum powder is added. This will separate the green contents from the decoction. The aquous portion is decanted and stored.

WEIGHT AND MEASURE

METRIC EQUIVALENTS OF UNANI CLASSICAL WEIGHT

1 Chawal	=	15 mg
1 Ratti	=	125 mg
1 Dang	=	500 mg
1 Masha	=	1 g
1 Dirham	=	3.5 g
1 Misqal	=	4.5 g
1 Tola	=	12 g
1 Dam	=	21 g
1 Chhatank	=	60 g
1 Pao	=	240 g
1 Ser	=	960 g
1 Man Tabrizi	=	2 Kg 900 g
1 Oqia	=	32 g
1 Astar	=	1 Kg
1 Surkh	=	125 mg
1 Ratal Tibbi	=	420 g
1 Qeerat	=	250 mg

In case of liquid the metric equivalents would be the corresponding litre and millitre.

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