THE UNANI PHARMACOPOEIA OF INDIA

PART - I
VOLUME - II

सत्यमेव जयते

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

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- **MONOGRAPHS**

LEGAL NOTICES

In India, there are laws dealing with certain drugs which are the subject of monographs which follow. These monographs should be read subject to the restrictions imposed by these laws wherever 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. I is the book of Standards for single drugs included therein and the standards prescribed in the Unani Pharmacopoeia of India Part-I Vol.-II would be official. If considered necessary these standards can be amended and the Chairman of Unani Pharmacopoeia Committee is authorized to issue such amendments. Wherever such amendments are made, the Unani Pharmacopoeia of India Part-I, Vol.-II would be deemed to have been amended accordingly.

सत्यमेव जयते

PALAT MOHANDAS
SECRETARY

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
आयुर्वेद, योग व प्राकृतिक चिकित्सा,
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FOREWORD

Unani System of Medicine is based on the drugs originated from plants, animals and minerals. This system, since thousands of years, is being used for improvement of human health. In the recent years, there has been resurgence of interest in the indigenous/traditional systems of medicine in both developing and advance countries of the world as the traditional drugs have no major side-effects and they help in accelerating the immunity i.e. body resistance. Furthermore, Unani drugs are time-tested, safe for use and cost effective.

However, there is a need to maintain purity, quality and safety of traditional medicines through rigorous scientific testing and standardization. It is absolutely essential to lay down pharmacopoeial standards for both single and compound drugs to bring them within the purview of the Drugs and Cosmetics Act, 1940, as amended in 1964. This necessitated to develop the standards for each Unani drug.

To fulfill the legal mandate and also to assure quality of drugs, the Government of India had set up the Pharmacopoeial Committee for Unani Medicine in 1964. A Pharmacopoeial Laboratory for Indian Medicine, Ghaziabad was also established in the year 1970. This Laboratory was established mainly to work for evolving standards for Ayurveda, Unani and Siddha drugs. The Government of India have all along been concerned with the quality of drugs in various Indian Systems of Medicine and consequently, the work in this direction was taken up by the different Laboratories i.e Drug Standardization Units of the Central Council for Research in Unani Medicine (CCRUM), New Delhi.

I am glad to say that it has now been possible to bring out the second volume of pharmacopoeial standards titled *The Unani Pharmacopoeia of India (Part-I Vol.-II)*. It comprises standards for 50 single drugs of plant origin included in the National Formularies of Unani Medicine and work on which has been carried out at various Drug Standardization Research Laboratories of the CCRUM. This would set pace for evolving standards in Unani Medicine and help researchers, pharmaceutical houses and the Government of India to enforce drug control measures on these drugs in order to maintain their quality, purity and safety for human consumption.

With the setting up of a separate Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy, we have, among other things, focused our attention on accelerating the pace of this work and currently, the work of laying down pharmacopoeial standards for more than 5000 drugs of Indian Systems of Medicine (ISM), of both plant and animal origin is in full swing. Government of India have identified 32 drug testing laboratories across the country to take up the work on single and compound formulations during the Tenth Five Year Plan, and to publish the subsequent volumes providing data on pharmacopoeial standards for various drugs investigated.

I take this opportunity to express my appreciation to Directors and scientific staff of Pharmacopoeial Laboratory for Indian Medicine, Ghaziabad and Central Council for Research in Unani Medicine, New Delhi and the experts of Unani Pharmacopoeia Committee, along with the technical and administrative staff of the Department for their valuable contribution and help in accomplishing this task.

As the first effort of its kind in the field of Unani System, there is always room for further improvement and we would greatly welcome suggestions and advice from the experts in the field.

New Delhi
9.9.2004

(Palat Mohan Das)
Secretary to the Government of India
Ministry of Health & Family Welfare
Department of Ayurveda, Yoga & Naturopathy,
Unani, Siddha and Homoeopathy (AYUSH)

PREFACE

Our country has a unique distinction of having a variety of geographical and climatic conditions and is rich in flora and fauna many of which are used in the preparation of poly-pharmaceutical recipes of Unani Medicine and a few as home remedies in the country.

Unani System of Medicine is a scientific system and its practitioners were innovative in therapeutics and carried out clinical trials of the local flora from the countries it passed through and discovered newer medicines and added to the classical literature. During Colonial rule, the Unani System of Medicine got a setback as it was not patronized by the then Government, and was confined to the rural areas where it was protected and nurtured.

Urbanization led to neglect of development and maintenance of forest and in turn the availability of rich flora. Later, better communication, transport and establishment of agencies for supply of crude drugs led to commercial manufacturing of Unani drugs on mass scale and many factories were established. In this set-up the Unani practitioners could no longer processes and prepare their own medicines but started depending on pharmaceutical houses run commercially and on supplier of the crude drugs to the extent they needed. There was no governmental control on the manufacturer/pharmaceutical houses to ensure the quality of medicines marketed.

The Government of India constituted a committee under the chairmanship of Lt. Col. R.N. Chopra in 1946, which had gone into the question of need for proper identification of plants used in Indian Systems of Medicine and control over collection and distribution of crude drugs, and made positive recommendations for compilation of pharmacopoeias. After independence not only the Unani education, but also Unani drugs, their marketing and manufacturing were given a concrete shape.

In compliance with the recommendations of various committees constituted by Union Government, the CCRIMH was established in 1969 by the Government of India for research in all aspects including drug standardization in Indian Medicine and Homoeopathy. In 1978, this Council was reorganized into four research councils and the research work in Unani System of Medicine was entrusted to Central Council for Research in Unani Medicine (CCRUM).

The Pharmacopoeial Laboratory for Indian Medicine (PLIM), Ghaziabad was established in 1970 for testing and standardization of single drugs and compound formulations of Indian Systems of Medicine (Ayurveda, Unani & Siddha). Unfortunately till date there is no component for Unani System of Medicine in this laboratory. In spite of repeated efforts by Unani Pharmacopoeia Committee and individual Unani experts at various levels, it could not be achieved so far. The CCRUM have six survey units in different states and also established standardization work of single and compound medicines at several Drug Standardization Research Units established by the Council.

The first Unani Pharmacopoeia Committee was constituted in 1964 under the chairmanship of Col. Sir Ram Nath Chopra. The Committee was reconstituted in 1968, 1977, 1988, 1994, 1998 and 2002 under the chairmanship of Dr. Hussain Zaheer, Dr. Mohd. Yusufuddin Ahmed, Dr. A.U. Azmi, Prof. Hakim Syed Khaleefathullah (twice) and Dr. Sajid Hussain, respectively for undertaking the work of Unani Pharmacopoeia of India.

After the publication of the first, second and third part of the *National Formulary of Unani Medicine* consisting of 441, 202 & 103 formulations, respectively, the fourth part of *National Formulary of Unani Medicine* was prepared. In this process, a list of single drugs which go into the formulations emerged and the committee applied their minds to the task of collection of data from various sources such as PLIM/CCRUM where the experimental work has been carried out and data produced.

With the uniformity in the educational pattern of Unani System of Medicine all over the country, the Government decided that there should be uniformity in the Unani medicines marketed. In so far as their identity, strength and purity are concerned and to assure the quality of the medicines, through proper drug control measures, to serve the public and the profession, the Government has published *National Formulary of Unani Medicine Part-I, Part-II* and *Part-III.* The Unani Pharmacopoeia Committee has completed *The Unani Pharmacopoeia of India, Part-I* for better quality assurance.

The Government of India have brought the Unani drugs under the purview of the Drugs and Cosmetics Act, 1940. The publication of the *National Formulary of Unani Medicine Part I, II & III* and *The Unani Pharmacopoeia of India Part-I, Vol. I* could help the Government to give a base for enforcement of the Act in respect of the standards.

The Unani Pharmacopoeia 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 Units of Central Council for Research in Unani Medicine. The modern medicine in Western countries has also passed through this phase decades ago. The Unani Pharmacopoeia Committee has made a beginning in this direction with regard to compilation of *The Unani Pharmacopoeia of India, Part-I, Vol.-I* comprising 45 monographs on single drugs of plant origin. *The Unani Pharmacopoeia of India, Part-I, Vol.-II* comprises 50 monographs of single drugs of plant origin which are used in one or more formulations enlisted in the *National Formulary of Unani Medicine, Part-I, Part-II, Part-III* and *Part-IV.* In compiling the monographs, the title of each drug has been given as standardised in the National Formularies of Unani Medicine. The description of the drug gives its identities in scientific nomenclature and very brief information about its source, occurrence, distribution etc.

It is followed by the list of other names in Arabic, Persian and Urdu followed by Indian regional languages. The monograph records the detailed gross and microscopic description of the drug and its microscopic tissue structures etc., having a pharmacognostic value in identification especially when the drug is in powder form.

The monograph also gives details of chemical constituents, physico-chemical standards and assay, pH value, extractive values and TLC behaviour of petroleum ether (60-80°C) extract. In the efforts to compile pharmacopoeial monographs of Unani drugs, the classical attributes of the drugs, according to Unani system, like action and therapeutic uses along with the dosage 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 microscopical examinations are given in appendices.

The Unani Pharmacopoeia Committee feels that with the publication of *The Unani Pharmacopoeia of India – Part-I, Vol.-II* comprising 50 single drugs of plant origin, the format and procedure have been laid down and there should not be any difficulty for the researchers and pharmaceutical houses to plan and expedite their research work.

On behalf of the Unani Pharmacopoeia Committee, I feel it is my duty to place on record our sincere thanks and appreciation to the Government of India; Director, PLIM, Ghaziabad; Director, CCRUM; Dr. Rajeev Kr. Sharma, Sr. Scientific Officer, PLIM, Ghaziabad and other Unani scholars for the whole-hearted co-operation in preparing the monographs on single drugs. I thank all the members of the Unani Pharmacopoeia Committee without whose co-operation this volume could not have seen the light of the day.

I place on record my sincere thanks to Prof. Hakim Anis A. Ansari, Adviser (Unani)/ Member Secretary, UPC for his timely guidance and initiatives for completing this assignment. I also thank Hakim S. Afaq, Deputy Adviser (Unani) for his continuous support and visionary attitude in completing and finalizing each of the monographs of this Pharmacopoeia. It would not be out of place if I mention the names of the officials Dr. M.A. Qasmi, Asstt. Adviser (Unani), Dr. M.J. Subhani, Asstt. Adviser (Unani), Shri O.P. Koli, Section Officer (APC), Shri Ashok Kumar R.A. (Chem.) and Shri N. Padma Kumar, R.A. (Botany) and other staff of the APC Cell, Department of AYUSH, Ministry of Health & Family Welfare, New Delhi for convening the meetings and finalizing the manuscript for printing.

Lastly, I thank all those who have directly or indirectly contributed in the preparation of this volume.

Dr. Sajid Hussain
Chairman
Unani Pharmacopoeia Committee

New Delhi
Dated : 9.9.2004

GENERAL NOTICES

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

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 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 and as procured from experts, scholars of Unani Medicine and officials working in the same field in different state.

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 gram (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 gram of distilled water at 15^0 C.

Metric measures are required by the Pharmacopoeia to be graduated at 25^0 C and all measurements involved in the analytical operations of the Pharmacopoeia are intended, unless otherwise stated to be made at the 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 with in the permitted and specified limits of lead, arsenic and heavy metals and not showing abnormal odour, colour, sliminess, mould or other evidence of deterioration.

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

The quantitative tests, e.g., total ash, acid soluble ash, water soluble ash, alcohol soluble extractive, water soluble extractive, other soluble extractive, moisture content, volatile oil content and assays are 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 on alternate method in any instance if he is satisfied that the method which is he uses will give the same result as Pharmacopoeial method in suitable instance, the methods of micro analysis of equivalent accuracy may be substituted. However, in the event of doubt or dispute, the methods of analysis of the Pharmacopoeia alone are authoritative.

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 weighting following an additional hour of drying of further ignition.

Constituents : Under this head, only the names of important chemical constituents, groups of constituents, reported in research publication 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 four meanings in order that the meaning to be attached to the expression in each instance may be clear, the following notations are used per cent w/w (Percentage weight in weight) expresses the number of grams of active substance in 100 grams of product.

Percent w/v (Percentage weight in volume) expresses the number of grams 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 grams of product.

Percentage of alcohol, all statements of alcohol (C_2H_5OH) refer to percentage by volume at 15.56 C.

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 general sense irrespective of con-comittent chemical changes.

Statements of solubilities which are express as a precise relation of weights of dissolved substance to 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 gram of a solid or 1 milliliter 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 for 1 part 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 in this Pharmacopoeia are as provided in recognized Unani classics and in the National Formulary of Unani Medicine (Part-I).

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 sated 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.

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

m	–	Metre
l	–	Litre
mm	–	Millimeter
cm	–	Centimeter
M	–	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
PS	–	Primary Standard

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 physician 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 Government of India considered it expedient to utilize the existing law "The Drugs & Cosmetics Act, 1940" to control the Unani, Ayurvedic & Siddha Drugs in a limited manner. The act was accordingly amended in 1964, namely:-

1. The manufacture should be carried under prescribed hygienic conditions, under the supervision of a person having prescribed qualification.
2. The raw material used in the preparation of drugs should be genuine and properly identified.
3. 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 second Unani Pharmacopoeia Committee was constituted 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 by 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 Government 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 constituted 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, Chairman
Prof. & Head,
Department of Pharmacology,
M.R. Medical College,
Gulbarga,
Karnataka.

2. Hakim Abdul Hameed, Member
President,
Institute of History of Medicine
and Medical Research,
Hamdard Building,
Delhi.

3. Hakim Shakeel Ahmed Shamsi, Member
Hakim Abdul Aziz Road,
Lucknow.

4. Hakim S.M. Shibli, Member
Hony. Director,
Central Research Institute of Unani Medicine,
11-4-625, Dilkusha, A.C. Guards,
Hyderabad.

5. Dr. H.M. Taiyab, Member
Principal,
Ajmal Khan Tibbiya College,
Aligarh Muslim University,
Aligarh.

6. Hakim Syed Khaleefathullah, Member
75, Pycrofts Road,
Madras.

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 fourth Unani Pharmacopoeia Committee was constituted in 1988 vide notification No. U. 20012/1/87 APC dated, the 13th June, 1988, under the Chairmanship of Dr. A.U. Azmi. The Committee consisted of the following:-

1.	Hakim Dr. A.U. Azmi, D-59, Abdul Fazl Enclave, Jamia Nagar, New Delhi-110 025.	Chairman

2.	Hakim Syed Khaleefathullah, 49, Bharati Salai, Madras-600 005.	Member
3.	Hakim Saifuddin Ahmed, Hakeem Mahmoodul Haq Road, Meerut (UP).	Member
4.	Hakim Qamaruzzaman, Director (ISM), Govt. of Bihar, Patna-800 004.	Member
5.	Hakim 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.	Hakim Malik Inamul Haq, Superintendent, Govt. Unani Pharmacy, Bhopal.	Member
8.	Prof. Hakim M. Arshad Sheikh, Principal, Tibbia College & Hospital, Nagpada, Bombay-400 008.	Member
9.	Hakim Syed Mehmood Najmi, Regional Dy. Director, Deptt. of ISM & H, Hyderabad – 500 001 (AP).	Member
10.	Hakim Mohd. Qayamuddin, Principal, Ajmal Khan Tibbia College, A.M.U., Aligarh-202 001 (UP).	Member

11.	Hakim 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

The functions of the Committee shall be as follows:

1. (a) To prepare official formulary of compound formulations/preparations which are frequently used in Unani practice throughout the country; and

   (b) To prepare official pharmacopoeia of Single Drugs whose identity and therapeutic value is under no doubt.

2. To provide standards for drugs and medicines of therapeutic efficacy or pharmaceutical necessity frequently used in the Unani Practice.

3. To lay down tests standards for identity, quality and purity of the drugs used in Unani system.

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

5. To provide all other information regarding the distinguishing characteristics, methods of preparations, dosages, method of administration with various vehicles and their toxicity.

A. FORMULARY SUB-COMMITTEE

1.	Hakim Saif-ud-din Ahmad	Chairman
2.	Hakim R.L. Verma	Member
3.	Hakim S.M. Najmi	Member
4.	Dr. A.M. Ansari	Member
5.	Prof. Hakim Qamruz Zaman	Member
6.	Hakim Mohd. Arshad Sheikh	Member

Functions:

To work out details of the formulations to be included in the National Formulary of Unani Medicine and to lay down standards of compound formulations.

B. SINGLE DRUG-SUB COMMITTEE

1.	Hakim Madan Swarup Gupta	Chairman
2.	Hakim Syed Khaleefathullah	Member
3.	Hakim Malik Inamul Haq	Member
4.	Hakim M. Qayam-ud-din	Member
5.	Dr. A.H. Israili	Member
6.	Dr. Rajendra Gupta	Member

Functions:

To consider monographs on single drugs providing information on identity, synonyms, descriptions etc.

C. COMMITTEE TO FRAME RULES AND REGULATIONS

1.	Hakim A.U. Azmi	Chairman
2.	Hakim M.S. Gupta	Member
3.	Hakim Saif-ud-din Ahmad	Member
4.	Hakim M.I. Haq	Member
5.	Prof. Hakim M. Arshad Sheikh	Member

Functions:

1. To suggest procedure and rules for conduct of business of the Committee.

2. The non-official members on these sub-committees shall be entitled to draw T.A. and D.A. as admissible under the rules of the Government of India. In cases of the official members the expenditure on TA/DA shall be met from the source from which their pay is being drawn except where the respective state Governments/autonomous bodies have stipulated that TA/DA to their officials may be met by the Government of India.

WORKING GROUP UNDER UNANI PHARMACOPOEIA COMMITTEE

1.	Hakim A.U. Azmi	Chairman
2.	Hakim Saif-ud-din	Member
3.	Hakim M.S. Gupta	Member
4.	Dr. Rajendra Gupta	Member

SPECIAL INVITEES

1.	Prof. Hakim Syed Ishtiaq Ahmad	A&U Tibbia College, Karol Bagh, New Delhi
2.	Prof. Hakim Altaf Ahmad Azmi	Institute of History of Medicine and Medical Research, Jamia Hamdard, Tughlaqabad, New Delhi

Keeping in view the vacancy in Dy. Advisor (Unani) in the Ministry of Health & F.W. since 1984, the Government of India has decided that till such time and until further order, 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.

The fifth Unani Pharmacopoeia Committee was constituted in September, 1994 vide Office Order No.:U.20012/1/94-APC dated 13th September, 1994 with following experts:

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, Member
   Head,
   P.G. Department of Ilmul Adviya,
   A.K. Tibbia College,
   A.M.U.,
   Aligarh-202 001 (UP).

6. Hakim Ved Prakash Sharma, Member
   Bassi Pathanan,
   Distt. Fatehgarh,
   Patiala, Punjab.

7. Hakim Syed M. Ghayasuddin Ahmed, Member
   Regional Research Institute of Unani Medicine,
   1, West Mada Church Street,
   Royapuram,
   Madras-400 006.

8. Prof. Hakim S. Shaji Haider, Member
   Principal,
   Govt. Unani Medical College,
   Red Cross Building,
   Race Course Road,
   Bangalore (Karnataka).

9. Hakim Mohd. Khalid Siddiqui, Member
   Director, CCRUM,
   61-65, Institutional Area, Janakpuri,
   New Delhi-110 058.

10. Hakim M.A. Wajid, Member
    C.R.I.U.M.,
    Opp. E.S.I. Hospital,
    Eragadda,
    Hyderabad (AP).

11. Hakim (Mrs.) Ummul Fazal, Member
    Dy. Director, CCRUM,
    5,Panchsheet Shopping Centre
    New Delhi-110 017.

12. Prof. M.S.Y. Khan, Member
    Deptt. of Pharmaceutical Chemistry,
    Jamia Hamdard, Hamdard Nagar,
    New Delhi.

13. Dr. S.S. Handa, — Member
Deptt. of Pharmaceutical Chemistry,
Patiala University,
Patiala, Punjab.

14. Dr. R.U. Ahmed, — Member
Director,
P.L.I.M., C.G.O. Complex,
Kamla Nehru Nagar,
Ghaziabad.

15. Prof. Wazahat Hussain, — Member
Chairman,
Deptt. of Botany,
A.M.U.,
Aligarh – 202 001 (UP).

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

The functions of the committee shall be as follows:-

(a) (I) To prepare official formulary of compound formulations/preparations Which are frequently used in Unani practice throughout the country;

and

(II) To prepare official Pharmacopoeia of single drugs of whose identity and therapeutic value there is no doubt.

(b) To provide standards for drugs and medicines of therapeutic usefulness or Pharmaceutical necessity sufficiently used in the Unani practice.

(c) To lay down tests standards for identity, quality and purity of the drugs used in Unani Systems.

(d) To ensure as far as possible uniformity in physical properties and active constituents.

(e) To provide all other information regarding the distinguishing characteristics, methods of preparations, dosage method of administration with various vehicles and their toxicity.

The Government of India has also set up the following sub-committees and a Working group consisting of the members of the Unani Pharmacopoeia Committee to assist in the task preparing the formulary and Pharmacopoeia vide Deptt. of Health letter No.U.20012/1/94-APC dated 14th December, 1994.

In continuation of this Ministry's order No.U.20012/1/94-APC dated the 13th September, 1994, the Government of India is pleased to constitute the Sub-Committee under Unani Pharmacopoeia Committees consisting of the following members.

FORMULARY SUB-COMMITTEE

1.	Prof. Hakim Syed Khaleefathullah	Chairman
2.	Hakim (Mrs.) Ummul Fazal, Delhi	Member
3.	Hakim Jameel Ahmad, Delhi	Member
4.	Hakim Mohd. Iqbal Ali, Hyderabad	Member
5.	Hakim Ved Prakash Sharma, Patiala	Member

Functions:

The formulary Sub-committee will work out the details of compound formulations/ preparation to be included in the official formulary.

To lay down standards of compound formulations and provide information regarding the distinguishing characteristics methods of preparation, dosage, method of administration with various vehicles and their toxicity.

2. SINGLE DRUG SUB-COMMITTEE

1.	Prof. Hakim Zillur Rahman, Aligarh	Chairman
2.	Hakim Mohd. Ghayasuddin Ahmad, Madras	Member
3.	Prof. Wazahat Hussain, Aligarh	Member
4.	Hakim M.A. Wajid, Hyderabad	Member
5.	Hakim S. Shaji Hyder, Bangalore	Member

Functions:

The single drug sub-committee will consider the preparation of monographs or single drugs, whose identity and therapeutic value is not in doubt.

It will evolve the methods to solve the identity of controversial drugs.

3. DRUG SAFETY & STANDARDISATION SUB-COMMITTEE

1.	Hakim Mohd. Khalid Siddiqui, Delhi	Chairman
2.	Hakim Faiyaz Alam, Bombay	Member

3.	Prof. M.S.Y. Khan, Delhi	Member
4.	Dr. S.S. Handa, Chandigarh	Member
5.	Dr. R.U. Ahmad,Ghaziabad	Member

Functions:

The Drug Safety and Standardization sub-committee will lay down test standards for identity, quality and purity of the drugs used in Unani System and ensure as far as possible uniformity in physical properties and active constituents.

4. PHARMACOPOEIAL STANDARD REVIEW WORKING GROUP

1.	Dr. S.S. Handa, Chandigarh	Chairman
2.	Dr. M.S.Y. Khan, Delhi	Member

Functions:

The working group to review the pharmacopoeial standards will go through the work of standardization done so far on compound and single drugs by the units of the Central Council for Research in Unani Medicine and recommend them if found in order to the Unani Pharmacopoeia Committee for taking a decision in accepting them as pharmacopoeial standards. The sub-committee will also suggest any improvements/deletion to the parameter being carried out by the Central Council for Research in Unani Medicine.

The Sixth Unani Pharmacopoeia Committee was constituted under the chairmanship of Prof. Hm. Syed Khaleefathullah vide Order No.U.20012/2/97-APC dated 6th January, 1998 consisting of the following members:-

1.	Prof. Hakim Syed Khaleefathullah	Chairman

OFFICIAL MEMBERS

2.	Drugs Controller General(I)	Member (Ex-officio)
3.	Director, PLIM	Member (Ex-officio)
4.	Director, CCRUM	Member (Ex-officio)

NON-OFFICIAL MEMBERS

5.	Prof. Hakim Zillur Rehman	Member
6.	Hakim Faiyaz Alam	Member
7.	Prof. Wazahat Hussain	Member
8.	Prof. M.S.Y. Khan	Member
9.	Hakim Habibur Rehman	Member

10.	Dr. S. Nandakumar	Member
11.	Dr. M.A. Jafri	Member
12.	Dr. A.H. Israily	Member
13.	Dr. (Mrs.) Aliya Aman	Member Secretary

FORMULARY SUB-COMMITTEE

1.	Prof. Hakim Zillur Rehman	Chairman
2.	Hakim Faiyaz Alam	Member
3.	Hakim Mazher Subhan Usmani	Member
4.	Hakim Wahabur Rehman	Member
5.	Hakim Ved Prakash	Member
6.	Dr. (Mrs.) Aliya Aman	Member Secretary

Functions:

The Formulary Sub-Committee will work out the details of compound formulations/ preparations to be included in an official formulary.

It will provide information regarding the distinguishing characteristics, methods of preparation, dosage, method of administration with various vehicles and their toxicity.

DRUG STANDARDISATION SUB-COMMITTEE

1.	Dr. R.U. Ahmad	Chairman
2.	Prof. S.H. Afaque	Member
3.	Dr. Muzaffar Iqbal	Member
4.	Dr. M.K. Siddiqui	Member
5.	Dr. (Mrs.) Aliya Aman	Member Secretary

Functions:

The Sub-Committee will deal with all the issues relating to chemistry and Phytochemistry of single and compound drugs monographs.

SINGLE DRUGS SUB-COMMITTEE

1.	Prof. M.S.Y. Khan	Chairman
2.	Dr. M.A. Jafri	Member
3.	Dr. Syed Jaleel Hussain	Member
4.	Dr. Sundarwala	Member
5.	Dr. Nand Kumar	Member
6.	Dr. (Mrs.) Aliya Aman	Member Secretary

Function:

Single Drug Sub-Committee will deal with taxonomy, pharmacognosy and botany of single drugs whose identity and therapeutic values are in doubt.

The Seventh and the present Unani Pharmacopoeia Committee was constituted under the Chairmanship of Dr. Sajid Hussain vide Office Notification No.U.20012/1/2002-APC dated 17th October,2002. The Committee consists of the following experts:

OFFICIAL MEMBERS:

1.	Dr. Sajid Hussain H.No.7/90, Zaheer Nagar Colony, Habsiguda-Hyderabad, Andhra Pradesh-500057.	Chairman
2.	Drug Controller General of India (or his representative), DGHS, Nirman Bhawan, New Delhi.	Member (Ex-officio)
3.	The Director, Pharmacopoeial Laboratory of Indian Medicine, Ghaziabad (or his representative) -201002	Member (Ex-officio)
4.	The Director Central Council for Research in Unani Medicine, 61-65, Institutional Area, Opp.'D' Block, Janakpuri, New Delhi (or his representative)	Member (Ex-officio)
5.	Adviser (Unani), Deptt. of ISM&H, Ministry of Health & Family Welfare New Delhi	Member Secretary

NON-OFFICIAL MEMBERS:

1.	Prof. Hakim S. Zillur Rahman Chairman, Ibn-e-Sina Academy, Tijara House, Dodhpur, Aligarh-202001	Member

2.	Prof. Hakim M.A. Jafry Dean, Faculty of Medicine(Unani), Jamia Hamdard,New Delhi-110062 (in service).	Member
3.	Hakim S. Jaleel Hussain Dy. Director, Central Research Instt.of Unani Medicine, Eraggadda, Opp.ESI Hospital, Hyderabad (Andhra Pradesh)	Member
4.	Prof. Hakim Naim A. Khan Chairman, Deptt. of Ilmul Advia, A.K.Tibbia College, AMU, Aligarh (in service)-202001.	Member
5.	Prof. Dr. M.S.Y. Khan Professor Emeritus, Hamdard University, New Delhi-110062	Member
6.	Dr. M. Sajid Ansari 454-E, Kaila, Near New Masjid,Ghaziabad-201009	Member
7.	Prof. Dr. S.H. Afaq I/c Pharmacognosy Division, P.G.Deptt. of Ilmul Advia, A.K.Tibbia College, AMU, Aligarh-202001	Member
8.	Dr. Yatender Kumar Singh Rathore Joint Director, Central Reveneus Control Lab., PUSA, New Delhi110012.	Member
9.	Prof. Hakim Jamil Ahmad Chairman, Deptt. of Moalijat, Hamdard University,New Delhi-110062.	Member
10.	Dr. Asad Mueed Manager, Research and Development Division, Hamdard Dawakhana,Delhi-110006.	Member

11. Hakim H.M. Farouqui Member
P.O. Muradnagar,
Distt. Ghaziabad (UP).

The functions of the Committee will be:-

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 and
4. Such other matters as are identical and necessary for preparation of Unani Pharmacopoeia.

As far as the pharmacopoeial standards for Unani Medicine are concerned, the Pharmacopoeial 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 Pharmacopoeial Laboratory for Indian Medicine, Ghaziabad. So far as 45 and 50 Pharmacopoeia Monographs on single drugs of plant origin used in National Formularies of Unani Medicine have been published in the Unani Pharmacopoeia of India, Vol. I and II respectively.

The Committee while appreciating the efforts made by Govt. of India to initiate the work on Standardization of Unani Drugs, is aware of the fact that steps taken so far, are inadequate and need to be further accelerated. The Committee strongly recommends that the Govt. of India should expedite the establishment of Drug Standardization Laboratories for Unani Medicine and setting up of drug farms from where genuine and authenticated drugs can be supplied. The Committee also recommends to take suitable steps to strengthen Pharmacopoeial Laboratory in Indian Medicine with Unani component and on the modern scientific lines so that work of bringing out the Unani Pharmacopoeia of India on single and compound drugs could be effectively worked out.

The Unani Pharmacopoeia Committee welcomes the efforts taken by the Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry of Health and F.W. in identifying 32 laboratories through out the country for carrying the pharmacopoeial work on single and compound drugs of AYUSH.

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

Prof. Anis A. Ansari
Member Secretary
Unani Pharmacopoeia Committee

MONOGRAPHS
PHARMACOPOEIAL STANDARDS
OF
SINGLE UNANI DRUGS

AAQARQARHA
(Root)

The drug Aaqarqarha consists of dried roots of *Anacyclus pyrethrum* DC. (Asteraceae). A perennial, procumbent herb. Leaves bipinnatisect, segments linear, ray florets white, purplish beneath. The plant is indigenous to North Africa and occurs throughout the year. Flowering and fruiting take place during winter season.

OTHER NAMES:

Arabic : Aaqarqarha, Ood-ul-qarah
Persian : Beikh-e-Tarkhun Kohi, Kakrah
Bengali : Akarkara
English : Spanish Pellitory
Gujarati : Akorkaro
Hindi : Akarakara
Kannada : Akkal -kare
Malayalam : Akkalkaruba
Marathi : Akkalkadha
Oriya : Aakarokara
Punjabi : Aqarqara
Sanskrit : Akarakarava
Tamil : Akkalkadha
Telugu : Akkalkraha
Urdu : Aaqarqarha

DESCRIPTION:

Macroscopic : The roots are 8-12 cm long and 0.5-1 cm thick, more or less cylindrical. They are brown in colour, roughly shrivelled, sometimes bear bristly remains of the leaves on the upper end and a few rootlets below.

Microscopic : The transverse section of the root is more or less circular in outline and bounded by several layers of tangentially flattened cork cells composed of thick walls. Stone cells are also found in the outer bark. The cork cambium on inner side have a few layers of parenchyma cells constituting the secondary cortex. It is followed by a single layer of endodermis. After the secondary growth takes place major portion of the stellar region is occupied by radiating secondary xylem in discrete strands capped with a few layers of secondary phloem on outer side. The secondary wood is interrupted by broad rays. The xylem and phloem are made up of usual components. A small stony pith is often present in young roots.

In older roots about 25-30 strands of secondary xylem are observed. Vessels are mostly in tangential bands and fibres are found in small groups associated with vessels. Schizogenous intercellular spaces form the special structures, the secretory ducts, each lined by cell to cell and their distribution is most common in the middle cortical layers and secondary xylem and phloem. Crystals of varying shape and sizes abundantly occur in the parenchyma cells of phloem, xylem, ray and pith region.

Powder: Powder greyish brown in colour, gine to touch bears a characteristic aromatic odour and pungent taste. The powder under the microscope after cleaning with 75% chloral hydrate revealed that it is made up of abundance of stone cells, fibres and crystals of calcium oxalate of varying shape and sizes. In addition, vessels type of parenchyma and sieve tube cells also constitute the root powder.

CHEMICAL CONSTITUENTS :

Alkaloids, proteins, sugars, volatile oils, aluminium, iron, magnesium and potassium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2% , Appendix 2.2.2
Total Ash	-	Not more than 6.5% , Appendix 2.2.3
Acid insoluble ash	-	Not more than 2.5% , Appendix 2.2.4
Alcohol-soluble extractives	-	Not less than 4% , Appendix 2.2.6
Water-soluble extractives	-	Not less than 16% , Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^0) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Pet. Ether (2:3)	I_2 vapours	1	0.94

TEMPERAMENT	: Hot 3^0 Dry 3^0
ACTION	: Mukhaddir, Muqawwi-e-Bah, Moharrik, Musakkin
THERAPEUTIC USE	: Waj -ul- Asnan, Falij, Surfa, Bohat-us-Saut, Zof-e- Bah
DOSE	: 2 to 3g
IMPORTANT FORMULATIONS	:Anqaruya-e-Kabir, Barshasha, Jawarish-Zarooni Sada, Luboob Sagheer, Majoon-e-Baladur, Majoon-e-Salab, Raughan-e-Seer, Raughan-e-Sudab, Tila-e-Mulazziz, Sunoon-e-Mukrij-e-Rutubat, Sunoon-e-Muluk, Habb-e-Falij Mulayin, Habb-e-Mumsik Qawi, Majoon-e-Zabeeb, Raughan-e-Qust, Sunoon-e-Mujalli, Qairooti-e-Aarad-e-Karsana.

AFSANTEEN
(Stem)

The drug Afsanteen consists of dried stem pieces of *Artemisia absinthium* Linn. Syn. *Absinthium vulgare* Gaertn., *A. officinale* Lam. (Asteraceace). The plant is found in Kashmir upto 2500 m Nepal and mountanious districts of India. It is a perennial plant and occurs throughout the year. Flowering and fruiting takes place from July to September.

OTHER NAMES :

Arabic	:	Khatraq
Persian	:	Marwah Afsanteen Rumi, Marw
Bengali	:	Mastaru
English	:	Absinth, Wormwood
Gujarati	:	Mastaru
Hindi	:	Vialayati Afsanteen
Kannada	:	Varuvalu
Kashmiri	:	Tethwan
Malayalam	:	Nipampala
Tamil	:	Machipattri
Telugu	:	Tartiha
Urdu	:	Afsanteen

DESCRIPTION :

Macroscopic : Dried sample of the drug consists broken stem, twigs, leaves and flower heads. The stem and twigs have prominent ridges and furrows covered by white hairs . Leaves and twigs are silvery hoary on both surfaces. Flowers heads show the receptacle with long white hairs.

Microscopic : The stem in transverse section shows a prominent wavy outline. The young stem and twigs show outer single layer of epidermis which consists of cubical cells. Many of the epidermal cells are extended outwards to form trichomes. The trichomes are formed of cells, arranged in single row. The epidermis followed by the cortical portion 4-6 layers of collenchymatous cells the endodermis is of parenchymatous cells. The cork of mature stem is 2-3 layered thick and phelloderm remains of 1-3 layers of thick cells.

The powdered drug is brownish yellow in colour. On examining the characteristic, nonlignified hairs were found to be T shaped. The hairs have 1-4 celled stalk and are collapsed twisted and broken, glandular hairs, stalk 1-2 celled, the glandular portion consisting of 4-8 secreting glands surrounded by membrane. Few simple hairs from flowers are long and upto 0.09 mm wide. The trichomes of the leaf fragments are either with a single celled stalk and with bicellular head or the multicellular stalk is with the unicellular head. The epidermal fragments are with elliptical stomata fragments of mesophyll and palisade cells containing chloroplastids, tracheids are mostly spiral upto

0.05 mm in width. Some sclerenchymatous fibres are with thick usually lignified walls and simple pores.

CHEMICAL CONSTITUENTS :

Phenols/tannins, glycosides, carbohydrates, lead, aluminium, iron, calcium, magnesium, potassium and sodium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2% , Appendix 2.2.2.
Total Ash	-	Not more than 8% , Appendix 2.2.3.
Acid insoluble ash	-	Not more than 3% , Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 9% , Appendix 2.2.6.
Water-soluble extractives	-	Not less than 18% , Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^0) extract :

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. ether: Diethyl ether (2:3)	I_2 vapours	4	0.34,0.43,0.78,0.87

TEMPERAMENT : Hot 1^0 Dry 3^0

ACTION : Mudirr-e-Baul, Daf-e-Humma, Qatil-e-Kirm-e- Shikam, Mufatteh Sudad, Muqawwi-e-Meda, Mohallil-e-Waram.

THERAPEUTIC USE : Deedan-e-Ama, Waram-e-Kabid, Waram-e-Tehal, Zof-e- Dimagh, Sara, Humma, Rasha, Falij, Laqwa, Istrirkha, Bawaseer.

DOSE : 4 to 9 g

IMPORTANT FORMULATIONS : Itrifal-e-Deedan, Araq-e-Afsanteen.

ANAR
(Leaf)

The drug Anar (Barg) consists of dried leaves of *Punica granatum* Linn. (Punicaceae). It is considered to be native of Iran, Afghanistan and Baluchistan. It is also found growing wild in the Himalayas between 900 to 1800 m and also cultivated throughout India. Flowers occur during April to July while fruiting takes place during July to September.

OTHER NAMES :

Arabic	: Waraq-ur-Rumman
Persian	: Barg-e-Anar
Assamese	: Dalim
Bengali	: Dalim Patra
English	: Pomegranate Leaf
Gujarati	: Dadam
Hindi	: Anar Patta
Kannada	: Dalimbe-Kayi
Kashmiri	: Danposh
Malayalam	: Dadimam, Mamtalam, Pumatalam, Raktabijam, Talimatalam
Marathi	: Dalimba
Oriya	: Dalimbo Patro
Punjabi	: Anar Patta
Sanskrit	: Madhubija, Raktabija, Suphala, Svadvamta,
Tamil	: Kalumal, Madala, Madulam, Madulungam, Pumadalai
Telugu	: Dadimamu, Dalimma, Karakamu, Fulladanimma
Urdu	: Barg-e-Anar

DESCRIPTION :

Macroscopic : Leaves are green, opposite, petiolate, ovate, obtuse entire, 2-8 cm long and 0.5 to 2 cm broad, shinning above, narrower at both the ends, especially at the base, inter-marginal nerve distinct.

Microscopic : In transverse section, cells of the upper epidermis of the lamina are rectangular and tangentially elongated in shape. Stomata are absent in upper epidermis. The cells of the lower epidermis have distinct wavy cells and varying number of stomata of anomocytic type. Outer walls of lower and upper epidermal cells have thin layer of cuticle. The mesophyll consists of single layer of palisade cells and 4-6 layers of spongy parenchyma. The palisade cells are elongated and contain chloroplast and starch grains.

Transverse section of the leaf through the midrib region is slightly convex above and very deeply convex below. Just below the lower and upper epidermis there is a layer of collenchyma cells. Between the collenchyma and vascular arc lies the cortex consisting of 5-8 layers of thin walled parenchymatous cells. Rosette crystals of calcium oxalate are found in the cortical cells. The petiole shows the same anatomical details as the midrib.

Powder: The crude drug powder is greenish brown colour. Microscopic examination shows the presence of parenchymatous cells of lower and upper epidermis, parenchymatous cells of mesophyll, cortical cells of petiole, cells of sclerenchyma, vascular tissues and stomata.

CHEMICAL CONSTITUENTS :

Glycosides, steroids, phenolic compounds / tannins and resins, iron, magnesium, sulphate, potassium, sodium.

IDENTITY, PURITY & STRENGTH:

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	7%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	0.5%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	18%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	29%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^0) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Chloroform (7:3)	I_2 vapours	4	0.3, 0.5, 0.6, 0.8.

TEMPERAMENT : Cold, Dry

ACTION : Muqawwi-e-Kabid, Muqawwi-e-Aam, Qabiz, Habis-ud-dam

THERAPEUTIC USE : Khafqan, Qai, Ishal, Qula, Khushunat-e-Halaq, Jiryan-ud-Dam

DOSE : 5-10 g

IMPORTANT FORMULATIONS : Joshanda Bara-e-Mazmaza.

ANARDANA
(Seed)

The drug Anardana consists of dried seeds of *Punica granatum* Linn.(Punicacea) It is considered to be native of Iran, Afghanistan and Baluchistan. It is also found growing wild in the Himalayas between 900 to 1800 m and also cultivated throughout India. Flowers occur during April to July while fruiting takes place during July to September.

OTHER NAMES :

Arabic	: Habb-ur-Rumman
Persian	: Anardana
Assamese	: Dalim
Bengali	: Dalim
English	: Pomegranate
Gujarati	: Dadam
Hindi	: Anar. Dhalim
Kannada	: Dalilmbe Kayi
Malayalam	: Dadimam, Matalam, Raktabijam, Talimatalam
Marathi	: Dalimba
Oriya	: Dalimba
Punjabi	: Anar Danu, Daran, Dariun
Sanskrit	: Bijapura, Dadima, Dadimasara, Dadimba, Dantabija
Tamil	: Daluma, Madalai, Madulam, Madulungam, Pumadalai
Telugu	: Dadimamu, Dadimba, Dalimma, Tiyyadanima, Karakmu
Urdu	: Anardana

DESCRIPTION :

Macroscopic : The seeds are irregularly ovoid, flattened and angular, They are about 0.5 cm long, testa is coriaceous with a water- soluble extractive(s) outer coat which is red in colour. The testa is sweet with agreeable sweet odour.

Microscopic : In sectional view the seed shows fleshy testa which is consisting of large multi-layered thin walled parenchymatous cells. Beneath the testa there is a region consisting of several layers of thick, lignified stone cells having broad lumen. This is followed by a single layer of thick walled cells containing yellowish brown content.

The epidermis of the cotyledon is made up of single layer, thin walled parenchymatous cells containing abundant aleurone grains. These cells are mostly wider than their length and outer wall of the cell is comparatively thicker. Rest of the cells of cotyledons are thin walled, parenchymatous. These cells contain aleurone grains.

Powder: Powder analysis of the crude drug reveals the presence of fragments of disorganised cells of fleshy testa, stone cells and parenchymatous cells of the cotyledons containing aleurone grains. It also exhibits abundant aleurone grains and thick walled cells are examined rarely.

CHEMICAL CONSTITUENTS : Alkaloids, glycosides, steroids, resins, phenolic compounds tannins, carbohydrates, iron, chloride, calcium, sodium, potassium and phosphate.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2% , Appendix 2.2.2.
Total Ash	-	Not more than 4% , Appendix 2.2.3.
Acid insoluble ash	-	Not more than 2% , Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 22% , Appendix 2.2.6.
Water-soluble extractives	-	Not less than 37% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^0) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Ethyl. Acetate (4:1)	2 % Ethanolic H_2SO_4	5	0.2, 0.37, 0.53, 0.79, 0.88

TEMPERAMENT : Cold 2^0 Moist 1^0

ACTION : Muqawwi-e-Meda, Muqawwi-e-Qalb, Qate- Bah, Musakkin

THERAPEUTIC USE : Ishal, Khafaqan, Sual, Istisqa, Atash-e-Mufrit

DOSE : 5 - 10g
(Sharbat 30 - 100 ml
Araq 50 - 100 ml)

IMPORTANT FORMULATIONS : Habb-e-Hindi Sual, Jawarish Pudina, Sufoo-e-Habb-ur-Rumman, Sufoof-e-Ziabetus Dulabi.

ANISOON
(Fruit)

The drug Anisoon consists of dried fruits of *Pimpinella anisum* Linn. (Apiaceae). It is widely cultivated in Southern and Central Europe and North Africa. It is grown in India to a small extent. The plant occurs during September to March. Flowering and fruiting takes place during January to March.

OTHER NAMES :

Arabic	: Habb-ul-Hulu, Bazrul Razyanaj Roomi
Persian	: Zeera-e-Rumi, Badian-e-Roomi
Bengali	: Muhuri, Mithi Jira
English	: Anise, Sweet fennel, Aniseed
Hindi	: Saonf, Saurif, Sonf.
Kannada	: Dodda-jirage, Sompu, Shambu
Malayalam	: Feramanis, Perin-chirakam
Marathi	: Somp
Oriya	: Pan mohori
Punjabi	: Anisun, Sonuf
Sanskrit	: Shatapushpa, Mudhurimisi, Karavee, Shatava
Tamil	: Shombu
Telugu	: Kuppi, Sompu
Urdu	: Anisoon

DESCRIPTION :

Macroscopic : The fruits are dried pear-shaped, yellowish-green, somewhat compressed, cremocarps usually with the pedicels attached and 3-4 mm long and 1.5-3 mm broad. They are rough to touch due to the presence of numerous, short, conical epidermal trichomes and crowned by a short, bifurcate styloped. Each mericarp has five somewhat wavy ridges and is slightly pubescent on the dorsal surface. They possess a sweet aromatic taste and give, an aromatic odour when crushed.

Microscopic : The epicarp is consisted of a single layer of cells which are rectangular to polygonal in shape and coated with thick cuticle on the outer side. Trichomes are conical slightly curved and usually unicellular and the walls are thickened and distinctly warted. Each mericarp has 2-3 or 4 large vittae on commissural surface and 15-30 small vittae on the dorsal surface. These vittae are composed of thin walled brown cells. In the mesocarpic region sclereids are usually found in groups in single layer which are often associated with thinner walled unlignified parenchyma. The sclereids are square to rectangular in outline with a large lumen and uniformly thickened wall traversed by numerous pits. The endocarp is made of a single layer of vary thin walled cells and is usually found attached to fragment of vitae. The cells of endosperm possess protein and fixed oil. A small amount of vascular tissue reticulated parenchyma is present. The element are small and are usually found in groups, the vessels show spiral or reticulate thickening.

Powder: Powder analysis of the crude drug revealed the presence of fragments of epicarp, mesocarp, vittae, endosperm, trichomes, vessels and sclereids.

CHEMICAL CONSTITUENTS :

Glycosides. phenolic compounds tannins saponins, resins, carbohydrates, flavonoids, steroids, iron. sodium, magnesium, potassium and calcium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 17% , Appendix 2.2.3.
Acid insoluble ash - Not more than 7% , Appendix 2.2.4
Alcohol-soluble extractives - Not less than 1.5% , Appendix 2.2.6.
Water-soluble extractives - Not less than 16% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract :

Solvent system	Spray/reagent treatment	No. of spots	Research Officer value
Benzene: Ethyl. Acetate (4:1)	I_2 vapours	2	0.11, 0.87

TEMPERAMENT : Hot 3° Dry 3°

ACTION : Kasir-e-Riyah, Musakkin-e-Auja, Munaffis-e-Balgham, Mudirr-e-Baul, Mudirr-e-Haiz, Mufatteh, Jali, Musakkin. Muqawwi-e-Kulya, Muqawwi-e-Bah.

THERAPEUTIC USE : Zeeq-un- Nafas, Nafkh-e-Shikam, Waj-ul-Meda, Waj-ul Uzn

DOSE : 2 - 5g

IMPORTANT FORMULATIONS: Habb-e-Iyarij, Itrifal-Ghudadi, Jawarish-e-Narmushk, Jawarish-e-Shahreyaran, Majoon-e-Antaki, Majoon-e-Hajr-ul-yahood, Majoon-e-Jalali, Majoon-e-Jalinoos Lului, Sufoof-e-Moya.

ANJEER
(Fruit)

The drug Anjeer consists of dried fleshy receptacles / fruits of *Ficus carica* Linn. (Moraceae). The tree is a native of Asia Minor and cultivated in many parts of the Northern India, Andhra Pradesh Karnataka 0and Maharashtra. Receptacles occur during January to April and ripe fruits (figs) from June to October.

OTHER NAMES :

Arabic	Teen
Persian	Anjeer
Urdu	Anjeer
Bengali	Anjir
English	Fig
Gujarati	Anjir
Hindi	Anjir
Kannada	Anjura, Simeyetti
Malayalam	Simayatti
Punjabi	Fagari
Sanskrit	Anjira
Tamil	Simaayatti, Tenatti
Telugu	Anjuro, Manjimedi, Medi, Simayatti, Teneyatti

DESCRIPTION :

Macroscopic : Dried fruits of *Ficus carica* Linn. Are compressed to a circular shape with a central hole,, 4-6 cm in diameter, 1cm thick. Surface of the fruit is wrinkled and light yellow to brown in colour. The fruit contains many small seeds in pulpy mesocarp.

Microscopic : In transverse section epidermis of the epicarp consists of single layer of oval or barrel shaped cells coated with thick cuticle. Hypodermal region consists of thick walled collenchymatous cells which are almost hexagonal to polygonal and 3-5 cells in thickness. These cells contain yellowish brown contents. Few cells contain rosette crystals of calcium oxalate, brownish black in colour. The mesocarpic region consists of large, thin walled, ovate to polygonal or squarish paranchymatous cells without intercellular spaces. The laticifers appearing in this region are elongated tubular and few are branched laticifers give positive test of tanin . Vascular traces are observed in this region.

In surface view, the epicarp shows thick walled parenchymatous cells which are oval to polygonal. The anomocytic type of stomta are observed which are abundant. The numerous guard cells are oval to round containing starch grains.

The powdered drug is brown in colour. Under the microscope it shows the presence of cells of epidermis, hypodermis and thick walled parenchymatous cells of testa. Vessels with spiral thickenings are also found along with the cells endosperm.

CHEMICAL CONSTITUENTS : Glycosides, proteins/amino acids, resins, reducing sugar, steroids/ triterpenes, tannins, fixed oils, potassium, calcium, magnesium, iron, copper, phosphorus in Phosphate and chlorine in chloride. Proteose, amino acid, tyrosin, cravin lipase, protease, carotin..

IDENTITY, PURITY AND STRENGTH

Foreign Matter	-	Not more than 2%, Appendix 2.2.2.
Total Ash	-	Not more than 4%, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 1%, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 20%, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 52%, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^o) extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (24:1)	2% Ethanolic H_2SO_4	2	0.76, 0.88

TEMPERAMENT : Hot 1° Moist 2°

ACTION : Mulattif, Mohallil-e-Waram, Munzij, Mulaiyin.

THERAPEUTIC USE : Waram-e-Tehal, Sara, Zeeq-un-Nafas

DOSE : Anjeer (Dry) 10 – 12 number

IMPORTANT FORMULATIONS : Zimad-e-Kibreet, Sufoof-e-Bars.

ASPAGHOL
(Seed)

The drug Aspaghol consists of mature dried seeds of *Plantago ovata* Forsk. Syn. *Plantago ispaghul* Roxb. (Plantaginaceae). The herb is found in North-West India,cultivated to a small extent in West Bengal, Karnataka and Coromandal coast. The plant occur during winter season. Flowering takes place during November to January while fruiting occurs during March – April.

OTHER NAMES :

Arabic	: Bazr Qatuna
Persian	: Aspiyoos, Aspghol
Urdu	: Aspaghol
Bengali	: Eshopgol
English	: Spogel seeds
Gujarati	: Isaphgol
Hindi	: Isbugol
Kannada	: Isafgole
Malayalam	: Karkata sringi
Tamil	: Iskalvirai
Telugu	: Isapghola

DESCRIPTION :

Macroscopic : The seeds are albuminous about 1.5-3 mm. Long and 1-1.5 mm. Wide, smooth, boat shaped and translucent. They are yellowish brown in colour usually with a pinkish tingle and the convex side is having a faint brown streak. The hilum lies on the concave surface which is covered by a thin whitish membrane. The seeds are highly mucilaginous in nature and the epidermis swells greatly when seeds are soaked in water.

Microscopic : Transverse section of seed is oval in outline while the longitudinal section is oblong, elliptical. The transverse section cut through one end of the seed shows a central core of radical surrounded by endosperm while the other end shows two fleshy cotyledons. The structure of seed coat is simple. The epidermis of the testa is composed of polyhedral cells, the walls of which are thickened by a secondary deposit, the source of mucilage. A thin brownish layer is found in between the epidermis and the albumin. The albumin is formed of thick walled cells which are rich in matter like the fixed oil and proteins. The cells of embryo are parenchymatous and packed with aleurone grains.

As the seeds are very slippery, fine powder could not be obtained. However, a coarse, creamy brownish powder with somewhat sweet & mucilaginous taste but without any characteristic odour was observed.

CHEMICAL CONSTITUENTS : Protein, tannin, glycosides, fixed oils, carbohydrates, iron, zinc, potassium and sodium.

IDENTITY, PURITY AND STRENGTH

Foreign Matter	-	Not more than 2% Appendix 2.2.2.
Total Ash	-	Not more than 4% Appendix 2.2.3.
Acid insoluble ash	-	Not more than 15% Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 0.4% Appendix 2.2.6.

TLC behaviour of petroleum ether (60-80°) extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Chloroform (1:4)	I_2 vapours	3	0.14, 0.26, 0.96

TEMPERAMENT : Cold 3° Moist 2°

ACTION : Musakkin, Mohallil, Mulaiyin

THERAPEUTIC USE : Zaheer, Qabz, Sual-e-Yabis, Zat-ul-Janb, Qulanj, Waram-e-Luhat, Waj-ul-Mafasil

DOSE : 4.5 – 7 g

IMPORTANT FORMULATIONS : Habb-e-Sil, Qurs-e-Kafoor, Qurs-e-Munawwim Barid, Qurs-e-Sartan, Qurs-e-Shadnaj, Qurs-e-Tabasheer Mulaiyin, Qurs-e-Ziabetus-Khaas, Shiyaf-e-Abyaz, Laooq-e-Behidana, Marham-e-Dakhilyun, Sufoof-e-Moya, Sufoof-e-Teen.

AZARAQI
(Seed)

The drug Azaraqi consists of dried seeds of *Strychnos nux-vomica* Linn. (Loganiaceae). The tree is found in tropical India upto 1200 m rarely in Bengal, common in Tamilnadu and Tenasserium region of Burma. The flowering and fruiting occurs from February to April.

OTHER NAMES :

Arabic	: Khaneq-ul- Kalb
Persian	: Falas-e-Maahi
Bengali	: Kuchila
English	: Nux-vomica
Gujarati	: Kuchla
Hindi	: Kuchla
Kannada	: Hemmusliri, Ittangi, Itti, Kanjira
Malayalam	: Kanjirium, Kariram
Marathi	: Kuchla
Oriya	: Kuchla
Punjabi	: Kuchila
Sanskrit	: Visha-mushti
Tamil	: Etti, Kagodi, Kanjirai
Telugu	: Mushti, Musidi
Urdu	: Kuchla, Azaraqi

DESCRIPTION :

Macroscopic : The seeds are ashy grey or greenish grey, disc shaped about 17-29 mm Across and 2.5-7 mm thick. They are usually uneven inside, a little depressed on one side and arched on the other. The seeds are covered with numerous closely appressed hairs radiating from the center to the circumference. The seeds are quite hard.

Microscopic : The testa is about 0.1 mm thick and is divided into an outer trichomatous epidermis and an inner layer of ground tissue. Each epidermal cell is extended to form an appressed trichome. The walls of these cells are highly thickened and lignified. The ground tissue of the testa functions as a nutrient layer and is represented by a brown bend of flattened parenchyma. In transverse section these cells appear as ill defined polygonal cells. The endosperm is composed of thick walled cellulosic parenchyma, the cells of which are isodiametric, are larger towards inside. The epidermis of the endosperm and the one or two outer layers are formed of rather smaller cells. The walls of which swell to a less extent in Water- Soluble extractive(s). Fixed oil and aleurone grains of irregular and various shapes are present in the protoplasm. The aleurone grains do not contain crystalloids but several globules are usually present in each grain.

Powder: The powder is a yellowish to brownish grey with a slightly fatty and rancid odour and an intensely persistent bitter taste. The powder analysis of the crude drug shows the sclerenchymatous epidermis of the testa, very abundant fragments of the lignified rods of the trichomes and abundant fragments of endosperm and large number of aleurone grains.

CHEMICAL CONSTITUENTS :

Alkaloids, glycosides, carbohydrates, proteins/amino acids, resins, steroids/ triterpenes, tannins. Glucoside-loganin from fruit brucine, strychnine, vormicine, metnoxyrthychinna and C-mavcusine from leaves and roots pseduobrucine, a and b-colubrines novacine, strychnine methosulphate isostrychnine, Nmethyl-sec. – pseudo-B-colubrine, 4-hydroxystrychine, P-hydroxybenzoic, vanillic, 2- hydroxy-4-methoxybenzoic, sinapic and syringic acids, kaemferol, quercertin and 3-0 methylquereetin, a new alkaloid- protostrychnine, normacusine B and 4- hodroxy-3-methoxystrychine.

IDENTITY, PURITY & STRENGTH:

Foreign Matter	:	Not more than 2% , Appendix 2.2.2.
Total Ash	:	Not more than 3% , Appendix 2.2.3.
Acid insoluble ash	:	Not more than 15% , Appendix 2.2.4.
Alcohol-soluble extractives	:	Not less than 2% , Appendix 2.2.6.
Water-soluble extractives	:	Not less than 7% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^0) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	1	0.76

TEMPERAMENT : Hot 3^0 Dry 3^0

ACTION : Mohallil, Musaffi-e-Dam

THERAPEUTIC USE : Falij, Laqwa, Waj-ul-Mafasil, Waj-ul-Qutn, Zeeq-un-Nafas, Sil, Suzak

DOSE : 60 – 250 mg

IMPORTANT FORMULATIONS : Habb-e-Azaraqi, Habb-e-Marwareed, Majoon-e-Azaraqi,Majoon-e-Lana, Raughan-e-Azaraqi, Til-e-Mubahhi, Tila-e-Mumsik, Sunoon-e-Mustahakam-e-Dandan.

Note. Seeds of Azaraqi should be used after proper detoxification (Mudabbar).

BADAM SHIREEN
(Seed)

The drug Badam Shireen consists of seeds of *Prunus amygdalus* Batsch. var. *dulces.* Syn. *Prunus communis* Fritsch, *Amygdalus communis* Linn. (Rosaceae). A middle sized tree distributed commonly in Europe and Central Asia. In India it is cultivated in Kashmir and Himachal Pradesh. It occurs throughout the year, flowering takes place in the month of March whereas fruits set from April to August.

OTHER NAMES :

Arabic	: Lauz-ul-Hulu
Persian	: Badam-e-Shireen
Bengali	: Bilaiti Badam
English	: Sweet Almond
Gujarati	: Badam
Hindi	: Badam
Kannada	: Badami
Malayalam	: Badam
Marathi	: Badam
Oriya	: Bilati Badam
Punjabi	: Badam
Sanskrit	: Badama
Tamil	: Vadumai
Telugu	: Badamu
Urdu	: Badam Shireen

DESCRIPTION :

Macroscopic : The seeds are found enclosed in stony shell. The seeds are about 2-2.5 cm, long and 1-1.5 cm wide, laterally flattened, rounded at one end and tapering at micropylar end, almost exalbuminous. The outer most covering of seed is a thin membranous rough brown colour seed coat. The seed coat is easily removed when soaked in water. The embryo is made up of two large slightly elongated plano-convex cotyledons, hinged together by a small axis and radical lies at the narrow end of the seed. One seed varies from 0.67 to 1.53 g.

Microscopic : Transverse section of the seed reveals that the seed coat has epidermis, the outer most layer of testa is represented by greatly enlarged, thick walled papiliform cells. The lower half of which appears to be pitted. The cells of middle region and tegmen are almost crushed. The inner epidermis of the tegmen persist as a single layer of small thick walled compactly arranged tubular cells. The single layered endosperm consisting of thin walled larger parenchymatous cells is often found persisting in mature seeds. The two cotyledons are made up of thin walled parenchymatous cells filled with proteins in the form of aleurone grains.

Powder: As the seeds are oily, a coarse powder is produced on grinding. It is creamy white in colour, sweet in taste and devoid of any characteristic odour.

CHEMICAL CONSTITUENTS :

Oil, fat, protein, sugar, glucoside and mucilage, daucostrin, sitosterol.

IDENTITY, PURITY & STRENGTH:

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 9%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 2%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 6%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 2%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^0) extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Benzene (60:40)	I_2 Vapours	1	0.20

TEMPERAMENT : Hot 1^0 Moist 1^0

ACTION : Muqawwi-e-Dimagh, Mulaiyin, Muqawwi-e-Bah

THERAPEUTIC USE : Zof-e-Dimagh, Sual, Zof-e-Bah

DOSE : 7 – 11 kernels

IMPORTANT FORMULATIONS: Banadiq-ul-Buzoor, Habb-e-Bohat-us-Saut Muzmin,Habb-e-Jadwar, Habb-e-Mushil-Dimaghi, Habb-e-Surfa Qawi, Qurs-e-Kaknaj, Laooq-e-Badam, Laooq-e-Hulba, Laooq-e-Zeequn-Nafas, Luboob-kabir, Luboob-e-Sagheer, Majoon-e-Aarad khurma, Majoon-e-Falasksair, Majoon-e-Mughalliz, Raughan-e-Badam Shireen, Raughan-e-Luboob-e-Saba Barid, Sufoof-e-Suranjan, Sufoof-e-Suranjan Zafrani, Laooq Behidana, Laooq sapist an, Laooq shamoon.

BADRANJBOYA
(Leaf)

The drug Badranjboya consists of dried leaves of *Nepeta hindostana* (Roth.) Haines Syn. *N. ruderalis* Hook.f. (Lamiaceae). The plant is found in hilly parts of Punjab, Bengal, Bihar, Kumaon, Rajasthan, Deccan and Konkan. It occurs during winter season

OTHER NAMES :

Arabic	: Waraq-e-Muffareh-ul-Qalb, Waraq-e-habaq-ur-Rauhawi
Persian	: Barg-e-Badrangboya
Punjabi	: Badrangboya, Billilotan
Urdu	: Barg-e-Badranjboya

DESCRIPTION :

Macroscopic : The leaves are broadly ovate, or ovate- lanceolate, crenate. The petiole varies in length from 1-1.2 cm while the lamina is about 2.5 x 1-3.5 x 1.2 cm.

Microscopic : In transverse section the leaf shows single layered upper and lower epidermis provided with glandular and non-glandular hairs. The glandular hairs are characterized by the presence of unicellular circular head and uni to multi-celled tail. The non-glandular hairs are unbranched, uniseriate, multi-cellular, with the outermost cells tapering. These are ornamented with small bristles. Upper epidermal cells are mostly larger than the lower ones, while both are covered with thick cuticle. The epidermis is followed by single layered palisade tissue continuous to lamina whereas it discontinues at the veins or midrib which is replaced by 3 to 4 layered collenchymatous tissue on the upper side and 3-6 layered on the lower side of the leaf. The collenchyma is followed by circular parenchyma tissues with large intercellular spaces. The vascular bundle is kidney shaped and is collateral. The vessel members are mostly with spiral to recticulate thickenings with simple perforation plates and tracheids are mostly pitted. The stomata are indistinct.

Powder : The powder under the microscope consists of fragments of parenchymatous tissue with intercellular spaces, collenchyma and strands of vascular bundles. The multicellular, uniseriate non-glandular trichomes together with glandular trichomes with globular unicellular head and uni-or multicellular uniseriate tail. Palisade tissue and spongy tissue are also met with . The colour is dull green and taste slightly bitter.

CHEMICAL CONSTITUENTS :

Glycosides, flavonoids, sesquiterpene, tannins, magnesium, sodium, potassium and iron.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2% , Appendix 2.2.2.
Total Ash	-	Not more than 19% , Appendix 2.2.3.
Acid insoluble ash	-	Not more than 12% , Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 15% , Appendix 2.2.6.
Water-soluble extractives	-	Not less than 8% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^0) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Pet.ether (1:1)	4% Ethanolic H_2SO_4	2	0.12, 0.31,

TEMPERAMENT : Hot 2^0 Dry 2^0

ACTION : Mufarreh, Muqawwi-e-Qalb, Munzij-e-Sauda, Musaffi-e-Dam, Mohallil-e-Warm, Musakkin.

THERAPEUTIC USE : Zof-e-Qalb, Khafqan, Sara, Laqwa, Falij, Waja-ul-Mafasil

DOSE : 5 – 7 g

IMPORTANT FORMULATIONS : Majoon-e-Khadar

BAQLA
(Seed)

The drug Baqla consists of dried seeds of *Vicia faba* Linn. Syn. *Faba vulgaris* Moench. (Papilionaceae). A woody annual herb native of North –Africa and North –West Asia it is also cultivated all over India. The plant occurs during October to April. The flowering and fruiting takes place from December to March.

OTHER NAMES :

Arabic	:	Abu Ramaaj
Persian	:	Baqla
English	:	Bean, Broad bean, Garden been
Hindi	:	Bakla, kala matar
Kannada	:	Kadu hurlikayee
Urdu	:	Baqla

DESCRIPTION :

Macroscopic : Seeds are oval to oblong and blackish brown about 3.5 x 5 – 5 x 8 mm in size. The seed coat is smooth, tough and highly glossy.

Microscopic : In transverse section the testa is characterized with single layered epidermis made up of long columnar cells. The hypodermis is made up of one layer of horse shoe shaped cells. This is followed by multi layered zones of cells, the outer 4-5 layers are tangentially elongated, large, thin walled parenchymatous cells, whereas, inner 4-6 layers of thick walled cells are totally compressed. The embryo is lined externally by small tubular parenchymatous epidermis which encloses long, thin walled parenchymatous cells densely filled with starch grains.

Powder : The creamy yellow coloured powder bears proteinaceous taste but without any marked odour. The powder is characterized by segments of long palisade cells, some horse shoe shaped cells, thick walled parenchyma cells and abundant starch grains.

CHEMICAL CONSTITUENTS :

- Alkaloids, protein, tannins, starch, fat and sterols. Acetylenic oxoester, p-2 and B-[3-D-glucopyranosyloxy-4-hydroxylphnyl] –L- alanine, g-hydroxylysine. Wyerone, L-dopa, vicine, medicarpin, a phytoalexin, gibberellin A (GA_{17}), GA_{19} GA_{20} GA_{29} GA_{44} and 13-hydroxy- GA_{17} (GA_{52})

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2% , Appendix 2.2.2.
Total Ash	-	Not more than 4% , Appendix 2.2.3.
Acid insoluble ash	-	Not more than 3% , Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 1.5% , Appendix 2.2.6.
Water-soluble extractives	-	Not less than 12% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether:Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	1	0.24

TEMPERAMENT	:	Hot 1° Dry 2°
ACTION	:	Munaffis-e-Balgham, Mohallil-e-waram
THERAPEUTIC USE	:	Bohat-us-Saut, Waram-e-Lauzatain, Sual
DOSE	:	5 – 10g

IMPORTANT FORMULATIONS : Qairooti, Bazr-e-Katan, Qurs-e-Munaww

BARTANG
(Seed)

The drug Bartang consists of dried seeds of *Plantago major* Linn. Syn. *Plantago asiatica* Linn. (Plantaginaceae). A perennial herb found in temperate and alpine Himalaya from Kashmir to Bhutan and upto 4000 m in Baluchistan , Sri Lanka, Burma, The Malay Peninsula extending to Afghanistan and Westwards to Atlantic . In India, it grows in Maharastra, Andhara Pradesh the Khasia Hills. Flowering and fruiting take place during July-September.

OTHER NAMES :

Arabic	: Lisan-ul-Hamal, Zanbul Far, Zanbul yarbooa
Persian	: Khargholah, Charghoon
English	: Plantain
Hindi	: Lahuriya, Baltang
Kashmiri	: Gula
Urdu	: Bartang

DESCRIPTION :

Macroscopic : The seeds are minute, irregularly angled and brown to blackish brown in colour. The testa is somewhat hard to break. When soaked in Water-Soluble extractive(s) the epidermis of the seed coat swells up and forms a mucilaginous envelope around the seed. Theses are mostly planoconvex and have an oval depression on the side of the hilum appearing like a dot. The whole surface of the seed is shining and has got ripple like zigzag dark linings which are abrupted at places.

Microscopic : The cross section of the seed shows that the testa of the seed comprises of two layers. The outer layer of epidermis consisting of translucent thin walled cells filled with mucilage. These are irregular rectangular cells. Below the epidermis is found the pigment layer, these are also having rectangular cells filled with brownish pigments. Under the pigment layer endosperm is found which surround the embryo. The cotyledonary cells are smaller near the outer margins and increasing in size towards the middle. The cells lumen is found to be filled with protein and oil globules. The embryo is straight and lies in the middle along the axis.

Powder : The powder of the drug is brownish in colour. The fragments showing epidermis of the testa are formed of large transparent cells which are filled with mucilage. The cells swell up in aqueous mounts and are polygonal in surface view. The mucilage stains with safranin red. The fragments showing the endosperm are composed of thick-walled, pitted cells which are polygonal in shape. The cells of testa under the epidermis are found to be filled up with brown pigment. The cells of the embryo are small, thin-walled and the cotyledon are composed of irregularly rounded cells

CHEMICAL CONSTITUENTS :

Alkaloids, tannins, reducing sugars, glycosides, potassium, sodium, calcium and iron.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	9%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	3%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	1%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	6%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (4:1)	I_2 vapours	5	0.27, .36, 0.45, 0.56, 0.77

TEMPERAMENT : Cold 3° Dry 3°

ACTION : Qabiz, Habis, Moharrik, Muaddil

THERAPEUTIC USE : Ishal, Zaheer, Ruaf, Kasrat-e-Tams

DOSE : 5 - 10g

IMPORTANT FORMULATIONS : Qurs-e-Kahruba

BED MUSHK
(Flower)

The drug Bedmushk consists of dried flowers (catkins) of *Salix caprea* Linn. (Salicaceae). A small tree distributed in northern Asia, Europe and also found in abundant in Peshawar and Lahore. Where it is said to have been introduced from Kashmir. Flowering and fruiting take place in spring season.

OTHER NAMES :

Arabic : Khallaaf-e-Balkhee
Persian : Mushk Bed, Gurba Bed
English : Sallow, Goat Willow, Musk Willow
Hindi : Bedmushk
Kashmiri : Bedmushi
Urdu : Bedmushk

DESCRIPTION :

Macroscopic : Catkins are 4-5 cm long, thick, cylindrical bright yellow, fragrant; bracts oblong small; scales obovate, blackish, hairy, nectary obovate, papillary; stamens longer than the scales, with oblong, yellow anthers; stigma oblong, thick, undivided. Staminate catkins sub-sessile, densely silky cottony about 2.5 cm long, erect, oblong ovoid, bracts dark, stamens two free. The smell is spicy.

Microscopic : Microscopically the drug is characterized by the polygonal epidermal cells from which arise numerous long cylindrical, thick walled, unicellular, simple trichomes with small lumen. Some globular scars left by broken trichomes are also seen. These trichomes deeply stain with safranin. The transverse section of the catkin is some difficult owing to bittleness. However, numerous thick walled deep orange crystals, numerous globular pollen grains and vascular bundles mostly composed of helical vessel members are some of microscopic characters by which the crude drug can be easily identified.

Powder : The drug powder is brown, cottony, with bitter taste and spicy smell. It is composed of fragments of light yellowish epidermal tissue from which numerous, elongated thick walled unicellular simple trichomes with small lumen arise. Certain trichomes scars are also visible in the tissue. Among other fragments are deep orange coloured slightly thick walled parenchyma tissue containing rosette crystals of calcium oxalate. Prismatic crystals are also met with. Numerous spherical pollen grains also characterise the drug powder.

CHEMICAL CONSTITUENTS :

Presence of alkaloids in addition to glycosides and saponins is reported in male infloresence. The fragrant flowers on distillation yield essential oil. Astragalin, quercimeritrin and quercetin-3,7-di-O-glucoside isolated from pollens.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 10% , Appendix 2.2.3.
Acid insoluble ash - Not more than 3% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 2% , Appendix 2.2.6.
Water-soluble extractives - Not less than 5% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No.of spots	Rf value
Pet. ether: Benzene (3:1)	2% Ethanolic H_2SO_4	4	0.11, 0.17, 0.38, 0.75

TEMPERAMENT : Cold 1° Dry2°

ACTION : Muqawwi-e-Qalb, Mulattif, Mufarreh

THERAPEUTIC USE : Zof-e-Qalb, Khafqan, Zof-e-Meda, Zof-e-Kabid

DOSE : 5 g

IMPORTANT FORMULATIONS : Araq-e- Bed Mushk.

BEEJBAND
(Seed)

The drug Beejband consists of dried seeds of *Rumex maritimus* Linn. Syn. *R. palustris* Sm. (Polygonaceae) an annual herb occurring in the temperate Himalayas and wet ground of the banks of rivers in the planes of north India and Marshes in Assam, Bengal, Western ghats, Neelgiri and Palani Hills at 1200 to 3600 m elevation. It is distributed to Europe, Asia, North Africa and North and South America. It occurs during summer season. Flowering and fruiting take place during April to June.

OTHER NAMES :

Bengali	: Bun-Palung
English	: Golden Dock
Hindi	: Jangilipalak Julpalam, Jap-palum
Punjabi	: Bijband, Jangli Palak
Urdu	: Beejband

DESCRIPTION :

Macroscopic : The seeds are angular, shining 2.5x1.5 mm and brown in colour. The seed coat is thin and encloses thick, cream coloured cotyledons. They are very slightly bitter or tasteless and odourless.

Microscopic : In cross section, the seed is triangular in outline. The testa is thin, two layered. The outer one is thick walled palisade tissue filled with yellowish colouring matter. The inner one is thick walled, more or less isodiametric and densely filled with brownish colouring matter. This layer is followed by a single layered thin walled tissues, the radial walls of these cells are sinuous. This layer in turn is followed by a very thick zone of cotyledonary cells which are parenchymatous, thin walled, with large inter cellular spaces and densely filled with granular matter. The embryo is circular in outline and lies in the centre of the cotyledons. The cells of embryo are thin walled polygonal with large intercellular spaces and greyish in colour.

Powder : The powder is characterised by the presence of thick walled testa filled with yellowish colouring matter, thin walled light greenish parenchyma with inter cellular spaces and densely filled with copious granular masses. Occasionally vascular strands are also met with. It is brown in colour, tasteless or very slightly bitter and without any definite smell.

CHEMICAL CONSTITUENTS : Tannin, Iron, Sodium, Potassium, Calcium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 8% , Appendix 2.2.3.
Acid insoluble ash - Not more than 3% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 15% , Appendix 2.2.6.
Water-soluble extractives - Not less than 9% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract :

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (3:1)	4% Ethanolic H_2SO_4	7	0.16, 0.21, 0.31, 0.30, 0.50, 0.70, 0.96

TEMPERAMENT : Cold 1° Dry 1°

ACTION : Musakkin-e-Alam, Mohallil-e-Auram, Muqawwi-e-Bah,

THERAPEUTIC USE : Zof-e-Bah, Jiryan, Waj-ul-Quturi, Sailn-ur- Reham

DOSE : 5 - 10 g

IMPORTANT FORMULATIONS : Majoon-e-Bandkushad.

BEHIDANA
(Seed)

The drug Behidana consists of dried seeds of *Cydonia oblonga* Mill. Syn. *Cydonia vulgaris* Pers., *Pyrus cydonia* Linn (Rosaceae). A shrub indigenous to Persia: but distributed throughout Europe and other countries. It is cultivated in Afghanistan North West Frontier province. In India it is found in Punjab, Kashmir and Nilgiris. The plant occurs throughout the year. Flowering and fruiting take place during August-September.

OTHER NAMES :

Arabic : Habb-us-Safarjal
Persian : Behidana
English : Quince
Hindi : AbiBihi
Kannada : Simodalibe
Kashmiri : Bamsutu, Bamtsuntu
Sanskrit : Amritphala
Tamil : Shimaim mudalai
Telugu : Simadanimma
Urdu : Behidana, Behi

DESCRIPTION :

Macroscopic : Dried seeds are irregularly ovoid, plano-convex and three ribbed. The lower tapering end of the seed is the hilum through which the seed is attached in the fruit, At the opposite end, there is slightly beaked and marked with scar indication chalaza. The testa of seed is dark brown or black in colour. It contains two distinct cotyledons. The kernel has the odour and taste of bitter almond and is covered with whitish coatings which is dried mucilage.

Microscopic : The testa of the seed is composed of two distinct layers-epidermis and pigmented layer of cells. The epidermis is composed of long thin-walled, single layered cells, which contain mucilaginous substances. The pigmented layer is composed of lignified, sclerenchymatous stone cells. In transverse section these cells are somewhat rectangular or elliptical in shape, thick-walled and with distinct lumen. Cells of endosperm are thin-walled, parenchymatous, 4-5 cells thick and are filled with aleurone grains. These grains occur as an inclusion in endosperm cells. In between the layers of endosperm and stone cells, there is an undifferentiated, dark brown layer followed by a thin wavy layer. A thin layer of unorganized and less distinct cells is also present at the end of endospermic cell layer.

Cells of cotyledons are distinctly marked by the presence of thin walled epidermal cells somewhat equal in size and shape. This layer is followed by larger cells, which are thin-walled, polygonal.

Powder : Powder of the drug is greyish brown in colour, odours and bitter in taste. It shows the presence of testa with mucilage, fibres, large number of pigmented stone cells and endosperm cells.

CHEMICAL CONSTITUENTS :

Fixed oil, Steroid, Protein, Glycoside, Tannin, Volatile oil, Iron, Calcium, Phosphorus, Magnesium, Potassium, glucoside, amygdalin, ursolic acid, roseoside, mixture of n-parffins, Alcohol-soluble extractive(s)s, β -sitosterol, saringosterol, uvaol, palmitic, oleic, linoleic, and ursolic acid, marmelolactones A&B.

IDENTITY, PURITY AND STRENGTH

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 6% , Appendix 2.2.3.
Acid insoluble ash - Not more than 2% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 17% , Appendix 2.2.6.

TLC behaviour of petroleum ether (60-80°) extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl acetate (17:3)	Phosphoric acid Methanol (1.5:10.5)	3	0.41, 0.62, 0.71

TEMPERAMENT : Cold 2° and Moist 2°

ACTION : Mulattif, Musakkin-e- Hararat, Daf-e-Sual Har, Daf-e-Nazla

THERAPEUTIC USE : Zaheer, Humuzat-e-Meda, Qarh-e-Amaa, Amraz-e-Safrawi,

Khushunat-e-Halaq, Nazla-e-Har

DOSE : 3 -9 g (Powder)
30-40 g (Soaked seeds)

IMPORTANT FORMULATIONS : Banadiq-ul-Buzoor, Habb-e-Shaheeqa, Habb-e-Sil, Habb-e-Surfa Qawi, Qurs-e-Kaknaj, Laooq-e-Behidana, Laooq-e-Nazli, Laooq-e-Sapistan, Laooq-e-Shamoon, Sharbat –e-Ejaz.

BISFAYEJ
(Rhizome)

The drug Bisfayej consists of dried rhizome of *Polypodium vulgare* Linn. (Polypodiaceae). A herbaceous, perennial fern native to Europe, also found in America and Turkey. The plant occurs throughout the year.

OTHER NAMES :

Arabic	: Akhras-ul-kalb, Saaqib-ul-Hajr
Persian	: Bist Paya
English	: Wall Fern, Adder's Fern
Hindi	: Khange, Khatkali
Urdu	: Bisfayej

DESCRIPTION :

Macroscopic : The dried rhizomes are flattened to round in cross section and yellowish brown to dirty brown externally. The upper surface is attached with tubercles of some of which a portion of the base of the fronds still adheres. The under surface is more or less spinous from the remains of broken radicals. The drug is characterized by a ferry odour, sweet, astringent and nauseous taste and moderately hard and brittle in fracture.

Microscopic : Transverse section of the rhizomes is somewhat oval to round is shape. The whole ground tissue of cortex consists of thick-walled cells arranged parallel to the epidermis. Each vascular bundle is surrounded by a thin-walled barrel shaped, single layered endodermis, followed by a single layer of pericycle containing starch. Various cells of the cortex are provided with dark brown substance probably tannins.

Mecerate of the powdered rhizome consisted of large number of isodiametric shaped cells, varying in size, these cells contained cell inclusions. Long to very long tracheids, with sclariform thickenings are also very clear. Layers of pigmented parenchyma are also seen.

CHEMICAL CONSTITUENTS :

Resins, tannins, steroids, flavonoids, alkaloids, glycosides, protein, reducing sugar, iron, calcium, magnesium, potassium, sulphur, chloride.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	9%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	4%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	5%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	17%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene: Chloroform (3:1)	I_2 vapours	3	0.20, 0.36, 0.66

TEMPERAMENT : Hot 2° Dry 1°

ACTION : Mushil-e-Sauda-wa-Balgham

THERAPEUTIC USE : Amraz-e-Balghami wa saudwi, Juzam, Malikhuliya, Nafkh-e- Shikam, Qulanj

DOSE : 10 – 15 g

IMPORTANT FORMULATIONS : Itrifal Ghudadi, Itrifal-e-Ustukhuddus, Jawarish-e-Shahreyaran, Majoon-e-Najah, Majoon-e-Seer Alvi Khani, Majoon-e-Ushba, Araq-e-Juzam, Sufoof-e-Chobchini, Sufoof-e-Lajward.

CHAKSU
(Seed)

The drug Chaksu consists of dried seeds of *Casssia absus* Linn. (Ceasalpiniaceae). An erect annual herb found throughout India form Himalaya to South Coast, and everywhere in the tropics of old world. The plant occurs during July – November. Flowering and fruiting takes place from September to November.

OTHER NAMES :

Arabic	: Chashmeezaj
Persian	: Chash Khaam
Gujarati	: Chinol
Hindi	: Chaksu Banar
Malayalam	: Karinlolla
Tamil	: Edikkal
Telugu	: Chanupalawittulu
Urdu	: Chaksu

DESCRIPTION :

Macroscopic : Seeds are about 4-4.5 mm. Long and 3-3.5 mm. Wide, black, highly, glossy, laterally compressed and oval or oblong in shape. They have bitter taste and bear a strong aromatic odour.

Microscopic : In longitudinal section the seed coat is thick and multi-layered. The outer most layer is cuticularized epidermis, composed of radially elongated, compactly arranged palisade like cells. The lumen of these cells is comparatively wider at the base (inner end) than at the top. Cotyledons are parenchymatous but the shape of their cells varies from polyhedral to elongated, all filled with a granular proteinaceous mass. Fibres and sclereids are lacking.

CHEMICAL CONSTITUENTS :

Protein, alkaloids, fat, sugars, tannins, and mucilage. Beta- Sitosterol Beta glucoside alpha –D- galacto-D-mannan composed of galactose (1 mole) and mannose (3 mole) isolated from seed. Palmitic, gentisic, 5-0-D glucopyranosylgentisic acids, ethyl-alpha-D- galactopyranoside, apigonin, luteolin, hydrocarpin and isohydrocarpin .

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	4%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	1.5%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	7%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	21%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	4	0.11, 0.18, 0.50, 0.76

TEMPERAMENT: Hot 2° Dry 2°

ACTION : Habis-ud-Dam, Mohallil, Qabiz, Jali, Musaffi-e-Dam.

THERAPEUTIC USE : Ramad, Nuzool-ul Ma, Bars, Juzam

DOSE : 2 – 3 g

IMPORTANT FORMULATIONS : Sufoof-e-Bars

Note: Seeds should be used after proper detoxification (Mudabbar)

DHATURA
(Seed)

The drug Dhatura consists of dried seeds of *Datura metel* Linn. Syn. *Datura alba* Linn. (Solanaceae). A perennial shrub found throughout India. The plant occurs throughout the year. Flowering and fruiting take places during August – December.

OTHER NAMES :

Arabic	: Jauz-ul- Masil
Persian	: Tatura
Bengali	: Dhatura
English	: Dowhy, Datura
Gujarati	: Dholo Dhaturo
Hindi	: Sadh-dhatura
Kannada	: Ummattegida
Kashmiri	: Dather
Malayalam	: Ummam, Ummata
Marathi	: Dhotara
Oriya	: Dudura
Punjabi	: Dhatura
Sanskrit	: Dhustura
Tamil	: Adukkumattai, Madulam, Vellaiyummattai
Telugu	: Tellavummetta
Urdu	: Dhatura

DESCRIPTION :

Macroscopic : A pear shaped 3.3-5.6 mm long and 3 mm broad thick, flattened, finely pitted, yellowish brown to brown in colour. The margin is wavy and thickened at the curved point. The very characteristic external feature of the seed is the edge of the seed is triple ridged. A large strophe is found near the micropyle. The taste is bitter and having no odour.

Microscopic : In transverse section the seed showed the seed-coat consisted of single layered epidermis which contains radially elongated parenchymatous cells with thick walls. These cells are coated with cuticle on the outer side. The cells are found possessing yellowish-brown contents. This is followed by 3-6 layers of polygonal to oval thin walled parenchymatous cells.

The epidermis of cotyledons composed of oval or squarish and slightly thick walled possessing yellowish-brown contents. Rest part of the cotyledons is made up of many layers of thin walled polygonal parenchymatous cells which contain aleurone grains. The cells of the outer region are radially elongated. The radical of the seed in sectional view showed the epidermis consisted of hexagonal parenchymatous cells. The cortical region consisted of several layers of thin walled polygonal to oval parenchymatous cells which contain aleurone grains.

Powder: Powder analysis of the crude drug revealed that tannins of seed coat and cotyledon are present in abundance. The aleurone grains are also present which are numerous and oval to round in shape. The fragment of radicle in powder are observed occasionally. Besides these fragments few single parenchymatous cells are also present.

CHEMICAL CONSTITUENTS :

Aklaloids, glyocosides, steroids, resins, tannins, proteins, iron, sodium, potassium, calcium and chloride.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 5%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 2%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 11%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 7%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^0) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pure Chloroform	2% Ethanolic H_2SO_4	1	0.07

TEMPERAMENT : Hot 4^0 Dry 4^0

ACTION : Musakkin-e-Alam, Mukhaddir, Mujaffif, Musakkin, Daf-e-Tashannuj, Mukhrij-e-Balgham, Mohallil-e- Waram

THERAPEUTIC USE : Waj-ul-Mafasil, Niqras, Irq-un-Nisa, Waj-ul-Asab, Shaheeqa, Zeeq-un-Nafas

DOSE : 500 mg to 750 mg

IMPORTANT FORMULATIONS : Habb-e-Shifa

GAOZABAN
(Leaf)

The drug Gaozaban consists of dried leaves of *Borago officinalis* Linn. (Boraginaceae). An erect, spreading hispid annual biennial plant. The plant is found mostly in Mediterranean region, Europe, Northern Asia, it is also reported to be planted in Indian gardens. The plant occurs during November to January.

OTHER NAMES :

Arabic	:	Lisan-us- Saur
Persian	:	Gaozaban
English	:	Borage
Gujarati	:	Gaozaban
Hindi	:	Gojihva
Urdu	:	Gaozaban

DESCRIPTION :

Macroscopic : The leaf is simple, obovate or ovate in shape, with an obtuse apex and crenate margin, The upper leaves are sessile or shortly stalked, while the lower ones exhibit a decurrent petiole. The leaves have a dark green upper surface with greyish green lower surface due to the prickly hairs.

Microscopic : The upper epidermis of lamina is covered with a thin, smooth cuticle and consists of one layer of polygonal cells with almost straight anticlinal walls. Stomata occur fairly frequently and are mainly of the anisocytic type, some are anomocytic. Covering trichomes are numerous, they are unicellular, straight having cellulose walls and tapering apices. The lumen is visible throughout the entire length, the base is somewhat swollen and may contain crystalline inclusions. Glandular trichomes consist of a unicellular stalk and a unicellular, sub-spherical head. The mid-rib has a typical dicotyledonous structure, the diameter of the central bundle increases from the apex to the base of the leaf. Large trichomes have their base surrounded by several small cells and the walls are sometimes warty. This type of trichomes are not as frequent as those with at the bulbous base. The cortex contains one or two rows of hypodermal collenchyma below the upper epidermis and above lower epidermis. The endodermal sheath is consisting of a single layer of cells containing starch grains. In transverse section this layer is horse-shoe shaped. The meristele is sub-spherical in shape and well defined in transverse section. The pericycle consists of a well defined area of collenchyma above the xylem and below the phloem. The transverse section through the petiole is similar to that of the mid-rib with a exception that cells are slightly large due to the increase in size of the total structure. Some trichomes contain crystalline deposit in their basis.

Powder: The powdered drug is light brown with greenish tinge, and have cucumber like odour and taste. On microscopic study it shows to contain various glandular and non-glandular unicellular trichomes, palisade and spongy mesophylls, collenchyma, and thin layer parenchymatous cells. The tracheidal vessels and vessels with annual and spiral thickenings are also seen scattered with epidermal fragments.

CHEMICAL CONSTITUENTS :

Alkaloids, mucilage, potassium nitrate, calcium oxalate.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 21% , Appendix 2.2.3.
Acid insoluble ash - Not more than 6% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 2% , Appendix 2.2.6.
Water-soluble extractives - Not less than 16% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Chloroform (3:5)	2% Ethanolic H_2SO_4	1	0.79

TEMPERAMENT : Hot 1° Moist 1°

ACTION : Munaffis-e-Balgham, Mulattif, Mohrriq, Muqawwi-e-Qalb

THERAPEUTIC USE : Zeeq-un-Nafas, Yarqan, Zukam, Nazla, Khafqan

DOSE : 7 -17 g

IMPORTANT FORMULATIONS : Khamira-e-Gaozaban Ambari Jawahir wala, Khamira-e-Gaozaban Sada, Khamira-e-Zahar Mohra,Majoon-e-Azaraqi, Majoon-e-Khadar, Majoon-e-Rahul-Momineen Dyaqooza, Majoon-e-Ushba, Mufarreh-e-Barid, Mufarreh-e-Sosambri, Mufarreh-e-Barid JawahirWali Mufarreh-e-yaqooti Barid, Mufarreh-e-Yaqooti Motadil, Sharbat-e-Deenar,Zuroor-e-Gaozaban, Arq-e-Chobchini, Arq-e-Gaozaban, Arq-e-Juzam.

GAZAR
(Root)

The drug Gazar consists of dried roots of *Daucus carota* Linn. (Apiaceae). A hispid much branched herb with conical fleshy roots. The plant is indigenous to Kashmir and Western Himalaya . It is cultivated throughout India. The plant occurs during winter season. Flowering and fruiting takes place during January to March.

OTHER NAMES :

Arabic : Abu Maqabil, Jazar
Persian : Zardak, Gazar
Assammese : Gajar
Bengali : Gajar
English : Carrot
Gujarati : Gajar
Hindi : Gajar, Gafar, Gajra
Kashmiri : Bulmuj, Kach, Marmuj.
Malayalam : Gajjara kelangu
Marathi : Gazara
Oriya : Gajaro
Punjabi : Gajar
Sanskrit : Dendiramodaka, Gajara
Tamil : Gajara-Kilamgu, Kerau karthikkilange
Telugu : Pita-Kande, Gajjaragedda, Pachcha Mulangi
Urdu : Gajar

DESCRIPTION :

Macroscopic : The tape root is thick fleshy about 5-30 long and more or less conical in shape. The colour varies from white to yellowish orange, yellow, light purple, deep red or deep violet.

Microscopic : The cross section of the roots is almost circular in outline. The rind is thin and mostly scrapped off. This layer is followed by 5-10 layers of secondary cortex the cells of which are tangentially elongated and filled with orange coloured pigments. This is followed by a thick zone of vascular bundles. Reserve food stuff is filled within this region. The xylem vessels are abundant in the central portion and occur solitary or in groups.

Powder : The powder is mostly composed of fragments of parenchymatous tissue mostly yellowish in colour, vessel members in groups as well as solitary. The powder is camel coloured, strongly odourous, odour not distinct, indefinite taste.

CHEMICAL CONSTITUENTS :

Sugars, starch, volatile oil, protein, pectin, malic acid, lignin and a neutral principle carotine and cortine oils.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 7%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 3%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 4%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 3%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (95:5)	5% Ethanolic H_2SO_4	1	0.43

TEMPERAMENT : Hot 2° and Moist 1°
Hot 1° Moist 1°

ACTION : Muqawwi-e-Aam, Muqawwi-e-Bah, Munaffis-e-Balgham, Mudirre-e-Baul, Mufattit-e-Hasat, Mufarreh.

THERAPEUTIC USE : Istisqa, Hasat-e-Kuliya

DOSE : 5-10 g

IMPORTANT FORMULATIONS : Halwa-e-Gazar in fresh form.

GUL-E-BABUNA
(Flower)

The drug Gul-e-Babuna consists of dried flowers of *Matricaria chamomilla* Linn. (Asteraceae). A glabrous much branched aromatic herb. The plant is a native of Europe, extensively cultivated Hungary, Germany, Russia, and Yugoslavia. In India it grows in Punjab and upper Gangetic plain. The plant is cultivated during winter season and the flowers and fruits occur in the same season.

OTHER NAMES :

Arabic	: Zahr-ul-Malik
Persian	: Gul-e-Babuna
Bengali	: Babunphul
English	: German Chemomile
Gujarati	: Babuna
Hindi	: Baboona
Punjabi	: Babanphul, Babuna
Urdu	: Gul-e-Babuna

DESCRIPTION :

Macroscopic : The dried flowers heads are 3-5 mm. in diameter, yellowish brown in colour. Peduncle is greenish, striated. The white strap shaped ligules are arranged in a single row on the periphery of the involucre of bracts. All the florets are borne on a dark central conical receptacle.

Microscopic : The receptacle in a longitudinal section shows that it is hollow inside. The wall of the receptacle is quite thin and consists of elongated parenchymatous cells. The vascular strands run longitudinally, small cavities are observed at some places.

Ligulate floret consists of an inferior appendage containing the ovary. The bracteole is thin papery, unevenly dissected into finger like projections at the apex. Androecium is absent. Gynoecium consists of an inferior, unilocular ovary containing a single basal ovule. The style is quite long and swollen near the base. The cells are thick walled in the swollen region. The stigma is bifid and protrudes out of the ligular tube. Two vascular strands run throughout length of the style.

The disc floret consists of separate inferior appendage containing ovary forming a neck. The stamens are borne on corolla tube by curved filaments. The anthers are bilobed and terminate into a conical structure. The structure of the gynoecium is same as in ligulate florets except the swelling near the base of the style is more prominent hair which appears like a disc. Cross section of the peduncle shows a continuous band of 3-4 rows of chlorenchymatous cells. Vascular bundles are present below ridges portion. The epidermis is single layered followed by 2-3 layered hypodermis only in the ridge portions. No definite endodermis is distinguishable. The cells of the pith region are thin walled and large in size.

The powder is yellowish brown in colour. It is slightly bitter in taste and has its own characteristic aromatic odour. The powder under microscope shows an abundance of sphaerical pollen grains which show a spiny exine. The measure 21-24.5 microns in diameter. Simple hairs and scales are seen amongst fragment of other floral appendages like corolla, stamens and style etc. isolated pitted xylem elements with reticulate thickenings are also seen.

CHEMICAL CONSTITUENTS :

Alkaloids, carbohydrates, phenols, proteins, aluminium, iron, potassium, sodium and zinc. Essential oil, glycoside, β- heteroside, chamazulene, apigenin, α-hetroside, salicylic acid and a non-crystalline β- hetroside: pure azulene isolated from the essential oil.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 12%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 4%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 4%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 26%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Benzene (2:3)	I_2 vapours	6	0.12, 0.20, 0.38, 0.54, 0.68, 0.89

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Moharrik, Mulattif, Kasir-e-Riyah

THERAPEUTIC USE : Suda, Suzak, Ramad, Waj-us-Sadr, Hasat-e-Kuliya Wa Masana, Zof-e-Aam, Ikhtinaq-ur-Rahem, Su-e-Hazm, Humma-e-Naubati

DOSE : 5 g

IMPORTANT FORMULATIONS : Majoon-e-Fotnaji, Majoon-e-Seer Alvi Khani, Zimad-e-Mohallil, Zimad-e-Sumbul-ut-Teeb, Zimad-e-Waram-e-Unsayain-Muzmin, Raughan-e-Babuna Sada, Raughan-e-Babuna Qawi Qarooti Bazr-e-Katan.

GUL-E-BANAFSHA
(Flower)

The drug Gul-e-Banafsha consists of dried flowers of *Viola odorata* Linn. (Violaceae). A glabrous of pubescent herb about 15 cm in height arising from a root stock. The plant is found in Kashmir and other parts of the Western Himalayan regions at altitudes of 1500 to 1800 m. The plant occurs October to August. Flowering and fruiting takes place during April to July.

OTHER NAMES :

Arabic	: Firfeer Banajsaj
Persian	: Gul-e-Banafsha
Bengali	: Banafshah, Bansa
English	: Sweet violet, Wild Violet
Gujarati	: Bahapa, Bahaphsa
Hindi	: Banafshah
Kashmiri	: Banafsha
Marathi	: Bugabanosa
Tamil	: Vialethoo
Telegu	: Vilalettu
Urdu	: Gul-e-Banafsha

DESCRIPTION :

Macroscopic : Flowers are pedicelate, deep violet in colour. Calyx consists of five sepals, green persistent and imbricate in bud. Corolla consists of 5 deep violet petals with a bluish white base. Androecium consists of 5 stamens. Gynoecium consists of three carpels which is syncarpous.

Microscopic : Transverse section of the pedicel shows almost circular in outline and a central stele. Single layered epidermis followed by multilayered cortex. The central stele is enclosed in common sclerenchymatous pericycle followed by a continuous phloem. The xylem is formed of vessels tracheids, fibres and parenchyma. The pith consists of straight walled parenchymatous cells. Rosettes of calcium oxalate crystals are observed in the cortical and phloem cells.

The sepal in transverse section shows an upper and lower epidermis made up of small rectangular cells. Epidermis is followed by 3-4 layers of parenchymatous cells loosely arranged with intercellular spaces. Calcium oxalate crystals are present in the cells of mesophyll.

Transverse section of the petal is similar to that of sepal. However, the cells of mesophyll and epidermis are comparatively smaller in size than cells of sepal.

Transverse section of anther shows four sporangia. The epidermis is single layered made up of isodiamatric cells. The cells of the epidermis show lignification on the radial and inner tangential walls of the anther. The interior spurred anther shows a beak like structure when cut longitudinally. The pollen grains are smooth thin walled spherical and having single germ pore.

Powder: The powder is brown in colour, without any definite smell. Powder analysis of the crude drug reveals the presence of fragments of calyx, corolla and epidermal cells of anther along with pollen grains. Tracheids of different size, cells of xylem parenchyma and occasionally trichomes born on pedicel are also observed under the microscope during powder analysis.

CHEMICAL CONSTITUENTS :

Glycosides, phenolic compounds, tannins flavonoids resin sterols, triterpenes, saponins, potassium, magnesium, sodium, iron.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2% , Appendix 2.2.2.
Total Ash	-	Not more than 11% , Appendix 2.2.3.
Acid insoluble ash	-	Not more than 3% , Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 1.5% , Appendix 2.2.6.
Water-soluble extractives	-	Not less than 11% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform	I_2 vapours	1	0.19

TEMPERAMENT : Cold 1° Moist 1°

ACTION : Mulaiyin, Munaffis-e-Balgham, Mohallil-e-Waram.

THERAPEUTIC USE : Qabz, Sual, Nazla

DOSE : 10 - 25 g

IMPORTANT FORMULATIONS : Habb-e-Sil, Itrifal-e-Zamani, Khamira-e-Banafsha, Majoon-e-Antaki, Mufarreh-Motadil, Mufarreh yaqooti Barid, Qairooti Bazr-e-Katan, Qarooti Mohallil, Zimad-e-Waram-e-Unsayain, Muzmin, Raughan-e-Banafsha, Sharbat-e-Banafsha, Sharbat-e-Ejaz, Habb-e-Ghariqoon, Dayaqooza.

GUL-E-MADAR
(Flower)

The drug Gul-e-Madar consists of dried flowers of *Calotropis procera* (Ait.) R.Br. Syn. *Calotropis hamiltoni* Wall. (Asclepiadaceae). An erect shrub, young parts clothed with white cottony tomentum. It is found more or less throughout India in warm and dry places. It is also found in Afghanistan, Persia, Arabia, Egypt and tropical Africa. The plant occurs throughout the year and flowering and fruiting take place from September to February.

OTHER NAMES :

Arabic	Zahr-ul-Ushr
Persian	Gul-e-Kharaq
Bengali	Akanda, Aak
English	Madder Tree
Gujarati	Akada
Hindi	Madar, Safedak
Kannada	Ekke
Malayalam	Bukam
Marathi	Mandaro
Oriya	Arako
Punjabi	Shakar-ul-Ushar
Sanskrit	Alarka, Arka-Vrishaha
Tamil	Erukku, Vellerakku
Telugu	Mandaramu
Urdu	Gul-e-Madar

DESCRIPTION :

Macroscopic : The flowers are pentamerous, calyx divided to the base, sepals ovate, acute, glabrous. Corolla is whitish outside and violet on inner surface. Lobes of corona is compressed equaling the staminal column. The prismatic stigma is fused with the androecium forming the gynostagiums. All the pollen grains of each lobe aggregate together to form pollinium. Each pollinium is provided with a stalk called caudicle and sticky base called disc of corpusculum.

Microscopic : Cross section of sepal and petal reveals that they are parenchymatous, externally bounded by papillose epidermis bearing numerous hairs. Some of the cells in the inner side of the petals contain the violet pigments. Cross section cut through gynostagium shows a peculiar outline. The carpel bears a bicarpillary ovary which contains numerous ovules. The pedicel shows similar structure to axis. They are circular in cross section the uniseriate epidermis bearing hairs and trichomes form outermost boundary. It is followed by a wide zone of cortex which shows abundance of branchy sclereids of varying size. The xylem bundles are arranged in a ring while the phloem lies outer to xylem.

Powder : The powder is coarse, heterogenous, yellowish brown in colour with a characteristic aromatic odour and slightly bitter taste.

CHEMICAL CONSTITUENTS :

Steroids, terpenoids, phenolics, tannins, glycosides, proteins, carbohydrates, aluminium, iron, calcium, magnesium and sodium. Cyanidin-3-rhamnoglucoside isolated from flowers. Quercetin –3-rutinoside, new triterpine-calotropenyl acetate isolated and its structure elucidated.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	:	Not more than	2%	, Appendix 2.2.2.
Total Ash	:	Not more than	23%	, Appendix 2.2.3.
Acid insoluble ash	:	Not more than	19%	, Appendix 2.2.4.
Alcohol-soluble extractives	:	Not less than	6%	, Appendix 2.2.6.
Water-soluble extractives	:	Not less than	20%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. ether: Diethyl ether (4:1)	I_2 vapours	3	0.25, 0.44, 0.89

TEMPERAMENT : Hot 3° Dry 3°

ACTION : Musakkin-e-Alam, Mohallil, Muqawwi-e-Meda, Munaffis-e-Balgham.

THERAPEUTIC USE : Zeeq-un-Nafas, Zof-e-Meda

DOSE : 125-375 mg

IMPORTANT FORMULATIONS : Habb-e-Papita Wilayati

GURMAR BUTI
(Leaf)

The drug Gurmar Buti consists of dried leaves of *Gymnema sylvestre* R.Br. Syn. *Asclepias geminata* Roxb., *Periploca sylvestre* Retz (Asclepiadaceae). A large more or less pubesecent climbing shrub found in Central and Southern India on the Western Ghats and Goa. The plant occurs throughout the year. Flowering takes place during April – May which is followed by fruiting.

OTHER NAMES :

Bengali	:	Gadalshingi
English	:	Small Indian Ipecacuanha
Gujarati	:	Dhulcti, Mard Shingi
Hindi	:	Gurmar, Merasingi
Marathi	:	Bedaki, Bedakuli
Sanskrit	:	Meshashringi, Ajaglandini, Ajashrajgi, Med Phale
Tamil	:	Shirukurinja
Telegu	:	Podapatri, Potla Podra
Urdu	:	Gurmar Buti

DESCRIPTION :

Macroscopic : The leaves are 2.5-7.0 cm by 1.0-3.5 cm in size. The lamina is ovate-elliptic or ovate lanceolate with a short petiole. Both the surfaces are pubescent. The margin is entire & the apex acute or shortly acuminate. The base is rounded or cordate sometimes cuneate. The leaves have the property of neutralizing sweet taste.

Microscopic : The petiole transverse section shows more less a plano-convex outline. the hairs present on the petiole are of non-glandular type only and are present all round. The cross section shows a single layered epidermis, a wide cortex composed of collenchyma followed by parenchyma on the inner side. There are usually five vascular bundles, a fan shaped bundle in centre flanked on either side by two small bundles of which the one lying close to regions of the lamina away from the central vascular bundle is small being represented by one or two xylem elements and a few phloem cells.

The midrib shows a ventral bulge, which becomes less prominent towards the apical region. The epidermis consists of a single layer of cells covered externally with a prominent cuticle. Following the epidermis is a wide zone of cortex composed of 4-5 layers of collenchyma and a wide zone of parenchyma. Rosette crystals of calcium oxalate are present in the cortex mostly in the parenchyma. The cross section of the lamina shows a dorsiventral structure with its mesophyll differentiated into palisade and spongy tissue.

The cells of upper epidermis are some what tubular and covered externally by a cuticle. The mesophyll is composed of a single layer of palisade parenchyma. Rosette crystals of calcium oxalate are present in idioblasts in the spongy parenchyma.

The powder obtained after straining through No. 30 mesh is homogenous, granular and pale green in colour. It gives no odour but is bitter in taste. The powder clearing in chloral hydrate shows under microscope a lot of the multicellular, non-glandular trichomes and various leaf tissues. Epidermal cells and stomata are also seen which appear paracytic type. Rosettes of calcium oxalate are also present.

CHEMICAL CONSTITUENTS :

Carbohydrates, glycosides, phenolics, proteins, steroids, tannins, calcium, chromium, iron, potassium, magnesium and sodium,

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 11% , Appendix 2.2.3.
Acid insoluble ash - Not more than 4% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 12% , Appendix 2.2.6.
Water-soluble extractives - Not less than 24% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Diethyl ether (4:1)	I_2 vapour	5	0.16, 0.23, 0.30, 0.55, 0.82

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Mulaiyin, Mulattif

THERAPEUTIC USE : Salas-ul- Baul, Amraz-e-Qalb, Ziabetus

DOSE : 4 - 6 g

IMPORTANT FORMULATIONS : Qurs-e-Ziabetus Khaas

HABB-UL-NEEL
(Seed)

The drug Habb-ul- Neel consists of dried seeds of *Ipomoea nil* (Linn.) Roth. Syn. *Ipomoea hederacea* auct. non Jacq. (Convolvulaceae). A spreading herbaceous twiner found throughout India, upto a height of 2000 m in the Himalayas and also grown in gardens for its ornamental flowers. The plant occurs throughout year, the flowering and fruiting take place from August –October.

OTHER NAMES :

Arabic	: Dam-at-ul-Ushshaaq Habb-ul-Neel
Persian	: Tukhm-e-Kubkoo
Bengali	: Kaladanh, Nilkalmi
English	: Pharbitis seeds
Hindi	: Kaladana, Mirchai
Kannada	: Ganribija
Tamil	: Kakkattan, Sirikki
Telugu	: Jirika, Kolli
Urdu	: Habb-ul-Neel, Kaladana

DESCRIPTION :

Macroscopic : The seeds are glabrous, black, three sided and plano-convex in shape. The seed coat is smooth with a micropyle on the plane side of the seeds. The seeds are 6-9 mm long and 3-4 mm broad. Fracture hard, difficult, to break.

Microscopic : Transverse section of the outer seed coat shows an epidermis consisting a palisade layer which is 3-4 cells in thickness. These palisade cells are radially elongated thin walled, almost rectangular and devoid of any content. Below the palisade layer is a region of 2-3 layers of large cells. The innermost layer is somewhat tangentially elongated. The inner seed coat is represented by a disintegrated layer which is yellowish brown in colour. Beneath this there is a 2-3 celled thick parenchymatous layers. Cells of endosperm are oval or rectangular and thick walled containing plenty of aleurone grains.

The powdered drug is light black or grey in colour, odourless and bitter in taste. Powder when passed through 60 mesh shows the presence of cells of palisade layer, parenchymatous cells beneath and palisade, thick-walled cells of the endosperm and aleurone grains. The palisade cells were found either singly or in groups. The cells of cotyledons were also observed. These cells are oval to round or polygonal in shape containing abundant aleurone grains. The aleurone grains are oval to round in shape and give positive test for proteins.

CHEMICAL CONSTITUENTS :

Steroids/ triterpenes, alkaloids, glycosides, flavonoids amino, acids, resins, reducing sugars, tannins, fixed oils, potassium, iron, phosphate and chloride.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	6%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	2%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	11%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	24%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^0) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform (100%)	I_2 vapours	1	0.05

TEMPERAMENT : Hot 3^0 Dry 3^0

ACTION : Jali, Mukharrish, Mushil-e-Qawi, Qatil-e-Deedan-e-Ama

THERAPEUTIC USE : Nazla, Istisqa-e-Ziqqi, Niqras, Waj-ul- Mafasil, Bars, Hikka, Deedan-e-Ama

DOSE : 1 - 1.5 g

IMPORTANT FORMULATIONS : Habb-e-Falij Mulaiyin, Habb-e-Shabyar, Kohal-e-Roshnai, Itrifal-e-Deedan, Jawarish-e-Shahreyaran, Majoon-e-Kakanaj, Majoon-e-Talkh, Habb-e-Iyarij.

HANZAL
(Root)

The drug Hanzal consists of dried roots of *Citrullus colocynthis* Schard. Syn. *Cucumis colocynthis* Linn. (Cucurbitaceae). A perennial trailing scabrid herb. The plant is a native of warmer parts of Asia and Africa. It is found in Arabia, Syria, Egypt and the Mediterranean region. It also occurs all over India. The plant occurs throughout the year. Flowering and fruiting take place from July to October.

OTHER NAMES :

Arabic : Urooq-ul-Hanzal
Persian : Bekh-e-Hanzal, Bekh-e-Henduana talkh, Bekh-e-Khanpza-e-Talkh
Bengali : Indarjan, Makhal
English : Bitter Apple Root, Colocynth
Gujarati : Indark, Indranan, Indravana, Indravanan
Hindi : Indrayan, Makal, Ghorumba
Kannada : Tumti kayi, Pava-makke kayi
Kashmiri : Peykommutti
Malayalam : Indraphal, Indravana, Indrayan, Kadurindavana
Marathi : Indaraunaraghune, Indrayan
Oriya : Atmaraksha, Brihadvaruni, Bhihatphala, Chitrala
Punjabi : Indraumarghune
Sanskrit : Atmaraksha, Brihadvaruni, Brihatphala, Chitrala
Tamil : Peykkumutti, Peyttumatti, Verikkummatti
Telugu : Chittipapara, Etipunchchha, Paprabudama
Urdu : Bekh-e-Hanzal

DESCRIPTION :

Macroscopic : The dry roots are 5.0 to 7.0 cm in length, 1.5-2.8 cm in diameter and cylindrical. Outer surface is yellowish brown having longitudinal striations. The fracture is coarsely fibrous; internal colour yellow. Odour is distinctive and taste is bitter.

Microscopic : In transverse section the root shows a wavy circular outline and a narrow cork; a moderate cortex and a large wood. The phellem or cork cells are rectangular, radially flattened which are attached to phellogen. The phellogen or cork cambium cells are rectangular, tangentially elongated and almost uniform in shape which are several layer in thickness. The phelloderm or secondary cortex is consisted of thin walled parenchymatous cells, 10-15 cells in thickness containing several starch grains. The vascular system is consisted of well developed xylem and phloem region. Scattered vessels in groups or singly are also found in small number in other part of the wood embedded in the parenchyma. The medullary rays are bi or tri-seriate and narrow. The parenchyma of wood contains starch grains which are simple or compound and oval to round in shape.

Powder: Powder analysis of the crude drug revealed the presence of fragment of cork cells, cortical cells and xylem parenchyma containing starch grains, xylem parenchyma trachieds, vessels and wood fibres. Free starch grains are also studied.

CHEMICAL CONSTITUENTS :

Glycosides, steroids, carbohydrates, phenolic, tannins, sodium, potassium, calcium, phosphorous & iron phosphate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	-	Not more than	2%	, Appendix 2.2.2.
Total ash	-	Not more than	10%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	5%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	4%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	10%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^{0}) extract:

Solvent system	Spray/reagent treatment	No.of spots	Rf value
Chloroform: Acetone (9:1)	I_2 vapours	2	0.10, 0.32

TEMPERAMENT : Hot 3^{0} Dry 3^{0}

ACTION : Mushil, Mohallil, Musqit-e-Janeen

THERAPEUTIC USE : Istisqa, Yarqan, Qabz-e-Daemi, Waram-e-Kabid

DOSE :125 – 250 mg

HINA
(Leaf)

The drug Hina consists of dried leaves of *Lawsonia inermis* Linn. Syn. *Lawsonia alba* Lam. (Lythraceae). A much branched shrub found in western India, and cultivated throughout the country. It occurs throughout the year. Flowering and fruiting take place during October to November.

OTHER NAMES :

Arabic	: Hinna
Persian	: Hina
Bengali	: Mehedi, Mendi
English	: Henna plant, Egyptian Privet
Gujarati	: Mendi
Hindi	: Mehendi, Hena
Kannada	: Gorante Mayilanchi
Malayalam	: Marutonni, Pontalasi
Marathi	: Mendi, Mehendi
Oriya	: Manjuati
Punjabi	: Hinna, Mehndi
Sanskrit	: Kukravaka, Sahashara, Kokadanta
Tamil	: Marutonri, Aivanam, Marithondi, Maruthani, Aivani, Korandam, Kurandagam, Kurinji, Pida.
Telugu	: Goranta, Goranti, Gorata, Krommi, Kuravakamu, Maida, Pachapeddagoranta
Urdu	: Mehndi

DESCRIPTION :

Macroscopic : Leaves are simple, entire greenish-brown to dull green lanceolate, apex mucronate, base tapering, short petiolate, glabrous, 2-3 cm in length and 1-1.5-cm in breadth. Odour when crushed, aromatic, taste sweet, mucilaginous and slightly astringent.

Microscopic : In transverse section the epidermis consists of single layer of mostly cubical cells, covered by thick and stratified cuticle, Beneath which the collenchymatous cells are more or less circular or elliptical in shape with granular thickening. A thin strip of pericycle, composed of 2-4 layers of cells is present encircling the stele. The stele is composed of an inter-xylary phloem and continuous xylem cylinder within. A thin strip of cambium is present between the phloem and xylem tissue. In transverse section lamina shows an upper and lower epidermis, covered externally by the thick and striated cuticle. Both the epidermis are composed of tangentially elongated cells, some of which are specialized into mucilaginous sacs. These sacs are bigger in size than epidermal cells. Stomata are present on both the surfaces. These are ranunculaceous type. The parenchymatous cells are oval or circular in shape, contain oil globules, rosette and monoclinic prisms of calcium oxalate crystals. The mid-rib has a structure almost similar to that of the petiole but some of the parenchymatous cells of the phloem get converted into thick walled cells and form an incomplete arc of sclerenchymatous fibres.

Powder : Powdered drug is olive to brownish green in colour. Microscopic examination shows many fragments of cuticle and leaf parenchyma, collenchyma, globular mucilaginous sacs, palisade tissue, epidermal cells with ranunculaceous stomata, rosette and prismatic crystals of calcium oxalate and oil globules. Some fragments of fibres and vessels are also present.

CHEMICAL CONSTITUENTS :

A colouring matter, Hanno-tannic acid/ tannin, resin, alkaloids, steroids, saponin, reducing sugars and mucilage. Two new xanthones-laxanthones (I) and (II) isolated and characterised as 1,3-dihydroxy-6,7-diamethoxy xanthone and 1-hydroxy-3,6 diacetsoxy-7- methoxy xanthone respectively. Laxanthone (III) isolated and identified as !-hydroxy-3,7- dimetaxy-6- acetoxyxanthone.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter : Not more than 2% , Appendix 2.2.2.
Total Ash : Not more than 7% , Appendix 2.2.3.
Acid insoluble ash : Not more than 1.5% , Appendix 2.2.4.
Alcohol-soluble extractives : Not less than 24% , Appendix 2.2.6.
Water-soluble extractives : Not less than 27% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Chloroform (1:1)	I_2 vapours	2	0.92, 0.98

TEMPERAMENT : Cold 2° Dry 2°

ACTION : Mudirr-e-Baul, Mohallil-e-Waram, Mujaffif, Musaffi-e-Dam

THERAPEUTIC USE : Suda, Shaqiqa, Qurooh, Qula, Qurooh-e-Aatishak, Ehtebas-e- Tams, Jarab, Amraz-e-Tehal

DOSE : 2.25 - 4.5 g

IMPORTANT FORMULATIONS : Habb-e-Surkhbada, Marham-e-Jadwar, Marham-e-Kharish, Araq-e-Juzam, Araq-e-Musaffi-e-Khoon Qawi.

HULBA
(Seed)

The drug Hulba consists of dried seeds of *Trigonella foenum-graecum* Linn. (Papilionaceae). An erect annual plant native to South Europe and Asia and is widely cultivated in many parts of India. The plant occurs during winter season. Flowering and fruiting takes place during February to March.

OTHER NAMES :

Arabic : Shimleet, Qarn-us-Saur
Persian : Shamleez, Shamiled
Bengali : Methi, Methi-Shak, Methuka, Hoemgreeb
English : Fenugreek, Greek Hayes
Gujarati : Methi, Methnini, Bhaji
Hindi : Methi, Muthi
Kannada : Menthya, Mentesoppu, Menk Pallao, Mente
Malayalam : Uluva, Venthiom
Marathi : Methi
Punjabi : Methi, Methri, Methun
Sanskrit : Bahuparni, Bahupatrika, Chandrika
Tamil : Vendayam, Ventayam
Telugu : Mentikura (herb), Mentulus (seeds)
Urdu : Methi

DESCRIPTION :

Macroscopic : The drug consists of dried seeds, rhomboidal in shape and with a deep olive yellow colour, compressed, truncate at both ends, 3.0-7.0 mm in length, 2.8-4.0 mm in breadth and 2.2-2.5 mm. in thickness. The funicular point on the lateral side and a "V" shaped narrow furrow starts just from the depression nearly at the center of the lateral side. The testa is smooth and hard. The taste is bitter, odour pungent and agreeable.

Microscopic : The transverse section of the seed coat consists of an outer palisade layer. Palisade cells are radially elongated and their tips are pointed and show thickenings on outer walls. Below the palisade layers there is a parenchymatous layer of oval to round cells, 1-2 cells in thickness, followed by 2-3 layers of squarish or tangentially elongated cells of parenchyma. Just beneath is another layer of oval to round parenchymatous cells. Certain cells of this layer are thick walled containing fixed oil. The parenchymatous cells of the endosperm are thin walled and oval to polygonal in shape. The epidermis of the cotyledons consists of small, hexagonal to polygonal cells with thickening in outer walls. Below this, a multilayered polygonal parenchymatous layer of cells containing aleurone grains.

The radical is situated in radicular pocket on the lateral side of the seed. The covering of the radical pocket is anatomically similar to that of the seed. The epidermis of radical consists of oval to round parenchymatous cells with their outer walls thickened. Rest of the radical is composed of thin walled parenchymatous cells which are oval to round in shape with inter cellular spaces.

CHEMICAL CONSTITUENTS :

Alkaloids, flavonoids, glycosides, proteins, aminoacids, reducing sugars, saponins, steroids, triterpenes, tannins, fixed oils, sodium, Potassium, magnesium, Iron, phosphates, sulphates and chloride. A glycoside of furost-5 -en-3B –22, 26 triol with glucose, rhamonose, and xylose as sugars isolated from seeds. Two new furostanol glycoside isolated as their methyl ethers –trigofoenosides A-1 and D-1 from seeds.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	:	Not more than	2%	, Appendix 2.2.2.
Total Ash	:	Not more than	4%	, Appendix 2.2.3.
Acid insoluble ash	:	Not more than	1%	, Appendix 2.2.4.
Alcohol-soluble extractives	:	Not less than	3%	, Appendix 2.2.6.
Water-soluble extractives	:	Not less than	10%	, Appendix 2.2.7

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl acetate (9:1)	Phosphoric acid	4	0.43, 0.56, 0.71, 0.84

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Mulattif, Mudirr-e-Baul, Mudirr-e-Haiz, Mulaiyin, Munaffis-e-Balgham, Mohallil-e-Waram

THERAPEUTIC USE : Sara, Istirkha, Niqras, Istisqa-e-Ziqqi, Sual-e-Muzmin, Izm-e-Tehal, Waram-e-Rahem, Bawaseer

DOSE : 3.5 -7 g.

IMPORTANT FORMULATIONS : Laooq-e-Hulba, Laooq-e-Zeeq-un-Nafas, Qairooti-e-Aarad-e-Karsana, Zimad-e-Khanazeer, Zimad-e-Kibreet, Habb-e-Khabsulhadeed, Dawaul Luk, Marham Dakhliyun

INDERJAO SHIREEN
(Seed)

The drug Inderjao Shireen consists of dried seeds of *Wrightia tinctoria* (Roxb.) R. Br. Syn. *Nerium tinctorium* Roxb. (Apocynaceae). A small deciduous tree found in Rajasthan, Madhya Pradesh and Western Ghats of Tamil Nadu upto 1400 m in the hills. It occurs throughout the year. Flowering takes place during May to September while the fruiting occurs during December to January.

OTHER NAMES :

Arabic : Lisan-ul Asafeer ul- Hulu
Persian : Tukhm-e-Inderjao Shireen, Tukhm-e-Anar Shareen
Bengali : Inderjou
English : Sweet inderjao
Gujarati : Indarjou
Hindi : Mitha indarjou
Kannada : Kiridosige, kodamurki, Beppalli, Hale
Malayalam : Kotakappala
Marathi : Kala kudi, Kalakura
Oriya : Dudho kuriya
Punjabi : Inderjao mitha
Sanskrit : Svetakutaja, Madhu indarjora
Tamil : Vetpala-virai
Telugu : Kodisha vittulu, Linga vittulu
Urdu : Inderjao shireen

DESCRIPTION :

Macroscopic : The seeds are greenish in colour, 1.0 –1.9 cm in length and 2-3 mm in breadth, apex slightly pointed. The base of the seeds has the coma of hairs. In dried seeds these are shaded. At one side it is flat or slightly longitudinally grooved. The seeds when soaked in water release greenish colouring matter.

Microscopic : In cross section, the inner most layer of the testa is followed by three layers of more or less tangentially elongated cells of endosperm filled with globular contents. The cotyledonary tissue consists of single layered, usually tangentially elongated outer and inner epidermis and the ground tissue in between.

The crude drug powder is brown in colour and shows the pieces of sclerenchymatous cells of seed coat, isodiametric cells of endosperm, epidermis and radially elongated parenchymatous cells of cotyledons. Prismatic crystals of calcium oxalate are also observed.

CHEMICAL CONSTITUENTS :

Alkaloids, steroids, saponins and reducing sugars.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 7% , Appendix 2.2.3.
Acid insoluble ash - Not more than 2% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 20% , Appendix 2.2.6.
Water-soluble extractives - Not less than 29% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^o) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Pet. ether (2:3)	I_2 vapours	4	0.34, 0.44, 0.84

TEMPERAMENT : Cold 2^o Dry 2^o

ACTION : Mohallil-e-Waram, Kasir-e-Riyah, Musakkin

THERAPEUTIC USE : Ramad, Yarqan, Warame-e-Tehal, Namal, Bawaseer, Nafakh-e-Shkikam

DOSE : 1-3 g also used externally

IMPORTANT FORMULATIONS : Qurs-e-Habis, Laboob-e-Kabir, Majoon-e-Kalkalanaj, Majoon-e-Khadar, Majoon-e-Muluki.Itrifal-e-Kabir.

IRSA
(Root)

The drug Irsa consists of dried roots of *Iris ensata* Thunb. (Iridaceae). The plant is found in Western Himalayan at altitudes of 1500 to 3000 m. It occurs throughout the year. Flowering and fruiting take place during June-September.

OTHER NAMES :

Arabic	:	Urooq-us-Sosan
Persian	:	Bekh-e-Sosan Asmanjoni, Bekh-e-Bansfsha
Hindi	:	Iirsa, Sosun
Kashmiri	:	Krishun, Marjal Unarjal
Urdu	:	Irsa

DESCRIPTION :

Macroscopic : The root of *Iris ensata* Thunb. are brown small pieces of different shapes but usually they are elongated having transverse wrinkles. The odour is pungent and taste is slightly bitter and aromatic.

Microscopic : The transverse section of root shows the single layer of epidermis which consists of typical parenchymatous cells with thick outer walls. The cortical region usually made up of several layers of rectangular to oval parenchymatous cells. Most of these cells possess oil globules with other yellowish-brown contents. The endodermis is found to attached with 4-5 layers of highly thick walled cells which are polygonal to oval in shape and they are present in somewhat compact masses. There is no cortical vascular bundle but vascular bundles are numerous and closely scattered in the pith internal to the endodermis. Vascular bundles are more or less roundish in shape on tapering to one side. Each vascular bundle consists of phloem and scattered xylem elements which are enclosed by lignified fibrous sheath of 1-3 layers of cells. The parenchymatous cells of pith are thin walled compact and polygonal to oval in shape.

Powder: Powder of crude drug is characterised by the presence of fragments of epidermis, cortical parenchyma and highly thick walled cells attached with endodermis, fragments of vessels and fibres. The vessels are long, lignified and generally have spiral and pitted thickenings.

CHEMICAL CONSTITUENTS :

Glycosides, steroids, resins, proteins, phenolic compounds, tannins, sodium, potassium, iron, calcium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	:	Not more than	2%	, Appendix 2.2.2.
Total Ash	:	Not more than	7%	, Appendix 2.2.3.
Acid insoluble ash	:	Not more than	2%	, Appendix 2.2.4.
Alcohol-soluble extractives	:	Not less than	6%	, Appendix 2.2.6.
Water-soluble extractives	:	Not less than	2%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	6	0.12, 0.21, 0.34, 0.59, 0.65, 0.78

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Mohalhil-e-Waram, Mulattif, Mufateh-e-Sudad, Munaffis-e- Balgham, Dafa-e-Tashannuj

THERAPEUTIC USE : Nazla, Sual, Ribu, Zat-ur-Riya, Falij

DOSE : 5-7 g

IMPORTANT FORMULATIONS : Majoon-e-Rahul Momineen, Zimad-e-Khanazeer, Arq-e-Chobchini

ISPAND
(Seed)

The drug Ispand consists of dried seeds of *Peganum harmala* - Linn. (Zygophyllaceae). A herbacious plant found in Kutch (Gujarat), Punjab, Delhi, Kashmir, Andhra Pradesh, Bihar, Uttar Pardesh, Karnataka and Maharasthra. The plant occurs from April to December. Flowering and fruiting takes place from July to October.

OTHER NAMES :

Arabic : Hurmul, Aspand
Persian : Sheersa, Sapand Sokhtani
Bengali : Isband
English : foreign Henna, Harmal, Wild Rue
Gujarati : Ispun, Hurmuro, Hurmal
Hindi : Ispand Lahouri, Kalandana, Lahouri-hurmul
Kannada : Simagoranta
Kashmiri : Isband
Marathi : Hurmala
Punjabi : Harmul, Isbound Lahouri
Tamil : Simaiyalavinai
Telugu : Simagoranta
Urdu : Ispand

DESCRIPTION :

Macroscopic : The seeds are triangular concavo-convex, dull brown in colour, up to 4 mm long and 1-2 mm broad. Fracture difficult to break but brittle. Taste very bitter, with a heavy narcotic odour when crushed.

Microscopic : The transverse section of the seed shows an outer epidermis consisting of layer of large cells with internal ramifications. The inner epidermis consists of the palisade layer containing a yellowish brown content. The endosperm occupies the major portion of the seed. The cell of the endosperm have abundant rounded to oval aleurone grains. All the cells of the cotyledon contain abundant, round to oval shape aleurone grains. A transverse section of the radical shows the pith consisting of small parenchymatous cells arranged with intercellular spaces. All the cells of the radical contain aleurone grains.

Powder : Powder analysis of the crude drug revealed the presence of parenchymatous cells with aleurone grains of endosperm cotyledons and radicle, parenchymatous cells of sepals and petals, palisade cells, large cells of outer epidermis of the seed-coat, epidermal cells of radicle, cotyledons, sepals and petals. Parenchymatous cells and epidermal cells of petals and sepals are found occasionally. Tracheids and fibres sometimes seen.

Tracheids are almost with round end and simple pits. The aleurone grains are present in powder.

CHEMICAL CONSTITUENTS :

Alkaloids, steroids, triterpenes, glycosides, resins, fixed oil, potassium, iron, phosphate and sulphate. harmine, vasicine and new alkaloid harmidine isolated from seeds. A mixture of harmine and harmaline found in stem, fruits and ripe seeds. In addition, oxodexy-pegamine and oxopegamine isolated from plant and seeds.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 7% , Appendix 2.2.3.
Acid insoluble ash - Not more than 2% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 9% , Appendix 2.2.6.
Water-soluble extractives - Not less than 19% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (9:1)	I_2 vapours	5	0.06, 0.40, 0.50, 0.71, 0.81

TEMPERAMENT : Hot 3° Dry 2°

ACTION : Mulaiyin, Muaddil, Daf-e-Kirm-e- Ama, Musaffi-e-Dam, Muallid-e-laban, Mudirr-e-Haiz, Mudirr-e-Baul, Muqawwi-e- Bah, Kasir-e-Riyah

THERAPEUTIC USE : Zeeq-un- Nafas, Fawaq, Waj-ul- Mafasil, Ikhtinaqur-Rahem, Irq-un- Nisa, Istisqa, Falij, Zof-e-Bah

DOSE : 4.5 - 9 g

IMPORTANT FORMULATIONS : Habb-e-Hindi Mumsik, Raughan-e- Ispand, Habb-e-Muntin Akbar, Zimad-e-Kibreet.

KAIFAL
(Stem Bark)

The drug Kaifal consists of dried stem bark of *Myrica esculenta* Buch. Ham. Syn. *Myrica nagi* Thunb. (Myricaceae). A small tree found in sub-tropical Himalayas, Shimla, Sylhet (Bangladesh) and Southwards to Singapore, Khasia mountains and hills of Burma. Very commonly cultivated in China and Japan. The plant occurs throughout the year. Flowering takes place during August – October, fruiting during May-June.

OTHER NAMES :

Arabic : Qandool, Old-ul-Barq
Persian : Darsheesha' An
Bengali : Kaipal
English : Box Myrtle
Hindi : Kaiphal
Malayalam : Marutumotoli
Tamil : Marudum, Pattai
Telugu : Kaideryamu
Urdu : Kaifal

DESCRIPTION :

Macroscopic : Bark occurs in pieces of varying size, rough brownish-grey, outer surface rough, greyish white, lenticellate, fissured longitudinally and transversely, inner surface smooth, brownish, outer ends uneven, margins, slightly curved towards inside, with pleasant odour, bitter and acrid taste. Fracture hard and brittle.

Microscopic : Phellem consists of 10-15 layers of cork cells filled with brown colouring substances. Phellogen is 5-6 layers in thickness. Phelloderm consists of 10-20 layers of cells in thickness. Solitary stone cells are abundant in the cork and phelloderm. presence of stone cells is also observed in the phloem region. Large laticiferous cells are present in the secondary phloem. Medullary rays are rare. Stone cells are present in the cork region, phelloderm and secondary phloem regions.

Powder : The powder as such is chocolate brown in colour with pleasant odour and bitter acrid in taste. The bark powder filtered through a 60 mesh sieve shows the presence of fragments of cork layer, stone cells of various sizes and shapes, parenchymatous cells of phelloderm and secondary phloem, large laticiferous cells and starch grains.

CHEMICAL CONSTITUENTS :

Glycosides, tannins, flavonoids, reducing sugars, resins, steroids, proteins, amino acids, potassium, calcium, iron, zinc, chloride and phosphate, β- sitosterol, taraxerol, myricadiol isolated from bark. Myriconol isolated from stem bark.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter : Not more than 2% , Appendix 2.2.2.
Total Ash : Not more than 3% , Appendix 2.2.3.
Acid insoluble ash : Not more than 1% , Appendix 2.2.4.
Alcohol-soluble extractives : Not less than 7% , Appendix 2.2.6.
Water-soluble extractives : Not less than 22% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (9:1)	I_2 vapour	2	0.37, 0.48

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Mohallil-e-Waram, Qabiz, Mujaffif, Muqawwi-e-Asab, Habis-ud-Dam.

THERAPEUTIC USE : Sual Muzmin, Zeeq-un- Nafas, Zof-e-Asab, Ishal.

DOSE : 3.5 -7 g

IMPORTANT FORMULATIONS : Habb-e-Mubarak, Habb-e-Munaish, Raughan-e-Surkh.

KATAI
(Shoot)

The drug Katai consists of dried aerial parts of the plant of *Solanum surattense* Burm.f. Syn. *Solanum xanthocarpum* Schrad. & Wendl. (Solanaceae). A perennial herb found throughout India as a waste land weed. The plant occurs almost throughout the year. Flowering and fruiting take place during April to August.

OTHER NAMES :

Arabic	: Badinjankare, Hadaq, Shaukatul Aqrab
Persian	: Badinaqane Dashti, Badin Jan-e-Barri
Bengali	: Kantakari
English	: Indian Solanum
Gujarati	: Bhoyaringani, Bodifingni
Hindi	: Katai, Kataikhuadda, Kateli, Ringni, Satyanasi
Malayalam	: Kantakarichunta, Kantankattiri, Puttachunta
Marathi	: Bhonyaringani, Bhuiringani, Kanteringani
Oriya	: Bheji Bengano
Punjabi	: Batkasteya, Chotimahari, Kandiari, Katela, Karnaali
Sanskrit	: Anakranta, Bahukanta, Bahuphala, Bhantak
Tamil	: Kandangattari, Satturam, Vdaravan, Vadavani
Telugu	: Challamulaga, Jidduvuste, Nelamulka, Pinnamulka
Urdu	: Katai

DESCRIPTION :

Macroscopic : The drug sample composed of dried aerial parts of the plant at flowering and fruiting stage. The plant is very prickly bearing prickles on almost all parts. Leaves are petioled which are small and prickly. The prickles on the mid-rib as well as on veins. The flowers are violet in colour, bearing prickles on pedicel and calyx. The fruits are globose with persistent calyx.

Microscopic : A section of the petiole shows a single layered epidermis with fine cuticle bearing prickles as well as stellate trichomes on the surface. The epidermis is followed by a zone of few layered hypodermis having collenchymatous cells which are pigmented just below the epidermis. This is followed by a comparatively larger zone of parenchymatous cortex. A crescent shaped vascular bundle is present in the centre which has numerous strands of vessels and a lot of parenchyma.

A cross section of the lamina shows a central prominent mid rib and span of lamina on both the sides the lamina shows a single-layered epidermis covered with a fine smooth layer of cuticle.

A few simple epidermis trichomes are also seen on adaxial as well as abaxial surfaces. The cells of the epidermis layer are rectangular-square, rather small with slightly thick walls. The mesophyll shows a dorsiventral structure. It is differentiated into a single layered palisade parenchyma and abaxial epidermal layer. The mesophyll cells are fully chlorenchymatous, Stomatal openings are seen on both the surfaces.

Cross section of seed shows that it consists of a seed coat made up of sclereids having little parenchyma towards inside. This is followed by endosperm tissue having plenty of oil globules. The embryo occupies the major portion of endosperm which is visible as distinct circular zones. The cells of embryo and endosperm have dense protoplasmic contents.

Powder : The powder is not granular but appears fluffy and heterogenous; light greenish brown in colour. It gives a slightly spicy odour and is bitter in taste. The powder after clearing in chloral hydrate and observed under microscope shows a lot of 2-5 armed, simple, aseptate trichomes and fragments of thorns. Portion of fruit surface with characteristic wrinkled marking and fragments of seed coat are also seen. Vascular strands show simple pits and spiral thickenings. Besides, a lot of leaf and stem fragments are present.

CHEMICAL CONSTITUENTS :

Steroids, terpenoids, alkaloids, tannins, glycosides & carbohydrates, iron, aluminum, calcium, magnesium, sodium and potassium.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 19%	, Appendix 2.2.3
Acid insoluble ash	-	Not more than 7%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 6%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 15%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Chloroform (4:1)	I_2 vapours	5	0.25, 0.34, 0.44, 0.71, 0.81

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Mudirr-e-Baul, Munafis-e-Balgham, Muhalhil-e-Waram, Kasir-e-Riyah

THERAPEUTIC USE : Sual, Nazlah, Zeq-un-Nafas

DOSE : 1-2 g

IMPORTANT FORMULATIONS : Sufoof-ul-Amlah

KHASHKHAASH
(Seed)

The drug Khashkhaash consists of dried seeds of *Papaver somnifera* Linn. (Papaveraceae). An erect annual plant cultivated in Italy, Greece and Asia Minor. It is also cultivated in India, Turkey and Russia upto some extent it is also grown in Yugoslavia, Bulgaria, Afghanistan, Pakistan and Japan. The plant occurs from September to April. Flowering and fruiting occurs during November to March.

OTHER NAMES :

Arabic	: Bazr-ul-Khashkaash
Persian	: Tukhm-e-Anarkewa
Assammee	: Pasto Dana
Bengali	: Pasto Dana
English	: Bale-wort, Caranation Poppy, Joan Silverpin
Gujarati	: Aphina, Khushus, Posta
Hindi	: Kashkash, Posta
Kannada	: Khasakhasi
Kashmiri	: Kashkash
Malayalam	: Kashakasha
Marathi	: Aphu, Khuskhus, Posta
Oriya	: Post Dana
Punjabi	: Khashkhash, Khishk
Sanskrit	: Khasa, Khakasa, Ullasata
Tamil	: Gasagasala, Kasakasa
Telugu	: Gasagasala, Gasalu, Kasakasa
Urdu	: Khashkhaash, Safaid

DESCRIPTION :

Macroscopic : The seeds of *Papaver somniferum* Linn. are dried, white to slate grey in colour sub-reniform and about 1.25 mm long, the surface is covered with polygonal reticulations about nine in length and five in the width of seed. The hilum and micropyle are situated in the depression near the smaller end. The embryo is curved and is embedded in an abundant oily endosperm. They are odourless and tasteless.

Microscopic : The sectional view of the seed-coat showed a single layer of epidermis which contains slightly elongated, thick walled parnchymatous cells with thick cuticle on the outer side. Beneath which the region is consisted of polygonal to oval, thin walled parenchymatous cells.

The cotyledons show the epidermis composed of rectangular to oval and slightly thick walled parenchymatous cells which possess yellowish-brown contents. Rest part is made up of many layers of thin walled, hexagonal to polygonal parenchymatous cells which contain starch grains. The starch grains are oval to round in shape and found in abundance.

The radical in sectional view shows the epidermis consisted of hexagonal to rectangular to squarish parenchymatous cells and the outer walls are slightly thickened. The cortical region is consisted of several layers of thin walled polygonal to oval parenchymatous cells which contains aleurone grains.

CHEMICAL CONSTITUENTS :

Glycosides, steroids, phenolics, sodium, potassium, calcium, iron.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 7%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 2%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 22%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 11%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	2	0.34, 0.48

TEMPERAMENT : Cold 2° Dry 1°

ACTION : Mukhaddir, Qabiz, Musakkin, Muqawwi-e-Bah, Daf-e-Nisyan, Munawwim

THERAPEUTIC USE : Ishal, Zaheer, Sual, Nazla, Nisyan

DOSE : 1 - 3 g

IMPORTANT FORMULATIONS : Banadiq-ul-Buzoor, Habb-e-Shaheeqa, Habb-e-Sil, Habb-e-Surfa Qawi, Qurs-e-Kahruba, Qurs-e-Munawwim Barid, Qurs-e-Sartan, Qurs-e-Shadnaj, Qurs-e-Tabasheer Kafoori Lului, Qurs-e-Tabasheer-Mulaiyin, Khamira-e-Khashkhash, Laooq-e-Behidana, Laooq-e-Nazli, Laooq-e-Sapistan, Laooq-e-Shamoon, Laboob-e-Barid, Laboob-e-Kabir, Laboob-e-Sagheer, Majoon-e-Khadar, Majoon-e-Rah-ul-Momineen, Mufarreh Motadil, Tiryaq-e-Nazla, Sufoof-e-Moya, Sufoof-e-Musammin, Sufoof-e-Suranjan, Sufoof-e-Ziabetus Qawi. Raughan Laboob Saba Barid, Raughan-e-Khashkhash

KHULANJAN
(Rhizome)

The drug Khulanjan consists of dried rhizomes of *Alpinia galanga* (Linn.) Sw. Syn. *Alpinia calcarata* Rosc.(Zingiberaceae). The plant is found in the eastern Himalayas and South west India. It is also cultivated throughout India especially in East Bengal and South India. The plant occurs during late summer or early. Flowering takes place during April – May.

OTHER NAMES :

Arabic : Bekh-e-Khulanjan
Persian : Khusrodaru
Bengali : Barakalijan, Kulanjan, Kulinjan
English : Greater galangal
Hindi : Barakolinjan, Kulanjan
Kannada : Dumbarasme
Malayalam : Aratta, Perasatta
Tamil : Anandam, Aratti, Arduban, Tumbarattagam
Telegu : Dumparashtrakamu, Kachoramu, Peddadumparsh trokamu
Urdu : Khulanjan

DESCRIPTION :

Macroscopic : The rhizomes are large, with a spicy taste and pungent odour. The skin of the rhizome is deep orange- brown in colour which is prominently contrasting with pale-buff colour of the internal portion. Rhizomes are marked with wavy annulation of the leaf basis which possess a lighter colour than the remaining surface.

Microscopic : The rhizome is characterized by the presence of a distinctive thick-walled endodermis which divides the rhizome into two parts, the outer cortical layer and the inner ground tissue containing closely scattered vascular bundles, which are completely sheathed. The most characteristic feature of the cortex is the presence of numerous scattered vascular bundles. Each vascular bundle is enclosed within a sheath of 3-4 layers of fibres. Vascular bundles of the ground tissue are numerous and closely scattered. Those bundles, just under endodermis, are more close to each other and form almost a ring just under the endodermis. Ground parenchyma also contains oleo-resinous matters and starch grains.

Powder: Powder analysis of the crude drug revealed the presence of fragments of epidermis, parenchymatous cells, oleo-resin cells, fibres with elongated, lignified tapering ends, vessels which are thick-walled, elongated having spiral thickenings and with blunt ends. Starch grains are abundant.

CHEMICAL CONSTITUENTS :

Glycosides, Proteins, carbohydrates, resins, steroids/ triterpens, aodium, potassium, calcium, magnesium , iron, chloride, phosphate and sulphate. Essential oil from rhizomes contained seven components – methyl cinnamate, cineole, 1- camphene, 1- borneol, methyl chavicol, cargene and α-pinene.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	6%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	3%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	1%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	11%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^{0}) extract:

Solvent system	Spray/ reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (9:1)	I_2 vapours	2	0.05, 0.94

TEMPERAMENT : Hot 2^{0} Dry 2^{0}

ACTION : Mufarreh, Muqawwi-e-Qalb, Kasir-e-Riyah, Muqawwi-e-Meda,Mutaiyyib-e-Dahan, Munaffis-e-Balgham, Muqawwi-e-Bah, Mohallil-e-Waram

THERAPEUTIC USE : Bakhr-ul-Fam, Zeeq-un-Nafas, Bohat-us-Saut, Zof-e-Bah, Nafkh-e-Shikam., Waj-ul-Mafasil

DOSE : 2 -3 g

IMPORTANT FORMULATIONS : Habb-e-Ambar, Habb-e-Mumsik, Halwa-e-Gazar, Jawarish Jalinoos, Jawarish Kundur, Jawarish Narmushk, Jawarish-e-ood-Shireen, Luboob Kabir, Luboob Saghir, Majoon-e-Chobchini, Majoon-e-Khadar, Majoon-e-Salab, Majoon-e-Seer Alvi Khani, Araq-e-Chobchini.

KONCH
(Seed)

The drug Konch consists of dried seeds of *Mucuna pruriens* Bak. Syn. *Mucuna prurita* Hook. (Papilionaceae). An annual twining herb found in Burma and Bengal, also cultivated in Bengal and Bihar. The plant occurs in cold season.

OTHER NAMES :

Bengali	:	Alkushi
English	:	Lyon bean
Gujarati	:	Kivanch
Hindi	:	Kawanch
Kannada	:	Turachigida
Malayalam	:	Nayik korana
Marathi	:	Kavacha
Oriya	:	Bidonka
Punjabi	:	Kawanch
Sanskrit	:	Atmagupta
Tamil	:	Punaikkali
Telugu	:	Dulangondi
Urdu	:	Konch

DESCRIPTION :

Macroscopic : Seeds large, 1-2 cm in length, 0.8 –1.2 cm breadth, laterally compressed and broad bean shaped. Surface shining and distinctly streaked. Raphe shorter than antiraphe. Funicle short and flattened. Seeds are totally exalbuminous and also lacking perisperm.

Microscopic : Transverse section reveals that the seed is multi-layered, where the epidermis is represented by a single layered, thick-walled, radially elongated palisade cells with lumen slightly wider at the base. Next to the epidermis is hypodermis, represented by one layered thick-walled, bone-shaped cells- the osteosclereids, between them are wider air spaces. It is followed by 4-8 layers of tangentially elongated cells with slightly thickened walls. Next to this wider zone there are certain layers of crushed cells with small lumen. Elongated schizogenous cavities are present in peripheral region of cotyledon. Rhomboidal crystals are found in large number in these cells.

Powder: The crude drug powder is light yellow in colour and shows the presence of palisade cells of epidermis, parenchymatous cells of cotyledons, osteosclereids of hypodermis and tangentially elongated parenchymatous cells. Starch grains are also observed during powder analysis.

CHEMICAL CONSTITUENTS :

Carbohydrates, steroids, phenols, glycosides, tannins, almunium, iron, zinc, calcium, magnesium and potassium

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	5%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	1%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	1%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	13%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/ reagent treatment	No. of spots	Rf value
Pet ether: Diethyl ether (8:2)	2% EthanolicH_2SO_4	6	0.16,0.20,0.31,0.39, 0.64, 0.68

TEMPERAMENT : Hot 2° Dry 1°

ACTION : Qabiz, Mughalliz-e-Mani, Muqawwi-e-Rahem

THERAPEUTIC USE : Sailan-ur-Rahem, Jiryan, Istirkha, Deedan-e-Ama

DOSE : 3 - 5 g

IMPORTANT FORMULATIONS : Luboob Kabir, Luboob Sagher, Majoon-e-Baladur, Majoon-e-Salab, Majoon-e-Sohag-Sonth, Majoon-e-Bandkushad

KUNJAD SIYAH
(Seed)

The drug Kunjad Siyah consists of dried seeds of *Sesamum indicum* D.C. Syn. *S. orientale* Linn., *S. luteum* Retz. (Pedaliaceae) . An erect annual plant more or less foetid and glandular . The plant is indigenous to tropical Africa and cultivated throughout the warmer parts of India.. It occurs from August– June. Flowering takes place during October- December and fruiting from December- January.

OTHER NAMES :

Arabic : Simsim-ul-Aswad, Simsim
Persian : Kunjad Siyah
Bengali : Bhadutil, Kalatil, Kattil, Khaslatil, Krishanatil,
English : Gingelly Sesame
Gujarati : Mithytel, Tal Tel, Til
Hindi : Bariktel, Gingli, Krishnatel, Mithatel,Til
Kannada : Ellu
Malayalam : Chiteluu, Chitrallum, Ellu, Karellu
Marathi : Til, Tila, Zilechatil
Oriya : Khasa, Rasi
Punjabi : Kunjad. Til, Tili
Sanskrit : Homadhanya, Jatila, Papaghana
Tamil : Ellu, Navvullu,Yelluchedi
Telugu : Nuvvu, Nuvvulu,Ballanuvvulu
Urdu : Kali Til

DESCRIPTION :

Macroscopic : The seeds are small(2-3 mm long, 1.5 mm wide and 1mm thick), black ovoid laterally compressed. One end is broad which tapers towards the hilum. The seeds are highly oily in nature, albuminous, longitudinal ridges. The seed coat is simple, thin and black. Seeds are swee in taste.

Microscopic : The microscopic examination of seed in cross section reveals that the seed coat shows a simple structure. The 1-celled thick outer epidermis of seed coat comprises radially elongated palisade cells. All these cells bear characteristically a large cup-shaped crystals of calcium oxalate in their inner half except the cells of ridges. The radial walls are wavy and more thickened at their inner halves. Rest of the testa comprises 2-3 layers of crushed cells. It is followed by a thin cuticle in form of a yellow membrane which clearly differentiates the seed coat from endosperm. The endosperm and cotyledons are made up of polygonal parenchymatous cells which contain abundance of oil drops and aleurone grains. The cotyledons are externally lined small rectangular cells. Besides, the parenchymatous cells lying on the inner side of two cotyledons are elongated like palisade while the remaining cells are isodiametric in shape.

Powder: It is black, heterogenous and oily with sweet taste and a characteristic oily odour. Microscopic examination of powder reveals that it is made up of abundance of large epidermal cells, some bearing a big crystal, palisade and isodiametric parenchyma cells of varying sizes, each densely filled with the protein bodies. All these cells mostly occur in small groups. Crystals are also present in large number.

CHEMICAL CONSTITUENTS :

Steroids/Terpenoids, Carbohydrate, protein, glycosides, alkaloids, aluminium, iron, calcium, magnesium and potassium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	31%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	37%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	8%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	6%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80^{0}) extract:

Solvent system	Spray/reagent treatment	No. of spots	Research Officer value
Benzene: Chloroform (4:1)	I_2 vapours	1	0.50

TEMPERAMENT : Hot 1^{0} Moist 1^{0}

ACTION : Mulaiyin, Mohallil-e-Waram, Muqawwi-e-Bah, Muqawwi-e-Kuliya

THERAPEUTIC USE : Kasrat-e-Baul, Zof-e-Kuliya Wa Masana Baulfilfarah

DOSE : 5 g

IMPORTANT FORMULATIONS: Mufarreh Sosambari,Majoon-e-Baladur,Habb-e-Hindi Mumsik, Majoon-e-Salab.

MOCHARAS
(Gum)

The drug Mocharas consists of dried gum of *Salmalia malabarica* (DC.) Schott. & Endl. Syn: *Bombax malabaricum* DC. (Bombacaceae). A deciduous tree widely distributed throughout India and the Andaman ascending the hills upto 1500 m or even more. It occurs throughout the year. Flowering takes place during January to March and fruiting during March to May.

OTHER NAMES :

Arabic : Samagh-ul-Mocharas
Persian : Gond Supari
Bengali : Roktosimul, Shimul, Shemgal, Senur, Pagu
English : Silk cotton Tree-Gum
Gujarati : Ratoshemalo, Sawar, Simala, Shemolo
Hindi : Simul, Nurma, Deokepas, Huttian, Shimal
Kannada : Booruga, Kempubooruga, Mullubooruga, Mulkra
Oriya : Bouro, Buroh
Punjabi : Mocharas
Sanskrit : Salmili, Rakta, Shalamali, Mahavriksha, Panchparni
Tamil : Purani, Elevam, Mulilavan
Telugu : Salmali, Mundlaboorugachettu, Poor, Kondaburaga.
Urdu : Mocharas

DESCRIPTION :

Macroscopic : The gum of *Salamlia malabarica* (DC) Schott & Endl. is amorphous opaque, solid, brick-red to black in colour. The pieces are irregular and of different sizes varying from 2.5 –5.0 cm long. The surface is quite smooth and shiny and sometimes a small portion of bark is attached. The odour is slightly pungent and taste is acrid Fracture is hard, difficult to break but brittle.

Microscopic : The powder of the crude drug shows the presence of abundant brick-red granules of different sizes. During the investigation different tissues are also reported; among these fragments of tissues, cork cells are found in abundance. In surface view of cork cells are hexagonal to polygonal or oval with slightly thickened wall containing reddish brown contents. These cells show presence of tannins with ferric chloride solution. The fibres are also studies but lesser in number and they are large and usually found fragmented. They occur singly or occasionally in groups of two or three. Individual fibres are fusiform with bluntly pointed ends. The walls are straight, thickened and lignified with somewhat uneven lumen and few inconspicuous pits. The starch grains are numerous, oval to round simple and are found singly or in groups.

CHEMICAL CONSTITUENTS :

Resins, Saponins, Proteins and Phenolic compounds/Tannins, Sodium, Potassium, Iron, and Calcium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	33%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	25%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	0.2%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	7%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	4	0.26, 0.44, 0.73, 0.81

TEMPERAMENT : Cold 2° Dry 3°

ACTION : Qabiz, Mumsik, Habis, Mujaffif

THERAPEUTIC USE : Kasrat-e-Tams, Zaheer, Sailanur Reham, Jiryan.

DOSE : 5 -10 g

IMPORTANT FORMULATIONS : Majoon-e-Bandkushad, Majoon-e-Muqawwi-e-Rahem, Majoon-e-Sohag sonth, Sufoof-e-Ziabetus Qawi, Sufoof-e-Sailan.

MUNDI
(Inflorescence)

The drug Mundi consists of dried inflorescence of *Sphaeranthus indicus* Linn. (Asteraceae). An aromatic herb found abundantly in damp situations in the planes all over India, ascending to an altitude of 1500 m in the hills, especially as a weed in the rice fields. The plant occurs during winter season. Flowering and fruiting takes place during November- December.

OTHER NAMES :

Bengali : Gorakh mundi
English : East India Globe Thistle
Hindi : Mundi
Malayalam : Adakkamanyan
Tamil : Kottakaranthi
Telugu : Boddatarupu, Boddasoramu
Urdu : Mundi

DESCRIPTION :

Macroscopic : Flower heads are spherical to oval or elliptical in shape, solitary, 1.0-1.5cm across, yellowish brown in colour. Bracts present and are also yellowish brown in colour. The drug is bitter in taste with a pleasant odour when fresh, the aroma gradually diminishes on drying and storage.

Microscopic : Cells of bract are thin-walled, elongated, rectangular to polygonal in shape. Marginal cells of the bract are modified into hair like projections. Centre of the bract is transversed by the vascular strand consisting of spiral elements. Monoclinic prismatic crystal of calcium oxalate are observed in the cells of bract.

Corolla is semi-transparent, the cells being rectangular to polygonal, thin walled. Sometimes crystals of calcium oxalate are observed.

The anthers are dark yellow in colour. Anther cells are elongated and the length is 2-3 times more than the breadth, containing simple, oval to round starch grains. The cells of filament are smaller, rectangular and thin walled.

The pollen grains are small, round, spinous, the tip of the spines are pointed. Pores are round 4-5 in numbers.

The gynoecium consists of two carpels, syncarpous. Ovary unicellular with basal placentation, superior and oval in shape, style short, stigma sessile. Ovary wall is composed of multilayered, 4-8 cells in thickness, cells are thin-walled, polygonal. Starch grains are seen in certain cells of the gynoecium. The locule is pentagonal and ovule cells are almost polygonal and thin-walled.

Powder: The powdered drug is yellowish brown in colour, bitter in taste and with pleasant odour when fresh. Powder analysis of the crude drug reveals the presence of fragments of bracts, corolla, stamens, seed and receptacles.

Occasionally simple starch grains (oval to round) and calcium oxalate crystals are also observed. Lignified stone cells of various sizes and shapes are seen either in groups or isolated and with a wide lumen. Occasionally phloem and xylem fibres and tracheal elements are found in abundance, fragments of anthers, pollen grains and ovary are also observed.

CHEMICAL CONSTITUENTS :

Alkaloids, glycosides, saponins, tannins, resins, flavonoids, steroids, proteins, volatile oils and salts of iron and calcium. A new eudesmenolide-7-hydroxy eudesm-4-en-6,12-olide (I) (7-hydroxy frullanolide) isolated from flowers. Its isomer-7-β-hydroxy eudesm-4-en-6,12-olide (II) and a new dihydralactone (II) isolated and identified. A new sesquiterpene acid-2-hydroxy costic acid, β-eudesmol and ilicic acid isolated. Isolation of an anthelmintic agent –24 (s) 24 ethyl cholesta –5, 22-dien-3β-0β-D-glucoside was reported.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 11%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 6%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 6%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 12%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/ reagent treatment	No. of spots	Rf value
Chloroform Methanol (19:1)	I_2 vapours	5	0.13,0.31,0.43, 0.72,0.82

TEMPERAMENT : Hot 2° Moist 2°

ACTION : Musaffi-e-Dam, Mufatteh Sudad, Muqawwi-e-Basar, Muqawwi-e-Aza-e-Raeesa

THERAPEUTIC USE : Jarab-o-Hikka, Quba, Zof-e-Basarat, Zof-e-Aza-e-Raeesa

DOSE : 15 -20 g

IMPORTANT FORMULATIONS : Araq-e-Mundi, Araq-e-Musaffi-e-Khoon Qawi, Sabadaritoos, Majoon-e-Mundi

MUR-MAKKI
(Gum-resin)

The drug Mur-makki consists of gum-resin of *Commiphora myrrha* (Nees) Engl. Syn. *Balsamodendron myrrha* T. Nees (Burseraceae). A small tree found in Arabia and African coast of the Red Sea. Often cultivated in western India. The plant occurs throughout the year.

OTHER NAMES :

Arabic : Mur Makki
Bengali : Gandharash
English : Myrrh
Gujarati : Bol
Hindi : Bol
Kannada : Bola
Sanskrit : Rasagandha, saindhava, Samudraguggul.
Tamil : Vellaippa polam
Telugu : Ballintropolum
Urdu : Mur Makki

DESCRIPTION :

Macroscopic : The gun resin is brittle and on breaking shows a rough and waxy fracture.

Microscopic : The gum resin secreted in the phloem cells of bark is in the form of irregular masses. When pressed they show a moist and uncuteous appearance and a rich brown hue. Some whitish mark of veins are seen in the translucent fractured surface.

The powdered drug is brownish in colour and possess and agreeable aromatic odour and a bitter & acrid but not unpleasant taste. When socked in water a yellowish emulsion is form .

CHEMICAL CONSTITUENTS : Carbohydrates, protein, steroids, resin, gum, aluminium, iron, magnesium, calcium, and zinc. Isolinalyl acetate, 3-epilupenyl acetate, lupenone, 3-epi-α-amyrin, α-amyron, β-eudesmol acetate, a new sesquiterpene Alcohol-soluble extractive(s)- commiferin (mp. 170°).

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	6%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	2%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	6%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	72%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. ether: Diethyl ether (4:1)	I_2 vapours	3	0.71, 0.76, 0.82

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Moharrik, Daf-e-Taffun, Munaffis-e-Balgham, Mudirr-e-Tams.

THERAPEUTIC USE : Sue-Hazm, Qurooh, Ehtebas-e-Tams, Deedan-e-Ama

DOSE : 1- 2 g

IMPORTANT FORMULATIONS : Qurs-e-Musallas, Dawa-ul-Kurkum, Majoon-e-Antaki, Majoon-e-Talkh Deedani, Sabadaritoos, Tiryaq-e-Afayee, Tiryaq-e-Arba, Tiryaq-e-Nazla, Tiryaq-e-Samania, Zimad-e-Khanazeer, Iyarij-e-Loghaziya, Sunoon-e-Muluk, Zuroor-e-Asiqoolan, Qurs-e-Mukhaddir.

MUSLI SUFAID
(Root)

The drug Musli Sufaid consists of dried roots of *Chlorophytum arundinaceum* Baker (Liliaceae) . An annual herb found in Eastern Himalayas, Assam and Bihar upto altitude of 1400 m. The plant occurs almost throughout the year. Flowering takes place from March to July and fruiting during cold season.

OTHER NAMES :

English	:	White Musale
Hindi	:	Safed Musli
Urdu	:	Musli Sufaid

DESCRIPTION :

Macroscopic : The drug consists of slender fusiform root pieces which are mostly curved or twisted. The length of pieces varies from 2.5-6 cm. They are ivory white or slightly grey in colour, and some pieces are yellowish. They are wrinkled longitudinally.

Microscopic : Transverse section of the root shows a circular outline without any appendages. A uniseriate epidermis consisting of cells with thickened walls due to siliceous depositions is observed. This is followed by a zone of cortex. The inner most layer of the cortex is a single layered epidermis. The vascular tissue is not very elaborate. The central region is occupied by a large pith region where the cells are closely tagged as in cortical region.

The powder is slightly brownish grey in colour. It gives a slight spicy odour. It is tasteless and becomes sticky in mouth. The powder forms a gummy mass in water or on clearing with chloral hydrate. Under microscope it mostly shows clumped cells. Very little xylery strands are seen.

CHEMICAL CONSTITUENTS : Steroids, resin, phenolics, tannins, carbohydrates, calcium, magnesium, potassium.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	7%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	1%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	1%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	46%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Chloroform (4:1)	I_2 vapours	3	0.13, 0.46, 0.58

TEMPERAMENT : Hot 1° Dry 1°

ACTION : Muqawwi, Muqawwi-e-Bah, Mudirr-e-Baul, Muharrik

THERAPEUTIC USE : Zof-e-Bah, Suzak ,Sailanur Reham, Nutoour Reham, Qillat-e-Mani

DOSE : 3 -7 g

IMPORTANT FORMULATIONS : Habb-e-Kattha, Majoon-e-Bandkushad, Majoon Muqawwi-e-Reham, Majoon-e-Piyaz, Majoon-e-Sohag Sonth.

NEEM
(Leaf)

The drug Neem (Barg) consists of dried leaves of *Azadirachta indica* A. Juss. Syn. *Melia azadirachta* Linn. (Meliaceae). A large tree native to India and widely distributed throughout India. It occurs throughout the year. Flowering takes place during April – May and the fruits set upto July.

OTHER NAMES :

Arabic	: Azad Darakhat-e-Hindi
Persian	: Barg-e-Azad Darakht-e-Hindi, Neeb
Bengali	: Nim, Nimgachh
English	: Margosa leaves
Gujarati	: Limba
Hindi	: Neem
Kannada	: Bevina-mara
Kashmiri	: Neem
Malayalam	: Arytikta
Marathi	: Balantanimba
Oriya	: Nimbo Patra
Punjabi	: Nimb
Sanskrit	: Vepa
Tamil	: Vepa
Telugu	: Vepa
Urdu	: Barg-e-Neem

DESCRIPTION :

Macroscopic : The leaves are compound, imparipinnate, leaflets 5-8 cm long serrate, falcately lanceolate, acuminate, glabrous dark green above and paler beneath.

Microscopic : Transverse section of the leaf reveals consisting of two layers of palisade cells below the upper epidermis. The spongy parenchyma exhibits intercellular spaces and secretary cells which are specially abundant on the border line of palisade and spongy parecnchyma. The mid-rib region shows ventral and dorsal ridges which are composed of cellenchymatous cells. The upper epidermal cells are polygonal without stomata. The lower epidermis possesses many anomocytic type of stomata.

Transverse section of the rachis shows a single layer of epidermis, 6-8 layers of cells forming cortex in which secretary cells are found to be in large number. It has a distinct phloem region, a xylem region and a pith region consisting of cells with intercellular spaces. The parenchyma cells of the cortical region of rachis show presence of rosette crystals of calcium oxalate.

Powder: The crude drug powder is green in colour with characteristic odour and very bitter taste. Microscopic examination shows the presence of cortical cells of the rachis, fragments of palisade cells, hairs, fibres, weed fibres, spiral and pitted vessels, epidermal tissue of the leaf with characteristic stomata and large pith cells, with intercellular spaces.

CHEMICAL CONSTITUENTS :

Alkaloids, glycosides, carbohydrates, steroid, flavonoids, phenolic compounds, tannins . resins and saponins, iron, chloride, magnesium, sulphate, potassium and sodium, meliacin-nimbolide, quercetin and β- sitosterol,β-D-glucoside, n-hexacosanol, β-carotene.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	12%	. Appendix 2.2.3.
Acid insoluble ash	-	Not more than	6%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	6%	. Appendix 2.2.6.
Water-soluble extractives	-	Not less than	23%	. Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (4:1)	2% Ethanolic H_2SO_4 heat the chromatogram for 10 mints. at 105°	2	0.34, 0.84

TEMPERAMENT : Hot 1° Dry 1°

ACTION : Musaffi-e-Dam , Daf-e-Taaffun, Mohallil-e-Waram, Daf-e-Ziabetus

THERAPEUTIC USE : Jarb, Hikka, Fasad-ud-Dam, Ziabetus Sukkari

DOSE : 6 – 10 g

IMPORTANT FORMULATIONS : Marham-e-Jadwar. Habb-e-Siyah Chashm,, Habb-e-Surkhbada, Araq-e- Juzam. Araq-e-Musaffi-e-Khoon Qawi.

PALASPAPRA
(Seed)

The drug Palaspapra consists of dried seeds of *Butea monosperma* (Lam.) Kuntze. Syn. *Butea frondosa* Koeing ex Roxb.(Papilionaceae). A moderate sized deciduous tree found throughout India and Burma, extending to North –West Himalayas upto 1000 m and upton 1200 m in hills of Southern India. It occurs throughout the year. Flowering takes place during February to April and fruiting from April to June.

OTHER NAMES :

Arabic	:	Liabb-ul-Palas.
Persian	:	Tukhm-e- Palas
Bengali	:	Palash, Palas
English	:	Butea, flame of the Forest
Gujarati	:	Khakara, Palasso
Hindi	:	Dhak, Palas, Tesu, Kankrei
Kannada	:	Mutthuga
Malayalam	:	Brahmavriksham, Muriku
Marathi	:	Phalasacha-bi, Phalas
Oriya	:	Palaso
Sanskrit	:	Palasha, Bramhavriksha, Tripatraka
Tamil	:	Kali Palasu, Kattukumurukku, Palasu
Telugu	:	Kimsukamu, Palasamu, Vatapodhamu
Urdu	:	Palaspapra, Tesu

DESCRIPTION :

Macroscopic : Seeds are large, about 4 cm Long , 2.5 cm broad, kidney shaped, reddish brown in colour and laterally compressed. Seeds are exalbuminous. Seed coat is brownish red, thin, and straight. The seeds are oily and mucilaginous.

Microscopic : Cross section of the seed shows that the epidermis is uniseriate and has covering of striated cuticle. Palisade cells have intercellular spaces. Below the epidermis is found a single layer of the characteristic hour-glass cells (Osteosclereids) constituting the hypodermal region. The hypodermis is followed by several layers of thick-walled aerenchymatous cells. The cells of the inner few layers become tangentially flattened.

The dicotyledonous embryo fills up the major portion of the seed and has two large fleshy. plano-convex cotyledons. The cotyledons consist of thin walled parenchymatous cells filled with granular proteinaceous mass and aleurone grains besides the other cells contents.

Powder: The powder of the seed is characterized by creamy yellow colour almost without any smell or taste. Under the microscope after clearing with 75% chloral hydrate, it shows lignified palisade cells, hypodermal cells and xylem vessels with spiral or scalariform thickenings in form of fragments and some thin-walled parenchyma cells with abundance of aleurone grains.

CHEMICAL CONSTITUENTS :

Fats, oils, lignin, mucilage, proteins and resin. A nitrogenous acidic compound and palasonin isolated from seeds. Two new glucoside- monospermosides and isomonospermoside isolated together with butrin isobutrin, coreopsin, isocoreopsin and sulfurein-α-amyrin, β-sitosterol, its glucoside and sucrose isolated from seed.

Glycerides of palmitic stearic, lignociric, oleic and linoleic acid isolated from seed oil. A new lactone n-heneicosanoic acid-ε-lactone isolated and identified.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 8%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 8%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 1%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 22%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/ reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (9:1)	I_2 vapours	5	0.11,0.26,0.35,0.47, 0.87

TEMPERAMENT : Hot 3° Dry 3°

ACTION : Qatil-e-Deedan, Kasir-e-Riyah, Mohallil-e-Waram, Mudirr-e-Baul

THERAPEUTIC USE : Deedan-e-Ama, Bawaseer

DOSE : 300 –900 mg

IMPORTANT FORMULATIONS : Qurs-e-Deedan, Itrifal-e-Deedan.

PANWAR
(Seed)

The drug Panwar consists of dried seeds of *Cassia tora* Linn. Syn: *Cassia obtusifolia* Linn. (Caesalpiniaceae). An annual herb found throughout India as a common weed along roadsides or in open waste places. The plant occurs during rainy season. Flowering and fruiting take place during August-November.

OTHER NAMES :

Arabic	Sanjboya, Qalb
Persian	Sang Saboya
Bengali	Chakunda, Panewar
English	Ringworm Plant, Sickle Senna, Fetid Cassia
Gujarati	Kawario, Kuvadio, Ponvadio
Hindi	Chakunda, Pamad, Chakavat, Panewar
Malayalam	Chakramandrakam, Takara
Marathi	Tankli, Takala, Tarota
Oriya	Chakunda
Punjabi	Chakunda, Panwari, Pawar
Sanskrit	Chakramarda, Dadrughna, Praputrata
Tamil	Senavu,Sirutagarai, Tagarai, Usittararai, Vanamavaram, Vindu
Telugu	Tagirise, Tantemu, Tantiyamu
Urdu	Panwar

DESCRIPTION :

Macroscopic : Dried seeds are small truncate at both ends, compressed, oval or rhomboidal in shape, 3.0 - 5.6 mm. long, 1.5 - 3.5mm broad and 1.2 - 2.8mm thick. Greenish brown or brownish black in colour. The faces are marked by an almost circular zone. The testa is hard, smooth and shining.

Microscopic : Transverse section of the seed shows the epidermis of testa composed of longitudinally elongated cells. Hypodermis characterized by the single layered, thick walled cells with broad lumen. Beneath and hypodermal region there is parenchymatous layer composed of oval to polygonal, elliptical or rectangular cells, 6-8 cells in thickness, enclosing irregular inter cellular spaces. Certain cells are found to possess rosette crystals of calcium oxalate. The endosperm region is mainly characterized by several layers of rectangular, polygonal to oval thick-walled parenchymatous cells.

In transverse section of the cotyledon the epidermis consists of rectangular to oval cells. Palisade attached to epidermis are longitudinally elongated, thin walled, compact two cells in thickness, few cells contain aleurone grains.

Powder: The powdered drug is yellow in colour. bitter in taste with pungent and agreeable odour. Powder analysis of crude drug reveals the presence of cells of epidermis, hypodermis, parenchyma and crystals of calcium oxalate. Occasionally, epidermal cells, palisade and parenchymatous cells are seen, aleurone grains and endosperm cells abundant.

CHEMICAL CONSTITUENTS :

Glycosides, proteins, reducing sugars, steroids, tannins, fixed oils, sodium, potassium and iron. Palmitic, steric and linoleic acid deducted in seed oil. A new Naphtha-α-pyrone-toralactone isolated from seeds; rubrofusar in –6-β-gentioioside and new anthroqukinone glycoside –8-hydroxy-3-methyl anthraquinone-1-B-gendtiobioside alongwith chrysophanol, physcion, emodin and rubrofusanin isolated from seeds. Chrysophanic acid –9-anthrone also isolated from seeds.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 6%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than 0.2%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 5%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 12%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/ reagent treatment	No. of spots	Rf value
Chloroform: Benzene (50:10)	0- Phosphoric acid	6	0.19,0.26, 0.45, 0.55,0.69,0.85

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Mushil-e-Balgham, Mushil-e-Sauda, Jali

THERAPEUTIC USE : Fasad-ud-Dam, Juzam, Bars, Quba, Bawaseer

DOSE : 1.7 -3.6 g

IMPORTANT FORMULATIONS : Sufoof-e-Bars

POST-E-KACHNAL
(Stem Bark)

The drug Post-e-Kachnal consists of dried stem bark of *Bauhinia racemosa* Lam. Syn. *Bauhinia parviflora* Vahl. (Caesalpiniaceae). A deciduous tree met within sub-Himalayan Track Ravi eastwards, ascending to 1700 m in Bengal, Burma and Central and South India. It occurs throughout the year. Flowering takes place from April- June while fruiting from November – February.

OTHER NAMES :

Bengali	:	Banraj
English	:	Mountain Ebony
Hindi	:	Kachnal, Gurial
Kannada	:	Aupta
Malayalam	:	Ambru
Marathi	:	Apta, Apata
Oriya	:	Ambhota
Sanskrit	:	Swetakanchan
Tamil	:	Arieka
Telugu	:	Ari, Are
Urdu	:	Post-e-Kachnal

DESCRIPTION :

Macroscopic : The external surface of the bark is greyish brown and rough due to transverse cracks and fissure. The fracture is short outside and fibrous within. The inner surface is smooth and light brown in colour. The dried pieces are slightly curved and channeled.

Microscopic : Cross section of the bark reveals that it is made up of externally the periderm and wide zone of phloem, which is further differentiated into conducting phloem and the remaining zone of non-conducting phloem. Cork consists of 10-15 layers of tangentially elongated, lignified cells. Below the cork a layer of phellogen is also observed which is followed by a wide zone of phelloderm. Lignified fibrous and stone cells are found distributed in this region. The phloem is made up of sieve tubes, companion cells, phloem parenchyma and phloem fibers in the conducting zone fibrous occur in tangentially extended bands and sieve tubes with companion cells surrounded by phloem parenchyma on either side. The medullary rays are also found. The non-conducting zone of phloem is distinguished due to the presence of somewhat wavy and dilated medullary rays. The stone cells are found in both in radial and tangential band in the outer bark in greater number than in inner. The phloem fibrous are long, tapering, thick walled, lignified having narrow lumen and intrusively grown pointed ends. The cells of medullary rays are rectangular in the outer region and radially elongated in the middle and inner region of the bark. Tannin is found throughout the bark. Starch grains, resin is also found in parenchymatous cells of phelloderm and phloem. Druses are also found throughout the bark in parenchyma cells.

Powder: The powder is fine, dark brown and with a acrid taste and a characteristic odour. Microscopic examination of power after clearing with lactic acid reveals that it is made up of abundance of lignified fibres in broken pieces, elongated parenchyma cells having various cells contents and reddish cork cells. Starch grains and calcium crystals are also found in good quantity.

CHEMICAL CONSTITUENTS :

Alkaloid, carbohydrate, steroid, phenol, glucoside, tannin, iron, calcium, potassium, magnesium.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	20%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	3%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	3%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than	9%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform :Benzene (4:1)	I_2 vapours	2	0.15, 0.40

TEMPERAMENT : Cold 2° Dry 2°

ACTION : Qabiz, Habis, Musakkin, Musaffi-e-Dam

THERAPEUTIC USE : Ishal, Bawaseer-e-Damia, Baul-ud-Dam, Damameel, Jarb

DOSE : 6 -12 g

IMPORTANT FORMULATIONS : Majoon-e-Suparipak, Araq-e-Juzam, Araq-e-Musaffi-e-Khoon Qawi.

RASAUT
(Root extract)

The drug Rasaut consists of dried root extract of *Berberis aristata* D.C. (Berberidaceae). A large shrub found in Himalayas and Nilgiri hills. It occurs throughout the year. Flowering takes place during February – April and fruiting from May- June.

OTHER NAMES :

Arabic : Huzuz
Persian : Huzuz, Feelzahraj
Bengali : Darhaldi
English : Indian Barberry
Hindi : Chitra, Chotra, Darhald, Kashmal, Kashmar, Rasvat
Kashmiri : Rasvat
Malayalam : Maradarisina, Maramanjal
Marathi : Daruhlad
Punjabi : Chitra, Kasmal, Simlu, Sumlu
Sanskrit : Daruhiridra, Darvi, Kata, Katankati, Survarnavarna
Tamil : Mullukala, Usikkala
Urdu : Rasaut

DESCRIPTION :

Macroscopic : The drug Rasaut occurs in the form of small pebbles of different irregular shapes. The pebbles are hard and do not break easily. When broken they are black and opaque, the breaking surfaces are lustrous and uneven. The taste is bitter with aromatic smell.

Microscopic : The drug is unorganized.

Powder: The drug powder is black in colour, little lustrous and is admixed with some foreign organic matters mostly broken leaves. Taste bitter and smell prominent and tobacco like.

CHEMICAL CONSTITUENTS :

Alkaloids-berberine, oxyacanthine, berbamins, palmatine, jatorarrhizine, columbamins, berbrrubine and hydrastine.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter - Not more than 2% , Appendix 2.2.2.
Total Ash - Not more than 28% , Appendix 2.2.3.
Acid insoluble ash - Not more than 15% , Appendix 2.2.4.
Alcohol-soluble extractives - Not less than 4% , Appendix 2.2.6.
Water-soluble extractives - Not less than 32% , Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Benzene: Chloroform (50:50:30)	2% Ethanolic H_2SO_4	4	0.14, 0.26,0.59,0.71

:

TEMPERAMENT : Cold 2° Dry 2°

ACTION : Mohallil-e-Waram

THERAPEUTIC USE : Amraz-e-Chashm, Yarqan, Waram-e-Tehal, Bawaseer

DOSE : 3 g

IMPORTANT FORMULATIONS : Habb-e-Bawaweer Amya, Habb-e-Bawaseer Damiya, Habb-e-Rasaut, Habb-e-Siyah Chashm, Kohal-ul-Jawahir, Zimad-e-Mubarrid, Zimad-e-Waram-e-Unsayain Haad, Tila-e-Musakkin

REWANDCHINI
(Root)

The drug Rewandchini consists of dried roots of *Rheum emodi* Wall. (Polygonaceae). A stout herb found in the Himalayas at altitudes of 1500 to 4000 m and in Kashmir, Nepal, Sikkim and Bhutan. Flowering and fruiting takes place during June-July.

OTHER NAMES :

Arabic : Rewand Sieni, Rewand
Persian : Rewandchini, Bekh-e-Jigri
Bengali : Banglarevanchini
English : Himalayan shuvarb, Indian Shabarb.
Gujarati : Gaminirevanchini
Hindi : Dolu, Hindi revandchini
Kannada : Nat-reva-chini, revalchini
Kashmiri : Chutial
Marathi : Mulka-cha-revalchini
Punjabi : Arts, Artso, Atsm, Chotial, Chuchi, Chukri
Sanskrit : Gandhini, Pita, Pitimulika, Revatchini
Tamil : Nattirevalchinni, Nattumanjatchinnakkilangu
Telugu : Nattupampuchinagadda, Natturevalchini
Urdu : Rewandchini

DESCRIPTION :

Macroscopic : The drug consists of dried, solid, compact cylindrical pieces of various sizes. Outer surface is irregularly longitudinally wrinkled, furrowed or ridged but few have transverse wrinkles and they are usually covered with brownish or yellowish brown cortex. Inner surface possesses yellow colour. Fracture is hard and shows cambium line.

Microscopic : The transverse section of the root shows brown bark which consists 10-14 layers of cells. Cortical region is usually made up of a few layers of parenchymatous cells which are mostly oval to irregularly rounded and thin walled. Most of the cortical cells possess grains in abundant, spheroidal or round in shape and found single or 2-4 compound. A few cells of the region merged into the secondary phloem tissue which forms a few layers of cells. Cambium is wavy and is much compressed. Medullary rays are prominent and radially elongated and consisted of one to two layers of cells. The ray cells are radiating and often extend through the phloem region. The vascular bundles are arranged in one to two cells of layer of radial chain and central cylinder of wood is formed in this way. The rest of the wood is composed of tracheids and xylem parenchyma. The vessels are mostly found to have scalariform and spiral thickenings.

Powder: Powder analysis of the crude drug reveals the presence of fragments of thin walled parenchyma and ray cells. The scalariform or spiral vessels, tracheids, rosette aggregate crystals of calcium oxalate and abundant starch grains.

CHEMICAL CONSTITUENTS :

Glycosides, sterioids, phenolica, flavonoids, sodium, potassium, calcium and iron, rhein, emodin, .

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2% , Appendix 2.2.2.
Total Ash	-	Not more than 11% , Appendix 2.2.3.
Acid insoluble ash	-	Not more than 2.5% , Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 22%. , Appendix 2.2.6.
Water-soluble extractives	-	Not less than 19% , Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^0) extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	4	0.27, 0.29, 0.37, 0.38

TEMPERAMENT : Hot , Dry

ACTION : Jali, Mohallil-e-Waram, Musakkin, Munaffis, Muqawwi-e-Meda-wa-Kabid,, Mudirr-e-Baul, Mudirr-e-Tams

THERAPEUTIC USE : Yarqan, Istisqa, Waram-e-Kabid, Ehtebas-e- Tams, Tams, Ehtebas-e-Baul

DOSE : 1-3 g

IMPORTANT FORMULATIONS : Habb-e-Miskeen Nawaz, Habb-e-Mushil Istisqaee, Habb-e-Shabyar, Habb-e-Shifa, Qurs-e-Zarishk, Dawa-ul-Luk, Jawarish-e-Narmushk, Majoon-e-Juntiyana, Majoon-e-Talkh, Sabadaritoos, Raughan-e-Aqrab, Sharbat-e-Deenar, Sufoof-e-Lajward, Sufoof-e-Mudirr-e-Haiz.Qurs-e-Mulaiyin, Zimad-e-Mohallil.

TUKHM-E-KARAFS
(Seed)

The drug Tukhm-e-Karafs consists of dried seeds of *Apium graveolens* Linn. (Apiaceae). An erect herb found in the base of the North West Himalayas and outlying hills in Punjab and Western India. The plant occurs from November-March. Flowering and fruiting take place during February-March.

OTHER NAMES :

Arabic	: Habb-ul-Karafs, Samarul Karafs
Persian	: Tukhm-e-Karafs
Bengali	: Chani, Randhuni
English	: Celery, Cultivated Celery, Marsh Parsley
Gujarati	: Bodiajamoda
Hindi	: Karafs
Marathi	: Amjoda, Ajmoda
Punjabi	: Bhutjhata
Sanskrit	: Ajamoda, Andhapatriki, Brahmakoshi, Dipyaka
Urdu	: Tukhm-e-Karafs

DESCRIPTION :

Macroscopic : The fruit of Tukhm-e-Karafs are mostly separated, mericarps. The cremocarp is brown, roundish ovoid, laterally compressed and about 1.0-1.5 mm long, 1.5 mm wide and 1.5 mm thick. Each mericarp has five straight, scarcely prominent primary ridges. The seeds are orthospermous. The odour and taste of drug is aromatic.

Microscopic : The sectional view of the fruit shows a wavy outline. Each mericarp has mostly five ridges and six to nine vittae. The epicarp consists of single layer of rectangular, thin walled parenchymatous cells coated with irregular cuticle on the outer side. The mesocarp region mostly composed of several layers of moderately thick walled parenchymatous cells which are polygonal to oval in shape. The sclereids of mesocarp are ovoid to elongated rectangular with a slightly sinuous outline. The walls are slightly thickened at corners. Innermost layer of mesocarp is made up of large brown parenchymatous cells which are elongated rectangular in shape and is attached to the endocarp. The endocarp consists of a single layer of rectangular to squarish thin walled parenchymatous cells brown parenchymatous cells which are elongated rectangular in shape and is attached to the endocarp. The endocarp consists of a single layer of rectangular to squarish, thin walled parenchymatous cells. The testa, which is usually associated with the endocarp, is generally single layered consisted of thin walled elongated rectangular and mostly collapsed cells. Beneath which the endospermic region is composed of several layers of rectangular to polygonal, thick walled parenchymatous cells containing aleurone grains, which are oval to round and are joined in groups. Most of the endospermic cells contain microspheroidal crystal of calcium oxalate. A small amount of vascular tissue and reticulated parenchyma is present. The elements are small and are usually in groups the vessels show spiral or reticulate thickenings.

Powder: Powder analysis of the crude drug reveals the presence of fragments of epicarp having stomata, mesocarp, vittae, endosperm, vessels, sclereids and aleurone grains and microspheroidal crystals of calcium oxalate.

CHEMICAL CONSTITUENTS :

Glycosides, steroids, phenolics, flavonoid, sodium, potassium, calcium and iron, essential oil, glucoside, apin.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than 2%	, Appendix 2.2.2.
Total Ash	-	Not more than 10%	. Appendix 2.2.3.
Acid insoluble ash	-	Not more than 4%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than 9%	, Appendix 2.2.6.
Water-soluble extractives	-	Not less than 9%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract;

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pure Chloroform	2% Methanol	1	0.19

TEMPERAMENT : Hot 2° Dry 2°

ACTION : Mufatteh Sudad, Muarriq, Mushtahi, Kasir-e-Riyah, Mufattit-e-Hisat, Mudirr-e-Tams

THERAPEUTIC USE : Zat-ul-Janb, Irq-un-Nisa, Niqras, Waja-ul-Zohar, Nafkh-e-Shikam, Istisqa, Ehtebas-e-Baul, Hasat-e-Kuliya-wa-Masana

DOSE : 3 - 5 g

IMPORTANT FORMULATIONS : Banadiq-ul-Buzoor, Habb-e-Khabs-ul-Hadeed, Jawarish-Falafili, Jawarish-Safarjali Qabiz, Jawarish-e-Shahreyaran, Jawarish-e-Zarooni Sada, Majoon-e-Hajr-ul-Yahood, Majoon-e-Jalali, Majoon-e-Jograj Gugal, Majoon-e-Kalkalanaj, Zimad-e-Sumbul-ut-Teeb, Sikanjabeen Buzoori Motadil, Sufoof-e-Namak Sheikh-ur-Raees, Sufoof-e-Moya, Majoon-e-Nankhwah, Majoon-e-Fotnaji, Sufoof-e-Mohazzil, Sufoof-e-Habb-ur-Rumman, Jawarish-e-Narmushk, Majoon Dabeedul Ward.

TUKHM-E-KASOOS
(Seed)

The drug Tukhm-e-Kasoos consists of dried seeds of *Cuscuta reflexa* Linn. Syn. *Cuscuta grandiflora* Wall., C. *verucosa* Sweet. (Cuscutaceae). A leafless parasitic annual found throughout plains of India. The plant occurs for most part of the year. Flowering takes place during January- February while fruiting occurs from March- April.

OTHER NAMES :

Arabic	: Habb-ul-Kasoos
Persian	: Tukhm-e-Kasoos, Zajmool
Assamme	: Amarlati
Bengali	: Algusi
English	: Dodder
Gujarati	: Akaswel
Hindi	: Amarbel, Akasbel
Marathi	: Nirmuli
Oriya	: Koilanirmuli
Punjabi	: Zarbuti
Sanskrit	: Akashabharana
Tamil	: Kodiyagundal, Sadadari
Telugu	: Stiama purgonalu
Urdu	: Tukhm-e-Kasoos

DESCRIPTION :

Macroscopic : The fruit consists of four seeds which are smooth and 0.4-0.6 mm in diameter, brownish or black in colour, convex on one side to concave on other.

Microscopic : The seed in cross section shows three zones; the seed coat , endosperm and embryo. Seed coat is characterized by a persistent testa and tegmen. The testa is further differentiated into three layers the epidermis consisting of large cuboid cells with starch, hypodermis composed of short cells with lignified walls while the third layer is of palisade like prismatic cells with thick lignified and brownish wall. Endosperm and embryo are parenchymatous.

The pale brownish fine powder having an acrid-bitter taste is without any characteristic odour. The powder is characterised by the presence of some cuboid cells containing starch grains, abundance of short and palisade like lignified cells and a few parenchymatous cells.

CHEMICAL CONSTITUENTS :

Proteins, phenols, tannins, resin, glycosides, carbohydrates, steroids, aluminium, iron, calcium, sodium, potassium.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	15%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	11%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	11%	, Appendix 2.2.6
Water-soluble extractives	-	Not less than	5%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Diethly : Pet. Ether (1:4)	2% Ethanolic H_2SO_4	2	0.14, 0.31

TEMPERAMENT : Moderately Hot Dry 1°

ACTION : Mudirr-e-Baul, Mohallil-e-Waram-e-Kabid, Daf-e-Humma, Mulaiyin.

THERAPEUTIC USE : Humma, Yarqan, Waram-e-Kabid

DOSE : 6-10 g

IMPORTANT FORMULATIONS : Majoon-e-Dabeed-ul-Ward, Sharabat-e-Deenar

ZUFA YABIS
(Flower)

The drug Zufa Yabis consists of dried flowers of *Hyssopus officinalis* Linn. (Lamiaceae). An under shrub, a native of Mediterranean region and temperate Asia and naturalised in France , Portugal and Sweden. It also grows in the Western Himalayan region at altitudes of 2500 to 4000 m. The plant occurs from June- December.

OTHER NAMES :

Arabic	: Zufa Yabis
Persian	: Ushnan-e-Dawood
English	: Hyssop
Hindi	: Zupha
Sanskrit	: Zupha
Urdu	: Zufa Khushk

DESCRIPTION :

Macroscopic : Flowers are pedicellate, complete and hypogynous. Calyx 15 nerved, five toothed, corolla, bilipped. Stamens four exerted diverging, lower longer , anther cells linear spreading, style lobes sub equal, subulate.

Microscopic : Transverse section of pedicel shows a solid central stele. The epidermis is single layered having rectangular cuticularised cells. This is followed by a multilayered cortex. The central stele is enclosed in sclerenchymatous pericycle followed by continuous phloem. The xylem is formed of vessel tracheids, fibers and parenchyma. The crystal of calcium oxalate are present in the cortical cells. The uniseriate and unicellular trichomes are also found on outer surface of pedicel.

Transverse section of sepal shows an upper and lower epidermis made up of rectangular cells. Epidermis is followed by 3-4 layered rounded parenchymatous cells loosely arranged with intercellular spaces, 4-5 vascular bundles are found in a sepal. Calcium oxalate crystals are also found in the parenchymatous cells of mesophyll.

Transverse section of petal is similar to that of sepal except the cells of mesophyll and epidermis are smaller in size than the cells of sepal. The number of vascular bundles is 3-4 only. Transverse section of anther shows four sporangia. The single layered epidermis having isodiametric cells filled with dense cytoplasm. The cells of endothecium show lignification on the radial and tangential wall.

The powder is brownish green in colour without any definite smell. Powder analysis of the crude drug reveals the presence of fragments of pedicel, calyx, corolla and epidermal cells of anther alongwih endothecium and pollen grains. Tracheids of different sizes, cells of xylem parenchyma and uniseriate trichomes borne on the pedicel are also observed.

CHEMICAL CONSTITUENTS :

Glycosides, phenolic compounds tannins, flavonoids, carbohydrates, resins saponins. Myrtenol methyl ether, methyl myrtenate, cis-penic acid, (+)2-hydroxyisopinocamphone, sis-pinonic acid along with β- pinene, pinocamphone and isopinocamphone, 14 unidentified compounds, essential oil (1.6 ml/Kg i.p.)presence of terpenic ketones, camphor, thujone, volatile oil yield α-β-pinenes α-camphene, car-3-ene P-cymene pinocamphone, 7 glycosides containing 5,4'-dihydroxy-7, 3'-dimethoxy flavanone, camphene, pinocampheol.

IDENTITY, PURITY AND STRENGTH :

Foreign Matter	-	Not more than	2%	, Appendix 2.2.2.
Total Ash	-	Not more than	17%	, Appendix 2.2.3.
Acid insoluble ash	-	Not more than	6%	, Appendix 2.2.4.
Alcohol-soluble extractives	-	Not less than	3%	, Appenaix 2.2.6.
Water-soluble extractives	-	Not less than	16%	, Appendix 2.2.7.

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Ethyl acetate (9:1)	I_2 vapours	1	0.80

TEMPERAMENT : Hot 3° Dry 3°

ACTION : Mulattif, Munaffis-e-Balgham, Mohallil-e-Waram, Kasir-e-Riyah, Daf-e-deedan-e-Ama, Moarriq

THERAPEUTIC USE : Zof-e-Ishteha, Nafkh-e-Shikam, Sual, Nazla, Zeequn nafas, Khushoonat-e-Halq

Dose : 5 - 10 gm

IMPORTANT FORMULATIONS : Majoon-e-Nankhwah, Habb-e-Ghariqoon

APPENDICES

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APPENDIX – 1

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

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 glass ware 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 weighting should dictate the type of balance. Where substances are to be "accurately weighed", the weighting 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

2.1 TESTING OF DRUGS

2.1.1 - 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, Fruti 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, rrot, 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 chlorzinc-iodine solution of with cuoxam. (Copper-oxide-ammonia) reagent. Lignin present in the middle lamella and secondary cell-wall of many vezzels, 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).

2.1.2 - Microscopical Methods of Examining Crude Vegetable Drugs

Methods of preparing specimens of crude materials of vegetable drugs for Microscopical studies vary, depending on the morphological groups of drugs to be examined and also on the natures of the material i.e., entire cut or powdered.

I. Leaves, Herbs and Flowers

For examining leaves, herbs and flowers (entire or cut) under microscope, following methods are employed for clarification:

A. Entire and cut materials

(i) **Entire materials** - When examining entire leaves, herbs and flowers, take pieces of leaf (margin and vein of leaves only), herbs (only leaf) and flowers (only calyx and corolla) in 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 hod) 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 t easing 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 powd 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:

(i) 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.

2.1.3. Types of Stomata

There are several types of stomata, distinguished by the form and arrangement of the surrounding cells. The following descriptions apply to mature stomata.

1. Anomocytic (irregular-celled) - Previously known as ranuculaceous. The stoma 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 stoma is usually surrounded by three subsidiary cells, of which one is markedly smaller than the others.

3. Diacytic (Cross-celled) - Previously known as caryophyllaceous. The stoma is accompanied by two subsidiary cells whose common wall is at right angles to the guard cells.

4. Paracytic (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.

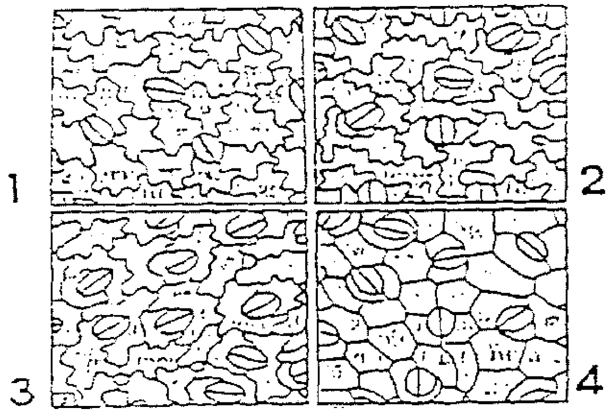

Fig. 1 Various types of stomata

2.1.4. Determination of Stomatal Index

The stomatal index is the percentage of the number of stomata formed by the total number of epidermal cells, including the stomata, each stoma being counted as one cell.

Place leaf fragments of about 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 stoma. 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.

2.1.5. 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.

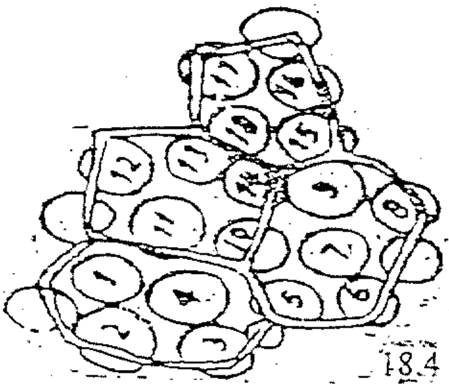

Fig. 2. Palisade ratio $\frac{18.4}{4} = 4.5$

2.1.6. Determination of vein-Islet Number

The mesophyll of a leaf is divided into small portions of photosynthetic tissue by anastomosis of the veins and veinlets; such small portions or areas are termed "Veinislets". The number of vein-islets per squiare 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 m 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 n 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 with in 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° 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°.

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°. 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 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°, 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° to 60°) 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° 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 cum long. Allow the coated plates to dry in air, heat at 100^0 to 105^0 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°±25° 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 petri-dish with alcohol and excess of alcohol evaporated on water-bath. The residue is dried at 105^0 C till constant weight.

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 arsenic, 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 HCl and complying with the following additional tests:

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

ii. To 50 ml add 0.2 ml of *bromine solution AsT*, evaporate on a water-bath until reduced to 16 ml adding more *bromine solution AsT*, if necessary, in order that an excess, as indicated by the colour, may be present throughout the evaporation; add 50 ml of water and 5 drops of *stannous chloride solution AsT*, and apply the *General test*; the stain produced is not deeper than a 0.2 ml *standard stain* prepared with the same acid, showing that the proportion of arsenic present does not exceed 0.05 part per million.

Hydrochloric acid (constant-boiling composition) AsT - *Boil hydrochloric acid AsT* to constant boiling Composition in the presence of *hydrazine hydrate*, using 1 ml of 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 40^0 but because the rate of the evolution of the gas varies somewhat with different batches zinc AsT, the temperature may be adjusted to obtain a regular, 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 parts of the substance (by weight), as determined by visual comparison of the colour produced by the substance with that of a control prepared from a standard lead solution.

Determine the amount of heavy metals by one of the following methods and as directed in the individual monographs: Method A is used for substances that yield clear colourless solutions under the specified test conditions. Method B is used for substances that do not yield clear, colourless solutions under the test conditions specified for Method A. or for substances which, by virtue of their complex nature, interfere with the precipitation of metals by sulphide ion. Method C is used for substances that yield clear, colourless solutions with *sodium hydroxide 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 water-bath; 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*. 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.

Potassium cyanide Solution Sp.: See Appendix 2.3.5 *Sulphuric acid Sp.* : *Sulphuric acid* which complies with following additional test : Add 5 g to 20 ml of *water* make alkaline with *ammonia solution Sp.*, add 1 ml of *potassium cyanide solution Sp.*, dilute to 50 ml with *water* and two drops of *sodium sulphide solution;* no darkening is produced.

Method A

Standard Solution : Into a 50 ml *Nessler cylinder,* pipette 2 ml of *standard lead solution* and silute 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 : Into 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° to 600° 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 : Into a 50 ml *Nessler Cylinder,* pipette 2 ml of *standard lead solution,* add 5 ml of *dilute sodium hydroxide solution.,* dilute with *water* to 50 ml and mix.

Test Solution : Into a 50 ml *Nessler Cylinder,* Place 25 ml of the solution prepared for the test as directed in the individual monograph; or, if not specified otherwise in the individual monograph, dissolve the specified quantity in a mixture of 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 : Weith 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 $BaCl_2 2H_2O$.

Method

Dissolve the specified quantity of the substance in *water,* or prepare a solution as directed in the text, transfer to a *Nessler cylinder,* and add 2 ml of *dilute hydrochloric acid,* except where *hydrochloric acid* is used in the preparation of the solution. Dilute to 45 ml with *water,* add 5 ml of *barium sulphate reagent* stir immediately with a glass rod, and allow to stand for five minutes. The turbidity produced is not greater than the *standard turbidity,* when viewed transversely. Standard turbidity: Place 1 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:

1. **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.

2. **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.

3. **Receiver:** A 100 ml cylinder, graduated in 1 ml sub-divisions.

4. **Thermometer:** An accurately standardised partial immersion thermometer having the smallest practical sub-divisions (not greater than 0.2°). 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°, cool it to between 10° and 15° 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 lt 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° 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° 'to 5° below the expected congealing point. If the substance is a liquid at room temperature, carry out the determination using a bath temperature about 15° below the expected congealing point. When the sample has cooled to about 5° 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°.

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° ± 2°, 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
ΔpH/Δt	+ 0.001	-0.001	-0.002	+0.001	-0.003	+0.003	-0.008	-0.009

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

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

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

(c) An accurately standardised thermometer suitable for the substance under examination (see Appendix 1.2). 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° 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° per minute. When the temperature is about 3° 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° 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° 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°, 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° 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° 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 1.2).

(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°. Cool and allow the temperature of the molten substance to drop to a temperature of 8° to 10° above the expected melting point. Chill the bulb of the thermometer to 5°, 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°,

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° and raise the temperature of the bath at rate of 2° per minute to 30°, then adjust the rate to 1° 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 0, take the average of the three as the melting point. If they differ by more than 1°, make two additional determinations and take the average of the five readings.

3.1.5 Optical rotation and specific optical rotation

Optical rotation '$\propto$' 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°, 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 calculated with reference to 1.0 dm thick layer of the liquid, and divided by the specific gravity.

The *specific optical rotation* $(\propto)_D^{25}$ 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 25^0 and 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° 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°.

Determine the zero point of the polarimeter and then make five readings of the observed rotation of the test solution at 25°. 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° 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 :

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

id

25

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

Where

a = corrected observed rotation, in degrees, at 25°
D = D line of sodium light $(\lambda=589.3 \text{ mm})$
l = length of the polarimeter tube in dm.
d25/25 specific gravity of the liquid or solution at 25°
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° 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° 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° , 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° and weighing the contents. Assuming that the weight of 1 ml of *water* at 25° 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° and fill the pycnometer with it. Adjust the temperature of the filled pycnometer to 25°, 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° (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° 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°.

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

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

Congealing Temperature - Not lower than 14.8°, 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° 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° 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°.

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 ; $(CH_3)_2CO$=58.08.

Description - Clear, colourless, mobile and volatile liquid; taste, pungent and sweetish, odour characteristic; flammable.

Solubility - Miscible with *water*, with *alcohol*, with *solvent ether*, and with *chloroform*, forming clear solutions.

Distillation Range - Not less than 96 per cent distils between 55.5°. and 57° , 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° and 30° 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°, 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°, 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° ; 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° 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° 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° 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° 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° 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° /15.56° , 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° /15.56° , 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° /15.56° , 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° /15.56° , 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° /15.56° , 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°, 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°, 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 Cl=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, Appendix2.2.7.

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_4Cl.

Storage - Store in tightly closed container.

Ammonium Chloride Solution - A 10 per cent w/v solution of *ammonium chloride* 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 - $BaC1_2, 2H_2$ O=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, $Na_2\ B_4\ O_7\ 10H_2O = 381.37$ Contains not less than 99.0 per cent and not more than the equivalent of 103 per cent of $Na_2\ B_4\ O_7\ 10H_2\ O$.

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 $C_{19}H_{19}\ Br_4\ O_5\ S=624$.

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 - $CaCl_2H_2O$=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° to 179° , 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° to 60°) is clear.

Non-Volatile Matter - Leaves not more than 0.05 per cent of residue when volatilized at 105°.

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° 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° 47° Appendix 3.1.1.

Wt. per ml. - At 25°, 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° , 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° and 77° , Appendix 3.1.1.

Wt. per ml. - At 20°, 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 CCl_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 Cl_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 - $CHCl_3$ = 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° to 62° , 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°

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 - $C_{10}H_8O_8S_22H_2O$=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 - $C_6F_8O_77H_2$,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°.

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° to 200° , 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° to 250° . 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° 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° , 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 $Fe (NH_4) (SO_4)_7$, $12 H_2 O$.

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 ; $FeCl_3$ = 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 $FeCl_3$.

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 $FeCl_3$.

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°, 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°.

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 - Clar, 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°. 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 - HCl=36.46
Concentrated Hydrochloric Acid.

Description - Clear, colourless, fuming liquid, odour, pungent.

Arsenic - Not more than 1 part per million, Appendix 2.3.1.

Heavy Metals - Not more than 5 parts per million, determined by method A on a solution prepared in the following manner : Evaporate 3.5 ml to dryness on a water-bath, add 2 ml of *dilute acetic acid* to the residue, and *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 HCl.

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: HCl=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:- $NH_2.OH,HCl$ = 69.49.

Contains not less than 97.0 percent w/w of $NH_2.OH,HCl$

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 $NH_2OH.HCl$.

Hydroxylamine Hydrochloride solution – Dissolve 1 g of *hydroxylamine hydrochloride* in 50 ml of *water* and add 50 ml of *alcohol* 1 ml *of bromophenol blue solution* and 0.1 *N sodium hydroxide* until the solution becomes green.

* **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 I.

Storage - Store in glass-stoppered bottles or in glass or earthern-ware containers with well-waxed bungs.

Iodine, 0.1N: 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 25^0, 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 (pH 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; $[(H_2NC_6H_4)_2C:C_6H_3(CH_3): NH_2+]Cl=337.85$

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, $MgSO_4aq$

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: $HgCl_2$=271.50

Contains not less than 99.5 percent of $HgCl_2$;

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 $HgCl_2$.

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 25^0, not more than 0.791, Appendix 3.1.8.

Distillation Range - Not less than 95 percent distils between 64.5^0 and 65.5^0, Appendix 3.1.1.

Refractive Index - At 200, 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 to 105^0.

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 - 90^0 to 96^0, 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, 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 - 40^0 to 45^0, 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 70^0. 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 60^0. 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, 30^0 to 40^0).
Wt. per ml. - At 20^0, 0,620 to 0.630 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 40^0 to 60^0).
Wt. per ml. - At 20^0, 0,630 to 0.650 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 60^0 to 80^0).
Wt. per ml. - At 20^0, 0,670 to 0.690 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 80^0 to 100^0).
Wt. per ml. - At 20^0. 0,700 to 0.720 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 100^0 to 120^0).
Wt. per ml. - At 20^0, 0,720 to 0.740 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 120^0 to 160^0).
Wt. per ml. - At 20^0, 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 to 136^0

Phenol - C_6H_5OH=94.11.
Analytical reagent grade.

Caustic, deliquescent crystals with a characteristic odour; freezing point, about 41^0.

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 110^0 for one hour, 215^0 to 219^0, Appendix 3.1.4.

Sulphated Ash - Not more than 0.1 percent, Appendix 2.2.11

Phloroglucinol Solution of - A 1 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 105^0.

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 135^0 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 $KClO_3$.

Potassium Chloride - KCl=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.

ves a red precipitate with *silver nitrate* in neutral solutions.

Potassium Cupri-Tartrate Solution - Cupric Tatrate Alkaline Solution: Fehling's Solution.

1. **Copper Solution** - Dissolve 34.66 g of carefully selected small crystals of **copper sulphate**, showing no trace of efflorescence or of adhering moisture, in sufficient water to make 500 ml. Keep this solution in small, well-stoppered bottles.
2. **Alkaline Tartrate Solution** - Dissolve 176 g of sodium *potassium tartrate* and 77 g of *sodium hydroxide* in sufficient water to produce 500 ml.

Mix equal volumes of the solutions No. 1 and No. 2 at the time of using.

Potassium 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 50^0 and add a few drops of *silver nitrate solution*; not more than a faint opalescence is produced.

Assay - Carry out the Assay described under Potassium Chromate, using 2 g. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.004904 g of $K_2Cr_2O_7$.

Potassium Dichromate Solution - A 7 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 110^0 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 105^0 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 111^0.

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, odour, slight, taste, bleed.

Solubility - Slightly soluble in alcohol; miscible with *chloroform*, with solvent *ether with light petroleum* (b.p. 40^0 to 60^0) and with carbon disulpide.

Refractive Index - At 40^0, 1.4650 to 1.4665, Appendix 3.1.7

Wt. per ml. - At 25^0, 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. Its absorptive capacity may be regenerated by heating at 150^0 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 110^0 for two hours and dissolve in 5 ml of *water*. Add 5 ml of *acetic acid*, 50 ml of *methyl alcohol* and three drops of eosin solution is equivalent to 1 ml of 0.1 *N silver nitrate*.

Sodium Bicarbonate - $NaHCO_3$=84.01

Description - White, crystalline powder or small, opaque, monoclinic crystals; odourless, taste, saline.

Solubility - Freely soluble in *water*; practically insoluble in *alcohol*.

Carbonate - 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 - NaCl=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 $C_4H_4O_6 KNa, 4H_2O$.

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: $Na_2 SO_3$=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 33^0.

Solubility - Very soluble in *water*; insoluble in *alcohol.*

pH - Between 6.0 and 8.4, determined in a 10 percent w/v solution, Appendix.

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:

1. Dissolve 330 g of *stannous chloride* in 100 ml of *hydrochloric acid* and add sufficient *water* to produce 1000 ml.

2. 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 - CI 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 - 203^0 to 205^0, 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 49^0

Thymol Blue-6, 6'-(3H-2, 1 Benzoxathil-3-ylidene) dithymol SS-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 $TiCl_3$.

Weight per ml, about 1.2 g.

Dull purplish liquid with a strongly acid reaction.

Titanous Chloride - 0.1N: $TiCl_3$=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 $TiCl_3$.

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) Bhilawaṇ

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:

(a) 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.
(b) 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.
(c) Sang-e-Surma is immersed in Aab-e-Triphala and boiled for 12 hours.
(d) 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.

APPENDIX - 6

6.1 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.

APPENDIX 7

7.1 BIBLIOGRAPHY

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