THE UNANI PHARMACOPOEIA OF INDIA

PART - I
VOLUME - III

GOVERNMENT OF INDIA
MINISTRY OF HEALTH & FAMILY WELFARE
DEPARTMENT OF AYURVEDA, YOGA & NATUROPATHY,
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CONTENTS

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 and II are the books of standards for single drugs included therein and the standards prescribed in the Unani Pharmacopoeia of India Part-I Vol.-III 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.-III would be deemed to have been amended accordingly.

सत्यमेव जयते

उमा पिल्ले
Uma Pillai

सचिव
भारत सरकार
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
आयुर्वेद, योग व प्राकृतिक चिकित्सा,
यूनानी, सिद्ध एवं होम्योपैथी (आयुष) विभाग
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FOREWORD

The Unani System of Medicine which owes its origin to Greece, is based on the teachings of Hippocrates and other great Greek scholars such as Galen, Rhazes and Avicenna. This system has been enriched by imbibing what was best at that time in the contemporary systems of traditional medicine of various countries such as Egypt, Syria, Iraq, Persia, India, China and other Middle East and Far East countries. The Unani system of medicine was brought to India by the Arabs where it is firmly anchored in the Indian culture being an integral part of the Indian Systems of Medicine. Like other Indian Systems of Medicine, its materia medica is a treasure house of plant, animal and mineral origin drugs which are based on time-tested, safe and efficacious formulations.

Maintenance of purity, quality and safety of Unani medicines through modern analytical scientific testing and quality standards is a prime concern and critical requirement. It is thus absolutely essential to lay down pharmacopoeial standards for both single and compound drugs to bring them within the purview of Chapter IV A of the Drugs and Cosmetics Act, 1940, as amended in 1964.

To fulfill the legal mandate and also to ensure quality of drugs, the Government of India has set up the Pharmacopoeial Committee for Unani Medicine in 1964 and subsequently reconstituted it in 1968, 1977, 1988, 1994, 1998 and 2002. A Pharmacopoeial Laboratory for Indian Medicine, Ghaziabad was also established in 1970 mainly to evolve standards for Ayurveda, Siddha and Unani (ASU) drugs. As the Government of India is committed to ensuring production of quality ASU drugs, work in this direction was taken up by the different Drug Standardization Units of the Central Council for Research in Unani Medicine (CCRUM), New Delhi.

The Department of AYUSH takes pride in bringing out the third volume of *The Unani Pharmacopoeia of India (Part-I, Vol.-III)* comprising pharmacopoeial standards on 53 single

drugs of plant origin included in the National Formularies of Unani Medicine, work on which has been carried out at various Drug Standardization Research Laboratories of the CCRUM. This would set the pace for evolving standards in Unani Medicine and help researchers, pharmaceutical houses and the Government of India to enforce drug control measures for the manufacture of these drugs in order to maintain their quality, purity and safety for human consumption.

The setting up of a separate Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) has accelerated 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 the drugs investigated. As this is the first effort of its kind in the field of Unani System, the Department of AYUSH is aware that there is room for further improvement. Hence, suggestions and advice from the experts in the field would be welcomed.

The Directors and scientific staff of the Pharmacopoeial Laboratory for Indian Medicine, Ghaziabad and Central Council for Research in Unani Medicine, New Delhi and the experts of the Unani Pharmacopoeia Committee, along with the technical and administrative staff of the Department must be commended for their efforts towards the timely completion of this pharmacopoeial volume.

Uma Pillai

(Uma Pillai)
Secretary to the Government of India
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New Delhi
17 August 2005

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.

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.

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). The CCRUM has six survey units in different states and also established standardization work of single and compound medicines at its various Drug Standardization Research Units.

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* and *Vol. II* 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* and *Vol.-II* comprising 45 and 50 monographs, respectively, on single drugs of plant origin. *The Unani Pharmacopoeia of India, Part-I, Vol.-III* comprises 53 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.-III* comprising 53 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 : 17.8.2005

GENERAL NOTICES

Title: The title of the book is "Unani Pharmacopoeia of India" Part-I Vol.-III 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°C.

Metric measures are required by the Pharmacopoeia to be graduated at 25°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 great emphasis on proper identification of single drugs. Discorides (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 Sina 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 Government 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 Govt. of India further extended the term of the Second Committee for one year more, vide notification No. F. 6-2/72-APC dated 19th November, 1974 which expired on 14th November, 1975.

The third Unani Pharmacopoeia Committee was 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, Prof. & Head, Department of Pharmacology, M.R. Medical College, Gulbarga, Karnataka.	Chairman
2.	Hakim Abdul Hameed, President, Institute of History of Medicine and Medical Research, Hamdard Building, Delhi.	Member
3.	Hakim Shakeel Ahmed Shamsi, Hakim Abdul Aziz Road, Lucknow.	Member
4.	Hakim S.M. Shibli, Hony. Director, Central Research Institute of Unani Medicine, 11-4-625, Dilkusha, A.C. Guards, Hyderabad.	Member
5.	Dr. H.M. Taiyab, Principal, Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh.	Member
6.	Hakim Syed Khaleefathullah, 75, Pycrofts Road, Chennai	Member

7.	Hakim Faiyaz Alam, Director, Islahi Dawakhana, Fancy Mahal, Mohd. Ali Road, Bombay.	Member
8.	Hakim Abdul Qawi, Kachehri Road, Lucknow.	Member
9.	Prof. Basheer Ahmed Razi, 22, East End Road, Basavangudi, Bangalore.	Member
10.	Prof. M.M. Taqui Khan, Prof. & Head, Department of Chemistry, Nizam College, Hyderabad.	Member
11.	Dr. S.A. Mannan, Road No.:11, Banjara Hills, Hyderabad.	Member
12.	Dr. S.S. Gothoskar, Drugs Controller (India) Directorate General of Health Services, New Delhi.	Member
13.	Hakim M.A. Razzack, Dy. Advisor (Unani), Ministry of Health & F.W., New Delhi.	Member Secretary

The 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 Govt. 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, Head, P.G. Department of Ilmul Adviya, A.K. Tibbia College, A.M.U., Aligarh-202 001 (UP).	Member
6.	Hakim Ved Prakash Sharma, Bassi Pathanan, Distt. Fatehgarh, Patiala, Punjab.	Member
7.	Hakim Syed M. Ghayasuddin Ahmed, Regional Research Institute of Unani Medicine, 1, West Mada Church Street, Royapuram, Madras-400 006.	Member
8.	Prof. Hakim S. Shaji Haider, Principal, Govt. Unani Medical College, Red Cross Building, Race Course Road, Bangalore (Karnataka).	Member
9.	Hakim Mohd. Khalid Siddiqui, Director, CCRUM, 61-65, Institutional Area, Janakpuri, New Delhi-110 058.	Member
10.	Hakim M.A. Wajid, C.R.I.U.M., Opp. E.S.I. Hospital, Eragadda, Hyderabad (AP).	Member
11.	Hakim (Mrs.) Ummul Fazal, Dy. Director, CCRUM, 5, Panchsheet Shopping Centre New Delhi-110 017.	Member
12.	Prof. M.S.Y. Khan, Deptt. of Pharmaceutical Chemistry, Jamia Hamdard, Hamdard Nagar, New Delhi.	Member

13.	Dr. S.S. Handa, Deptt. of Pharmaceutical Chemistry, Patiala University, Patiala, Punjab.	Member
14.	Dr. R.U. Ahmed, Director, P.L.I.M., C.G.O. Complex, Kamla Nehru Nagar, Ghaziabad.	Member
15.	Prof. Wazahat Hussain, Chairman, Deptt. of Botany, A.M.U., Aligarh - 202 001 (UP).	Member
16.	Hakim (Mrs.) Aliya Aman, Dy. Advisor (Unani), Deptt. of ISM & H, Ministry of Health & F.W., Red Cross Bldg., Annexe, New Delhi.	Member Secretary

The 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 Rehman, 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. HakimSyed 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 Rehman Chairman, Ibn-e-Sina Academy, Tijara House, Doodhpur, 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 Pharmacopoeia Monographs on single drugs of plant origin used in National Formularies of Unani Medicine have been published in the Unani Pharmacopoeia of India, Part I Vol. I .

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 Homeopathy (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

MONOGRAPHS
PHARMACOPOEIAL STANDARDS
OF
SINGLE UNANI DRUGS

AFTIMOON
(Whole Plant)

The drug Aftimoon consists of dried stem and fruits of *Cuscuta reflexa* Roxb. (Convolvulaceae), a total parasite, common throughout India in plains and growing abundantly during rainy season on various host plants.

OTHER NAMES:

Arabic	:	Aftimoon
Persian	:	Darakht-e-pechan
Bengali	:	Algusi
English	:	Dodder
Gujarati	:	Amar bel
Hindi	:	Akash bel
Marathi	:	Nirmuli
Punjabi	:	Nilathari
Sanskrit	:	Amarvela
Telugu	:	Sitana pugonalu
Urdu	:	Aftimoon

PART USED : Whole plant

DESCRIPTION:

Macroscopic:

Dry, thread like stem pieces, brown in colour; about 0.8 mm in thickness; fruits capsule, small, globose or ovoid; seeds dark in colour, spherical to ellipsoidal, less than 1 mm in thickness, no specific odour or taste.

Microscopic:

Transverse section shows outline of stem circular or slightly wavy; epidermal cells oblong, thin walled; cortex wide, parenchymatous; vascular system reduced to a central core of a few collateral, 4 or 5 bundles, around a central small pith region; xylem elements in radial rows in each bundle; phloem occurs in prominent patches on the outer part of each xylem strand.

Fruit: The pericarp of the fruit is thin and membranous, consisting of an outer layer of tangentially and narrowly oblong, thin walled parenchyma cells showing periclinal division at certain places; inner layer consists broad, barrel shaped cell with their inner tangential and radial walls very thick, the thickened portion appearing "U" shaped in cross section.

Seeds: Triangular or rectangular in Transverse section; testa thick and brittle; a thick echinate cuticle present followed by a narrow zone of epidermis consisting of radially elongated cells with thick walls; inner to epidermis a broad compact, thin walled radially elongated palisade like layer of cells present; mesophyll tissue shrunken, collapsed, forming membranous zone, adhering to

inner layer at some places, but occasionally found detached; embryo minute, embedded in a mass of crushed or shrunk cotyledons.

Powder: Brown, polygonal and oblong cells present,; epidermal cells polygonal; thick walled xylem elements with spiral and annular thickenings present; length of vessel elements 90 to 110 μ; fragments of fibres with simple and bordered pits seen, length varying from 1000 μ to 1100 μ.

Chemical Constituents: Dulcitol, luteolin, quercetin and a glycoside or lutcolin.

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 9 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 9 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 16 % , Appendix 2.2.7

TLC behaviour of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (5 : 1.5)	Dipped in Vanillin sulphuric acid reagent and heated in air oven at 105^0 for 10 minutes	7	0.14 0.20 0.31 0.47 0.53 0.67 0.82

TEMPERAMENT : Hot 2^o, Dry 2^o

ACTION : Mushil Sauda, Mushil-e-Balgham, Musaffi-e- Dam, Muhallil-e-Warm, Mufatteh Sudad, Mudirr-e-Haiz, Mudirr-e-Baul.

THERAPEUTIC USE : Waram-e-Tehal, Malikholia, Kaboos, Junoon, Zof-e-Kabid, Waram-e-Kabid

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Sharbat Dinar, Itrifal Aftimoon

ANJABAR
(Rhizome)

The drug Anjabar consists of dried rhizome of *Polygonum historta* Linn. Syn. *P. paleaceum* Wall. ex Hook f. (Polygonaceae), a perennial herb, upto 60 cm high with a thick twisted root stock, found in Himalayas from Kashmir to Sikkim & hills of Assam at 2,700-4,500 meters.

OTHER NAMES

Arabic	:	Asar-rai, Anjubar
Persian	:	Hozar, Bandak
Bengali	:	Machutie
English	:	Bissstort, Snake-root
Hindi	:	Kuwar, Bijband, Ban-natia
Kashmiri	:	Drop
Punjabi	:	Bijband, Kuwar, Ban-natia
Sanskrit	:	Miromati, Nisomali
Urdu	:	Anajabar

PART USED : Rhizome

DESCRIPTION:

Macroscopic:

Rhizome in pieces of 6.0 cm to 12.0 cm in length and 1.0 to 2.0 cm in thickness, solid, cylindrical and somewhat flattened in shape, longitudinally wrinkled and twisted; a few show marks of annulation of leaf bases and parts of lateral roots with traces of attached rootlets; external surface dark brown, but freshly broken surface cinnamon brown; fracture hard, tough and uneven; odour slightly aromatic, taste pungent and slightly bitter.

Microscopic: A cross section of the rhizome shows an almost circular or oval outline, cuticle present; phellem is composed of 4 or 5 layers of large, compact, rectangular to oval cork cells slightly thick and somewhat wavy; containing yellowish-brown contents positive for tannin; followed by 3 or 4 layers of phellogen several layers of cortical cells, elliptical or circular, thin walled, parenchymatous cortical cells usually containing abundant starch grains that are simple, elliptic to oval or circular in shape, hilum at centre and fissured with distinct striations; a few cells show also the presence of a single cluster crystal of calcium oxalate; a group of sclerenchymatous cells, thick walled and polygonal in shape, present adjacent to vascular bundles, which are numerous, radially arranged, collateral; phloem cells present below the group of sclerenchymatous cells; cambium distinguished at some places only; vessels mostly in small groups showing simple pits; xylem fibres are found in small groups or isolated and associated with vessels; rays-bi-or triseriate, rectangular and slightly radially elongated; pith, cells oval to circular, thin walled, parenchymatous and loosely arranged with large intercellular spaces. Cells are usually filled with many starch grains; a few of them contain clusters of calcium oxalate crystals.

Powder: Powder Pinkish-brown, coarse, free flowing, slightly bitter taste, fragments of cork, cork cambium, parenchyma from cortex, filled with starch grains; in surface view, the sclerenchymatous cells, thick walled to polygonal, highly lignified; ray cells found in groups of 2 to 4; cluster of calcium oxalate crystals are usually present in free state, broken or intact, from 30 to 50 μ in size; starch grains about 4 to 10 μ wide and upto 15 μ in length are also found in large numbers; fibres long, upto 400 μ long and upto 25 micron wide in the middle, almost spindle shaped, unseptate, wall lidgnified with wide lumen, tips pointed, a few of them pitted and a few are branched at the tip. Vessels short but wide, thick walled, with simple pits and having spiral or reticulate thickenings; tracheids are also present but less in number, short, wide, spindle shaped, strongly pitted and their tips are rounded or truncated; xylem parenchyma thick walled, and rectangular.

CHEMICAL CONSTITUENTS : Phenolic compounds and flavonoids

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 extractive	:	Not less than 6 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 16 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate : Acetic Acid (5:4:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	4	0.33 0.55 0.83 0.90

TEMPERAMENT : Cold, Dry 1°

ACTION : Qabiz, Habis-e-Dam, Muqawwi-e-Meda, Muqawwi- e-Ama, Daf-e-Taffun

THERAPEUTIC USE : Ishal, Baul-ul-dam, Ishal-e-Damvi, Sil, Zof-e-Ishteha, Sahaj-e-Ama, Ghasayan, Bawaseer-e-Damia

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Sharbat-e-Anjabar, Qurs Anjabar, Majoon Hamal Ambri Alvi Khani

BAKAYIN
(Fruit)

The drug Bakayin consists of dried fruits of *Melia azedarach* Linn. (Meliaceae), a medium sized tree, upto 12 meter high found throughout India and occasionally planted in gardens.

OTHER NAMES :

Arabic	:	Ban, Habulban
Persian	:	Azadedarakhta, Bakaen
Assamese	:	Thamaga
Bengali	:	Ghoranim, Mahanim China, Pride of India
English	:	Barbados lilac, Bead free, Indian lilac, Persian lilac, Pride of
Gujarati	:	Bakanlimbodo
Hindi	:	Bakayin, Bakarja, Bakayan, Betain, Deikna, Drek, Mahanimb Mahadroksha, Paraneshta, Mahatikta, Nimbaka, Parvata, Mahanimba, Kaitarya, Kakanda, Kashira, Karmuka, Keshamushti
Malayalam	:	Malaveppu
Marathi	:	Bakananimb, Limbara, Vilayatinimb
Punjabi	:	Bakayin, Chein, Dhek, Jek, Kachen
		Ramyaka, Sakaleyaka, Shuklasaraka, Vishamushtika
Sanskrit	:	Akshadru, Brihannimba, Gairika, Giripatra, Dreka, Himadruma
Tamil	:	Malaivembu, Malaiveppam, Pisidam, Sigarinimbam, Tittam
Telugu	:	Turakavepa, Vettiveppa
Urdu	:	Bakayin

PART USED : Fruit

DESCRIPTION:

Macroscopic :Drupes ovoid to globose, upto 15mm long and 12 mm wide, yellowish brown to chocolate brown, skin wrinkled, pericarp hard and creamish in colour; single stone present, upto 5.0 mm, long, ovoid or globose, brown, slightly flat at apex, 5 ridged, endocarp hard to break, 5 chambered and each chamber contains a single seed; reddish-brown in colour, 2.5 to 3.5 mm long and 1.0 to 2.5 mm broad, shiny, lanceolate; taste of the seed slightly bitter than pericarp but agreeable; odour unpleasant.

Microscopic :Transactional view of the fruit wall shows a cuticle followed by a single layer of epicarp consisting of rectangular to squarish, thick walled parenchymatous cells with slightly irregular walls containing yellowish-brown pigments; the mesocarpic region is of 3 or 4 layers in depth and is composed of rectangular to tangentially elongated, thick walled parenchymatous cells which contain oil globules; lower region of mesocarp parenchymatous cells, gradually reducing in size nearer the endocarp; a very few cells in the lower region possess rosette crystal of calcium oxalate. At few places in the mesocarpic region secretory cavities present. The

endocarp is mainly composed of highly lignified cells; contents of the cells give positive test for tannins.

Cross section of seed shows a cuticle and a testa which is generally made up of two layers of cells. The outer consists of rectangular to slightly elongated, thin walled Parenchymatous cells, and inner comprised of slightly radially elongated, thick and straight walled cells possessing yellowish-brown contents; beneath this there are 5 or 6 layers of tegmen consisting of compact, hexagonal to polygonal, thin walled Parenchymatous cells with pigments; cells of the endosperm are compact, large, tangentially elongated thin-walled Parenchymatous filled with aleurone grains and oil globules.

Powder : Powder brown, coarse and free-flowing, taste slightly bitter but agreeable with unpleasant odour, fragments of epicarp, mesocarp, testa, tegmen, endospermic cells, parenchymatous cells containing aleurone grains and oils globules in abundance, fibre and vessels are also seen but less in number. Rosette crystals of calcium oxalate are occasionally found, some elongated fibres and fibre-tracheids are also present. The fibres are quite long upto 600 μ in length and 13.0 μ in width, thick walled lignified with narrow lumen and ends tapering; sclereids present, 40 to 120 μ broad. Vessels are short, broad, lignified and have annular or spiral thickenings.

DESCRIPTION:

CHEMICAL CONSTITUENTS :

Bitter principle- Bakayanin, Alkaloid azridine (Margosine), a brown resinous substance, a non-bitter acidic substance, a sterol and tannins.

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 2 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 16 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 25 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (93:7)	On spraying plate with 5% Ethanolic conc. H_2SO_4	5	0.27 0.50 0.58 0.74 0.94

TEMPERAMENT	:	Hot, Dry2[0]
ACTION	:	Musaffi-e-Dam, Mohalil-e-waram, Musakkin-e- Alam, Munaqqi, Qatil-e-Kirm-e-ama, Dafa-e- Humma, Qabiz, Mudirr-e-Baul, Bawaseer, Daf-e-Bawaseer
THERAPEUTIC USE	:	Niqras, Jaryan, Waj-ul-Mafasil, Bawaseer, Waj-ul-Uzn
IMPORTANT FORMULATION	:	Habb-e-Bawaseer, Majoon Musakkin Dard-e-Rahem, Tila-e-Musakkin

BAKAYIN
(Leaf)

The drug Bakayin consists of dried leaves of *Melia azedarach* Linn (Meliaceae) a medium sized tree upto 12 high found throughout India and occasionally planted in gardens.

OTHER NAMES :

Arabic	:	Ban, Habulban
Persian	:	Azadedarakhta, Bakaen
Assamese	:	Thamaga
Bengali	:	Ghoranim, Mahanim
English	:	Persian lilac, Barbados lilac, Bead tree, Indian lilac, Pride of Chine, Pride of India
Gujarati	:	Bakanlimbodo
Hindi	:	Bakayin, Bakarja, Bakayan, Betain, Deikna, Drek, Mahanimb
Malyalam	:	Malaveppu
Marathi	:	Bakananimb, Limbara, Vitayatinimb
Punjabi	:	Bakain, Chein, Dhek, Drek, Jek, Kachen
Sanskrit	:	Akshadru, Brihannimba, Dreka, Gairika, Giripatra, Himadruma, Kaitarya, Kakanda, Karmuka, Kshira, Keshamushti, Mahadroksha, Mahaminba, Parvta, Mahatikta, Nimbaka, Paraneshta, Vishamushtika, Ramyaka, Sakaleyaka, Shuklasaraka
Tamil	:	Malaivembu, Malaiveppum, Pisidam, Sigarinimbam, Tittam
Telugu	:	Turakavepa, Vettiveppa
Urdu	:	Bakayin

PART USED : Leaves

DESCRIPTION :

Macroscopic : Dried broken rachis and leaves; rachis 23 to 45 cm long; leaves imparipinnate, with pinnae opposite, 3 to 11, ovate or lanceolate, upto 8 cm in length and upto 2.5 cm in width, acuminate, obtusely serrate, oblique at the base, petiolules short, slender; only faintly bitter which distinguishes them from leaves of *Azadirachta indica*; which are intensely bitter; odourless.

Microscopic :

Rachis : Transverse section of epidermis of the rachis shows unicellular trichomes and multicellular glandular trichomes on unicellular stalk; a wide cortex, some cells containing rosette crystals of calcium oxalate; vascular tissues nearly circular in the middle region of the rachis, but compressed and ellipsoid at the stalk region.

Midrib: Shows a ridge above and below, single layered epidermis, covered with cuticle on both surfaces, cortex consists of 2 to 3 layers of collenchymatous cells on both sides followed by thin walled parenchyumatous cells; vascular region shows arc of xylem after with three subsidiary bundles; crystals distributed in cortical region.

Lamina: Isobilateral, thick cuticle present; single layer of epidermal cells; multicellular glandular and unicellular long trichomes present; single layer of palisade cells present, some dividing pereclinically; occasionally some of them contain rosette crystals of calcium oxalate; the lower epidermal cells are similar to the upper epidermal cells but somewhat smaller in size; straight walled in surface view; stomata only on lower surface; palisade layer adjoining the lower epidermis is characterized by cells which are smaller than the upper palisade cells; spongy parenchyma in between; vascular bundles present, with xylem vessels showing spiral thickening.

Powder: Yellowish brown, no odour, slightly bitter; microscopic examination of the powder shows fragments of epidermis which bear multicellular glandular and unicellular long trichomes, two types of palisade cells, large and small, crystals of calcium oxalate, spiral and pitted xylem vessels.

CHEMICAL CONSTITUENTS : Flavonoids

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 13 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 3 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 8 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 20 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (93:7)	On spraying plate with 5% Ethanolic conc. H_2SO_4	5	0.13 0.30 0.40 0.48 0.55

TEMPERAMENT : Hot, Dry 2°

ACTION : Musaffi-e-Dam, Muhallil-e-Awram, Musakkin-e-Aam, Daf-e-Bawasir, Muqqwwi-e-Dandan, Qatil-e-Kirm-e- Ama Munaqqi, Daf-e-Humma, Qabiz, Mudirr-e-Baul

THERAPEUTIC USE : Juzam, Bars, Bawaseer, Qabz, Suda, Jaryan, Ehtabas-e-Tams

DOSE : 1-2 g

IMPORTANT FORMULATIONS : Habb-e-Bawaseer, Majoon Musakkin, Dard-e-Rahem, Tila-e-Musakkin

BAKAYIN
(Stem Bark)

The drug Bakayin is the dried, mature stem bark of *Melia azedarach* Linn. (Meliaceae) a medium sized tree upto 12 metre high found throughout India, and often planted in gardens.

OTHER NAMES :

Arabic	:	Ban, Habulban
Persian	:	Azadedarakhta, Bakaen
Assamese	:	Thamaga
Bengali	:	Ghoranim, Mahanim
English	:	Persian lilac, Barbados lilac, Bead tree, Indian lilac, Pride of China, Pride of India
Gujarati	:	Bakailimobdo
Hindi	:	Bakayin, Bakarja, Bakayan, Betain, Deikna, Drek, Mahanimb
Malyalam	:	Malaveppu
Marathi	:	Bakananimb, Limbara, Vilayatinimb
Punjabi	:	Bakain, Chein, Dhek, Drek, Jek, Kachen
Sanskrit	:	Akshadru, Brihannimba, Dreka, Gairika, Giripatra, Kakanda, Himadruma, Kaitarya, Karmuka, Kshira, Keshamushti, Mahadroksha, Mahaminba, Parvata, Mahatikta, Paraneshta, Ramyaka, Vishamushtika, Sakaleyaka, Shuklasaraka
Tamil	:	Malaivembu, Malaiveppum, Pisidam, Sigarinimbam, Tittam
Telugu	:	Turakavepa, Vettiveppa
Urdu	:	Bakayin

Part Used : Stem bark

DESCRIPTION :

Macroscopic : Bark curved, length is 4 to 8 cm, breadth 1 to 2 cm, thickness 1 to 1.5 cm; outer surface cracked and scaly; colour blackish grey outside and snuff brown after scrapping; cracks both transverse and longitudinal; shallow fissures with clear edges, inner surface straw coloured with fine striations, fractures splintery, bitter on chewing.

Microscopic : Transverse section of stem bark shows the presence of rhytidome along with alternate zones of cork and secondary phloem. Cork cells rectangular; inter cellular space absent, phellogen indistinct. Phelloderm present inside the cork not prominent everywhere. Cortex not visible into outer and inner zones; divided into many layers but newly originated cork layers. In secondary phloem sieve tube elements are always present along with compound sieve plates; end wall oblique. Phloem fibres with tapering ends; angular in Transverse section, fibre pits indistinct, fibres solitary or in aggregates of 2-30 μ thick walled; sclereids absent; phloem parenchyma thin walled; crystals prismatic, rectangular rhomboidal and aggregated rhomboids in rosettes in chambered parenchyma. Radially compressed soft cells occasional, having tangential walls thickened and the lumen filled up with a yellowish resinuous content. Rays usually

multiseriate; rosettes and prismatic crystals present in ray cells. In radial longitudinal section the ray cells measure 150 to 200 μ in height and 20 to 25 μ in width.

Powder: Chocolate brown, shows the presence of cork cells, medullary ray cells, parenchymatous cells of periderm, phloem fibres measure 8 μ to 16 μ in length and 0.6 μ to 1.2 μ in breadth with pits and aggregated crystals, prismatic and rhomboidal crystals abundant; Simple starch measuring 2.8 μ to 5 μ in diameter. Sclerieds absent.

CHEMICAL CONSTITUENTS : Kulin Kulolactone and Kulonone 5, 4-Dihydroxy lavone-7-∝-L-rhamnopyranopsyl (1-4) B-D-glucopyranoside 1-8 Dihydroxy-2 Methylanthraquinone-3-o-B-D-galactopyranoside and 1, 5-dihyroxy-8-methoxy-2-methyl anthraquinone-3-o ∝-rhamnopyranoside. Isochuanliansu. 7-∝-acetoxy 14-B-epoxygedunan-1-ene-3-o-B-D-glucopyranoside

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 1 % , Appendix 2.2.4
Alcohol soluble extractive(s)	:	Not less than 5 % , Appendix 2.2.6
Water soluble extractive(s)	:	Not less than 4 % , Appendix 2.2.7

TLC behaviour of Ethanolic extract

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Acetate : Acetic Acid (5:4:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	5	0.25 0.45 0.59 0.71 0.87

TEMPERAMENT : Hot, Dry 2°

ACTION : Musaffi-e-Dam, Muhallil-e-Warm, Musakkin-e-Aam, Daf-e-Kirm-e-Ama, Daf-e-Humma Qabiz, Kasir-e-Riyah

THERAPEUTIQUE USES : Qula, Juzam, Bars, Arq-un Nisa, Nafkh-e-Shikam

DOSE : 5-10 g

IMPORTANT FORMULATION : Habb-e-Bawaseer, Majoon Musakkin, Dard-e- Rahem, Tila-e-Musakkin

BANAFSHA
(Leaf)

The drug Banafsha consists of dried leaf of *Viola pilosa* Blume. (Violaceae), a hirsute or glabrous spreading runner found throughout the temperate Himalayas upto an altitude of 2000 m, extending eastwards to the hills of Meghalaya, Nagalnd and Manipur; it is also found in the Ganjam hills in Orissa and in the Nilgiris and Palani hills in Tamil Nadu at altitudes of 1500 to 2000 m.

OTHER NAMES:

Arabic	:	Banafsi, Banafsaj
Persian	:	Kokash
Bangali	:	Baga Banusa
English	:	Sweet Voilet
Hindi	:	Banafshah
Kumaun	:	Thungtu
Punjabi	:	Banafsha
Urdu	:	Banafsha

PART USED : leaf

DESCRIPTION :

Macroscopic :

Originate radically all around the upper part of the root stock; petiole about 20 cm long; thin and wiry; leaf about 2 cm broad 3 cm long, puberlus, base sinuate, margin serrate, apex acuminate.

Microscopic:

Petiole: Wavy outline in Transverse section with an adaxial ridge and distinct lateral wings; epidermis single layered, followed by two to three layers of collenchyma; cortex parenchymatous, compact; druses of calcium oxalate present in the cortical cells; vascular system appearing deeply cup shaped, with invagilating ends, leaving a gap on the adaxial side; phloem surrounding the xylem.

Midrib: Transverse section shows midrib forming a broad blunt hump on the adaxial surface and broadly hemispherical on the abaxial side; cuticle thin and striated, epidermis single layered, epidermal cells more radially elongated than tangentially, ground tissue differentiated into an outer narrow, one or two layered collenchymatous tissue, adjacent to both upper and lower epidermis; rest of the cells parenchymatous; vascular bundle, single, small, arc shaped, with 5 to 7 radial rows of xylem and an abaxial phloem.

Lamina: Dorsiverntral, cuticle thin and striated; adaxial epidermis cubical to rectangular, thin walled; unicellular warty trichomes seen on both surfaces of leaf; palisade single layered; spongy parenchyma 2 or 3 layered of irregular shape; some parenchyma cells adjacent to the lower

epidermis are tangentially elongated with dark contents; abaxial epidermal cells tangentially oblong and narrow; vascular bundles of lateral veins similar to midrib bundle with an arc of collateral xylem and phloem.

CHEMICAL CONSTITUENTS :

Volatile oil consists of 2, 6-nonadien-1-al (aldehyde), 2,6-nonadien-1-ol (alcohol).n-hexanol, n-hexenol, n-heptenol, n-eugenol, palmitic salicylic & octanoic acid.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 13 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 6 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 30 % , Appendix 2.2.7

TLC behaviour of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (5 : 1.5)	Dipped in Vanillin Sulphuric acid reagent and heated in air oven at 105^0 for 10 minutes	6	0.18 0.47 0.68 0.73 0.82 0.86

TEMPERAMENT : Hot 2^0, Dry 2^0

ACTION : Moaddil, Mulattif, Muarriq.

THERAPEUTIC USE : Humma, Nazla, Zukam, Zatul Janb, Zat –ur- Riya, Sual.

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Habb-e-Banafsha, Khamira Banafsha, Sharbat Banafsha.

BANAFSHA
(Whole Plant)

The drug Banafsha consists of dried whole plant of *Viola Pilosa* Blume. (Violaceae), a hirsute or glabrous spreading runner found throughout the temperate Himalayas upto an altitude of 2,000 m, extending eastwards to the hills of Meghalaya, Nagaland and Manipur,; it is also found in the Ganjam hills in Orissa and in the Nilgiris and Palani hills in Tamil Nadu at altitudes of 1,500 to 2,000 m.

OTHER NAMES:

Arabic	:	Banafsi, Banafsaj
Persian	:	Kokash
Bangali	:	Baga Banusa
English	:	Sweet Voilet
Hindi	:	Banafshah
Kumaun	:	Thungtu
Punjabi	:	Banafsha
Urdu	:	Banafsha

PART USED : Whole plant

DESCRIPTION:

Macroscopic

Root Stock: Vertical, thick, hard, surface corky; upto 5 mm thick and 6 to 8 cm long; giving off many wiry long lateral roots.

Root: Thin, wiry, brownish, arising from tapering rootstocks.

Stem: Underground runner attached with rootstock; pieces about 2 mm thick.

Leaf: Originate radically all around the upper part of the root stock; petiole about 20 cm long; thin and wiry; leaf about 2 cm broad 3 cm long, puberlus, base sinuate, margin serrate, apex acuminate.

Flower: Pedicel about 12 cm long, thin and wiry; flower axillary, solitary, about 0.5 cm broad and 1 cm long; dried to a light yellow colour, bisexual, zygomorphic, hypogynous; pentamerous, stamens 5, polypetalous, sepals 5, petals 5, unequal.

Microscopic

Root Stock : Transverse section shows an epidermal layer of rectangular, thin walled cells followed by a broad zone of thin walled parenchymatous layers of cortex; endodermis present; vascular bundle in a broken ring, consisting of a discontinuous phloem and xylem; vessels angular in Transverse section, narrow, thick walled, in radial rows alternating with radial rows of

thick walled, narrow lumen xylem fibres; medullary ray absent, druses of calcium oxalate crystals ranging from 21 to 54 abundant in the pith and cortex.

Stem: Transverse section shows, single layered epidermis, cells cubical to barrel shaped; cortex parenchymatous, cells compact, vascular system in a continuous cylinder with dense radial rows of xylem elements, vessels angular, thick walled; phloem continuous occurring outside the xylem ring; sieve tubes distinct; pith parenchymatous, polygonal to spherical, less compact.

Petiole: Wavy outline in Transverse section with an adaxial ridge and distinct lateral wings; epidermis single layered, followed by two to three layers of collenchyma; cortex parenchymatous, compact; druses of calcium oxalate present in the cortical cells; vascular system appearing deeply cup shaped, with invaginating ends, leaving a gap on the adaxial side; phloem surrounding the xylem.

Midrib: Transverse section shows midrib forming a broad blunt hump on he adaxial surface and broadly hemispherical on the abaxial side; cuticle thin and striated, epidermis single layered, epidermal cells more radially elongated than tangentially, ground tissue differentiated into an outer narrow, one or two layered collenchymatous tissue, adjacent to both upper and lower epidermis; rest of the cells parenchymatous; vascular bundle, single, small, arc shaped, with 5 to 7 radial rows of xylem and an abaxial phloem.

Lamina: Dorsiverntral, cuticle thin and striated; adaxial epidermis cubical to rectangular, thin walled; unicellular warty trichomeS seen on both surfaces of leaf; palisade single layered; spongy parenchyma 2 or 3 layered of irregular shape; some parenchyma cells adjacent to the lower epidermis are tangentially elongated with dark contents; abaxial epidermal cells tangentially oblong and narrow; vascular bundles of lateral veins similar to midrib bundle with an arc of collateral xylem and phloem.

Powder: Brown, showing parenchyma cells polygonal or rectangular, thin and straight walled surface view of epidermal cells polygonal, stomata paracytic; trichome fragments thin walled, warty with pointed tip; width at the middle 22 μ to 36 μ; trichome arises from an epidermal cell with radially oriented subsidiary cells; striated cuticle prominently visible in surface view, striation radiate from the base of trichome towards adjacent cells; vessels narrow, scalariform, tailed at both ends; length varies from 86 μ to 222 μ, width 14μ to 2μ; perforation plate simple and oblique; druses of calcium oxalate crystals size varying from 17 μ to 54 μ.

CHEMICAL CONSTITUENTS :

Alkaloid – Violine.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 13 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 3 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 2 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 11 % , Appendix 2.2.7

TLC behaviour of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (5 : 1.5)	Dipped in Vanillin Sulphuric acid reagent and heated in air oven at 105^0 for 10 minutes	6	0.18 0.47 0.68 0.73 0.82 0.86

TEMPERAMENT : Hot 1^o, Dry 1^o

ACTION : Muaddil, Mulattif, Muarriq.

THERAPEUTIC USE : Humma, Nazla, Zukam, Zatul Janb, Zatur- Riya, Sual.

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Habb-e-Banafsha, Khamira Banafsha,Sharbat Banafsha.

BASAL
(Fresh Bulb)

Basal consists of fresh bulbs of *Allium cepa* Linn. (Liliaceae); a biennial herb, cultivated throughout India for its leaves and bulbs; used as vegetable. It flowers during February to March.

OTHER NAMES:

Persian:	:	Piyaz
Assam	:	Palandu, Piyaj
English	:	Onion
Gujarati	:	Dungali
Hindi	:	Piyaz
Kanada	:	Irulli
Malayalam	:	Ulli
Marathi	:	Kanda Nripakanda, Nripapriya, Dirghapatra, Mahakanda.
Punjabi	:	Piyaz, Ganda
Sanskrit	:	Raktakanda,Yavaneshtha, Rajapalandu,Rajeshta,
Tamil	:	Ira - vengayam, Iruli,Vella-vengayam
Telugu	:	Nirulli, Vulli gaddalu
Urdu	:	Piyaz

PART USED : Bulbs (Fresh)

DESCRIPTION:

Macroscopic : Bulbs globose, tunicated, external layers membranous, white, Pink or purplish; variable in size, ranging from 2 to 10 cm in diameter, weighing 30 g to 200 g per bulb; covered with fleshy leaf bases, peeling in layers, arranged around a much reduced stem; characteristic odour, taste irritating and pungent. However, skinned bulbs.

CHEMICAL CONSTITUENTS :

Volatile oil, organic sulphur compounds, quercetin, amino acids and minerals.

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 extractive	:	Not less than 20 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 45 % , Appendix 2.2.7
Moisture content on wet wt. basis	:	Not less than 86 % , Appendix 2.2.9

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
N-butranol : Acetic acid : Ethyl acetate (14 : 4 : 2)	On spraying plate with Aniline diphenyl amine H_2SO_4 and heating at $110^{0}C$ for 15 minutes.	4	0.8 0.13 0.26 0.48

TEMPERAMENT : Hot Dry

ACTION : Mohallil, Moharrik, Daf-e-Taffun

THERAPEUTIC USE : Aram, Etebas-e-Baul Sal-e-Shoebi, Zof-e- Bah

IMPORTANT FORMULATIONS : Majoon Piyaz

BASAL
(Seeds)

Basal consists of dried seeds of *Allium cepa* Linn. (Liliaceae); a biennial herb, cultivated throughout India for its leaves and bulbs. It flowers during February to March.

OTHER NAMES:

Persian	:	Piyaz
Assamese	:	Piyas
Bengali	:	Palandu, Piyaj
English	:	Onion
Gujarati	:	Dungali
Hindi	:	Piyaz
Kannad	:	Irulli
Malayalam	:	Ulli
Marathi	:	Kanda Nripakanda, Nripapriya, Dirghapatra, Mahakanda.
Punjabi	:	Piyaz, Ganda
Sanskrit	:	Raktakanda, Yavaneshtha, Rajapalandu, Rajeshta,
Tamil	:	Ira-vengayam, Iruli,Vella-vengayam
Telugu	:	Nirulli, Vulli gaddalu
Urdu	:	Piyaz

PART USED : Seeds

DESCRIPTION:

Macroscopic : Seeds are irregularly triangular, wrinkled, about 3 mm long and 1 mm broad, dark brown to black, rough, slight characteristic odour; 100 seeds weighs about 0.35 to 0.40 g.

Microscopic : Elongated to oval in outline, divided into seed coat and cotyledons; seed coat is covered with dark brownish to black, hyper pigmented, unevenly deposited, wavy, thick cuticle; seed coat cells are thick walled, rectangular, compactly packed, overlapping, 4 to 7 layered, followed by single layered parenchymatous epidermis of cotyledon; cotyledon cells are thick walled, multi layered, transparent, polygonal, polyhedral, varies in diameter, few cells with densely deposited oil globules.

Powder : Fine, black powder with grey particles; smooth, oily textured, characteristic smell, astringent taste; under microscope shows thick walled, polygonal, transparent cotyledon cells, averages about 270 micron in diameter, few cells with dense oil globules; thick walled, brownish coloured seed coat cells, size about 144 to 360 micron in length and 90 micron in breadth. No effervescence, no tannin, volatile oil present.

CHEMICAL CONSTITUENTS:

Terpenoids, azadirachtin, fixed oils, fatty acids, amino acids.

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 extractive	:	Not less than 20 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 8 % , Appendix 2.2.7
Fixed oil	:	Not less than 16 % , Appendix 2.2.8

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether : Diethyl ether : Acetic acid (80 : 20 : 1)	On spraying plate with 10% aquous H_2SO_4 and heating it for 30 minutes at 110^0 C	7	0.26 0.34 0.39 0.69 0.86 0.92 0.98

TEMPERAMENT : Hot Dry

ACTION : Jali, Mukharrish, Moharrik

THERAPEUTIC USE : Daus-Salab, Kalaf, Behaq, Zof-e-Bah, Zof-e-Asab

DOSE : 2 g

IMPORTANT FORMULATIONS : Habbe-e-Khabsul Hadid, Laboob-e-Sagheer, Laboob-e-Kabir

BEHMAN SAFED
(Root)

The drug Behman safed consists of dried roots of *Centaurea behen* L. (Asteraceae), an annual hardy herb; roots are imported from Iran to India.

OTHER NAMES :

English : Behen
Urdu : Behman Safed

PART USED : Root

DESCRIPTION:

Macroscopic: Cut pieces of root pale yellowish brown, cylindrical; 1 to 2 cm in thickness and 3 to 7 cm in length; hard, longitudinal wrinkles present; lateral roots or root scars absent; fracture, short and splintery; no distinct odour or taste.

Microscopic: Root circular in outline; cork composed of 5 to 15 layers of thin walled, tangentially elongated cells; followed by thin walled, rectangular to polygonal shaped parenchymatous cortex; central core of root consists of xylem with a few wide vessels and thick walled lignified fibres; vascular system consists of radial narrow arms of vascular elements extending towards periphery, consisting of tangential clusters of wide, thick walled vessels, thick walled lignified fibres and parenchyma cells; phloem a patch cupping the ex periphery, consisting of tangential clusters of wide, thick walled vessels, thick walled lignified fibres and parenchyma cells; phloem a patch cupping the xylem tissue; radial bands of cubical shaped parenchymatous and medullary ray present.

Powder : Light yellow; vessel showing scalariform thickening; length varying from 108 μ to 162 μ and breadth from 32 μ to 54 μ; fibres thick walled, narrow lumen; length varying from 338 μ to 648 μ and breadth from 7 μ to 29 μ.

CHEMICAL CONSTITUENTS : Taraxasterol, myristic ester and alkaloid-behamine.

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 extractive	:	Not less than 2 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 45 % , Appendix 2.2.7

TLC behaviour of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluenen : Ethyl Acetate (5 : 1.5)	Dipped in Vanillin Sulphuric acid reagent and heated in air oven at 105^0 for 10 minutes	4	0.29 0.47 0.67 0.90

TEMPERAMENT : Hot 2^o. Dry 2^o

ACTION : Muqawwi-e-Qalb, Mufarreh, Mubahhi, Mughalliz.

THERAPEUTIC USES : Khafqan, Zof-e-Qalb, Zof-e-Bah

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Habb-e-Jadwar, Majoon Chobchini, Khamira Gaozaban, Luboob-e-Kabeer.

BEHMAN SURKH
(Root)

The drug Behman Surkh consists of dried roots of *Salvia haematodes* Linn. (Lamiaceae), shrub, distributed in the Mediterranean region; roots are imported into India.

OTHER NAMES :

Arabic	:	Behen
English	:	Blood veined sage
Hindi	:	Behamana
Urdu	:	Behman Surkh

PART USED : Root

DESCRIPTION:

Macroscopic: Cut pieces of roots, 2 to 3 cm in diameter and 0.5 to 5 cm in length; light to reddish brown, hard, shrunk, rough with transverse fissures; lateral roots or root scars absent; cut surface exhibits concentric rings and radial lines from centre; no characteristic odor or taste.

Microscopic: Transverse section roughly circular in outline showing remnants of peeled dry tissues towards periphery; cortex present with outer layers collapsed and inner cells rectangular to isodiametric, several showing druses and brown coloured contents; cambium present, vascular system consists of a central core of xylem with about 17 or 20 radially extending narrow arms of tissues, with patches of xylem alternating with parenchyma and capped by a patch of phloem; broad wedges of medullary rays dilating slightly towards periphery present.

Powder : Brown, shows straight walled isodiametric to rectangular parenchyma cells; reticulate and spiral vessel elements of length 85 μ to 268 μ and width 35 μ to 67 μ with transverse or oblique simple pores, occasionally tailed; druses of calcium oxalate crystals varying from 31 μ to 64 μ in diameter.

CHEMICAL CONSTITUENTS :

Fatty acids, tannins, alkaloids and terpenes

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 extractive	:	Not less than 3 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 45 % , Appendix 2.2.7

TLC behaviour of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (5 : 1.5)	Dipped in Vanillin Sulphuric acid reagent and heated in air oven at 105^0 for 10 minutes	2	0.42 0.51

TEMPERAMENT : Hot 3^o, Dry 3^o

ACTION : Muqawwi-e-Qalb. Mufarreh, Mubahhi, Mughalliz.

THERAPEUTIC USE : Khafqan, Zof-e-Qalb, Zof-e-Bah

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Habb-e-Jadwar, Majoon Chobchini,Dawaul Misk Motadil, Khamira Gaozaban Luboob-e- Kabeer.

FUNDUQ
(Fruit)

The drug Funduq consists of the fruit of *Corylus avellana* Linn. (Betulaceae), a shrub about 15 feet high, found and cultivated in the Middle East and Mediterranean religion and mostly imported into India.

OTHER NAMES :

Arabic	:	Jalooz
English	:	Hazel nut, European Hazel
Hindi	:	Findak, Bindak, Bhutttia Badam
Kashmiri	:	Thangi, Thankoli, Warawi, Wiri, Wuriya
Persian	:	Bandaq
Punjabi	:	Urni, Thangi
Urdu	:	Funduq

PART USED : Fruit

DESCRIPTION:

Macroscopic: Fruit is a nut, hemi-ellipsoid, with somewhat flat base, upto 2 cm in size, almond coloured, carrying a paler scar left by its attachment to bracteoles on the flat base; shell finely and longitudinally striated and at a few places characteristic elongated depressions are also seen; broken nut shows contains one seed, globose to pyramidal with rounded edges; seed coat orange-brown having striations; kernel is cream coloured and very mush oily; taste sweet and pleasant, no specific odour.

Microscopic: The cross section of the nut shows a cuticle, followed by a single layer of epicarp composed of oval to rectangular and thick walled parenchymatous cells. Trichomes simple, unicellular, thin walled, non-glandular and varying in size present; mesocarp is composed of several layers of sclereids, the first few layers have smaller cells and middle portion consists of bigger cells while the lower portion generally has smaller cells; the sclereids are hexagonal to polygonal or oval, very thick lamellate walls with pits canals radiating through then, ranging from 9.0 to 76.0 μ in length and 6.0 to 36.0 μ in width. The vascular bundles prominently show the presence of vessels with associated parenchyma; innermost part of the mesocarp mainly consists of collapsed cells. Testa of the seed shows an outermost cuticle and 2 or 3 layers of parenchymatous cells which are compact, rectangular and thin walled, some containing oil; vascular strands surrounded by a layer of almost disorganised cells.

Transectional view of the cotyledon shows a single layered epidermis composed of oval to rectangular and slightly thick walled parenchymatous cells; rest of cotyledon consists of compact, thin walled, hexagonal to polygonal parenchyma and mostly filled with oil droplets. Small rosette crystals of calcium oxalate also present in these cells.

Powder: Powder of the crude drug is brown, coarse, free flowing; taste is slightly sweet and pleasant, no specific odour, cells from epicarp, testa, cotyledon present, sclereids and oil containing parenchyma seen; sclereids are abundant, hexagonal to polygonal, vary in size, highly thickened with broad lumen and conspicuous raidal striations. Vessel in less number, short, thick walled having spiral or scalariform thickening.

CHEMICAL CONSTITUENTS :

Myristic acid, Palmitic acid, stearic acid oleic acid, Linoleic acid

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 2 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 6 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 11 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Acetate : Acetic Acid (5:4:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	5	0.33 0.62 0.76 0.83 0.88

TEMPERAMENT : Hot Dry 2^0

ACTION : Muqawwi-eDimagh, Muqawwi-e-Bah, Muqawwi-e-Ama, Munaffis-e-Balgham

THERAPEUTIC USE : Zof-e- Dimagh, Zof-e-Kabid Suzak, Khafqan, Zeequn Nafas

DOSE : 5-10 g

IMPORTANT FORMULATION : Majoon Arad Khurma, Laboob-Sagheer, Laboob-e-Kabeer, Halwa-e-Gazar, Majoon-Falaksair, Raughan-e-Laboob-e-Saba

GANDANA
(Leaf)

The drug Gandana consists of dried leaves of Asphodelus tenuifolius Cav. (Liliaceae), a small stem less annual non bulbiferous herb with fibrous roots, about 30 to 50 cm. high, growing commonly as a winter weed.

OTHER NAMES :

Arabic	:	Kurras
Persian	:	Gandana
English	:	Shallot
Gujarathi	:	Dungro
Hindi	:	Bokat, Piyajh
Punjabi	:	Piazi, Bokat
Urdu	:	Jangli Piaz

PART USED : Leaves

DESCRIPTION:

Macroscopic: Leaves radical, linear, cylindrical, 15 to 30 cm long and 2 to 3 mm wide, fistulous, acute apex, sheathing at the base, finely puberlous, taste and odour not specific.

Microscopic: Transverse section of leaf circular in outline, centric, epidermis uniseriate, with strongly cuticularized outer walls, stomata arranged in rows, parallel to the long axis of leaf, mesophyll differentiated into an outer palisade and inner spongy cells; a few cells show rosettes of calcium oxalate crystals; the hollow central part bordered by inner epidermal cells; vascular bundles small collateral, closed, arranged in a circle in the lower part of mesophyll, having phloem on outer side and xylem towards centre; each bundle surrounded by a parenchymatous bundle sheath; Palisade ratio 4 to 8, stomatal number 20 to 30, stomatal Index 28 to 33.

Powder: Powder light brown without any specific odour or taste; shows fragments of epidermis with stomata, parenchyma and elongated palisade cells, calcium oxalate crystals and tracheids having spiral thickening.

CHEMICAL CONSTITUENTS :

Lupeol, Chrysophanol, aloe-emodin.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Note more than 2 % , Appendix 2.2.2
Total ash	:	Note more than 20 % , Appendix 2.2.3
Acid insoluble ash	:	Note more than 6 % , Appendix 2.2.4
Alcohol soluble extractive	:	Note less than 5 % , Appendix 2.2.6

Water soluble extractive : Note less than 25 % , 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	On spraying plate with 2% Ethanolic conc. H_2SO_4 and heated for 5 minutes at 105^0 C	6	0.11 0.20 0.33 0.40 0.66 0.76

TEMPERAMENT : Hot 2°, Dry 2°

ACTIONS : Mufatteh-e-Sudad, Habis.

THERAPEUTIC USE : Ishal

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Jawarish Fanjnosh, Habbe – Jalinoos, Habbe-Muqil

GHAFIS
(Flower)

The drug Ghafis consists of dried flowers of *Gentiana olivieri* Griseb. Syn. *G. dahurica* Fisch. (Gentianaceae), a stout herb bearing opposite leaves and flowers in terminal clusters, found in Western Himalayas.

OTHER NAMES:

Arabic	:	Hasheesha Shulghafiz
English	:	Persian Gentian
Hindi	:	Ghafis
Urdu	:	Ghafis

PART USED : Flowers

DESCRIPTION:

Macroscopic : Flowers complete, bisexual, actinomorphic, dull brown coloured, pedicellate; pedicel cylindrical, 3.5 to 6 cm long; calyx 5-partite, lobes equal; corolla funnel shaped, about 2 cm long, erect, and 5-partite, often with folds between lobes; stamens 5, attached at the middle of the lobes, alternate to corolla segment, included, filament linear, stigma bilobed, style short, ovary superior, one celled, ovule many, odour not specific, taste bitter.

Microscopic: Transverse section of pedicel circular in outline, epidermis single layer, parenchymatous cells of cortex contain abundant calcium oxalate druses and prismatic crystals, xylem forms a complete ring and consists of long thick fibres, about 350 to 450 μ long, phloem present; inner to xylem ring a few parenchymatous cells present enclosing a hollow centre; petals show simple parenchymatous cells bounded by epidermis on either sides having slightly wavy anticlinal walls; the anther wall consists of fibrous endothecial cells; spherical, pollen grains of 14 to 16μ, with three pores, exine smooth;

Powder: Powder dull brown coloured having a bitter taste; consists of abundant smooth pollen grains, fragments of endothecial cells of anther, brownish fragments of petals showing epidermal cells with wavy walls, tracheids with spiral and scalariform thickenings; druses and prismatic crystals of calcium oxalate also found;

CHEMICAL CONSTITUENTS:

Oleanolic acid, ursolic acid and alkaloids

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Note more than 2 % , Appendix 2.2.2
Total ash	:	Note more than 5 % , Appendix 2.2.3
Acid insoluble ash	:	Note more than 2 % , Appendix 2.2.4
Alcohol soluble extractive	:	Note less than 4 % , Appendix 2.2.6

Water soluble extractive : Note 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
Toluene : Ethyl Acetate (9:1)	On spraying plate with 2% Ethanolic conc. H_2SO_4 and heated for 5 minutes at 105^0 C	12	0.12 0.20 0.25 0.32 0.45 0.50 0.55 0.65 0.68 0.81 0.83 0.95

TEMPERAMENT : Hot 1°, Dry 2°

ACTION : Moaddil, Moarriq, Daf-e-Humma, Mohallil-e-Waram, Jali

THERAPEUTIC USE : Humma, Waram-e-Kabid, Istisqa, Waram-e- Tehal

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Majoon Dabeedul-ward, Sharbat-e-Deenar

GUL-E-SURKH
(Flower)

The drug Gul-e-Surkh consists of dried flowers, intact and separated of *Rosa damascena* Mill. (Rosaceae) an erect prickly shrub upto 2 meter high, native of the middle east but cultivated throughout India.

OTHER NAMES :

Arabic	:	Ward-e-Ahmar
Persian	:	Gul-e-Surkh
Bengali	:	Golap phul
English	:	Damascus Rose, Otto Rose
Gujarati	:	Gulal-akali
Hindi	:	Gulab
Malayalam	:	Penimirpusham
Marathi	:	Gulal-akali
Sanskrit	:	Atimajula, Lakshapushpa, Mahakumari, Shatadala
Tamil	:	Irosa
Telugu	:	Gulabi, Panniur, Roja
Urdu	:	Gulab

PART USED : Flowers

DESCRIPTION:

Macroscopic :

Drug consists of small intact flowers including prickly pedicel and separated floral parts; sepats-5, lanceolate, apex-attennuate, entire, 1.5 to 2.0 cm long and 0.4 to 0.7 cm broad, reddish brown; petals many; stamens many inserted on the disc pistil apocarpus, carpels free but wholly enclosed within calyx tube, covered with hair; ovary inferior, odour pleasant, taste astringent.

Microscopic :

Pedicel: Cuticle present; shows single layer epidermis of radially elongated unequal thin walled parenchymatous cells containing yellowish-brown contents, hypodermal region characterized by the presence of collenchymatous cells, oval to circular, 3-4 layers in depth and possessing yellowish-brown contents; cortex composed of 8-10 layers of slightly thick walled parenchymatous cells, oval to circular, with intercellular spaces, a few cells containing rosette crystals of calcium oxalate; vascular bundle numerous, simple, collateral and radially arranged with a patch of sclerenchymatous cells capping it, medullary rays uni or biseriate, ray cells oval to radially elongated, thin walled parenchymatous. Pith well developed and composed of oval to circular thin walled parenchymatous cells with intercellular spaces.

Sepal: Transectional view of sepal shows a cuticle, epidermal cells carrying long, simple, unicellular and non-glandular trichomes; mesophyll undifferentiated and mostly composed of

several layers of slightly thick walled, polygonal to oval parenchymatous cells, some containing rosette crystal of calcium oxalate; vascular bundle found here and there in the mesophyll. Stomata present on lower epidermis, anamocytic.

Petal: In surface view, the epidermal cells are rectangular or somewhat elongated and thick walled; walls of the cell are reported to be zigzag or wavy that may be due to the dried petals used for study. Sectional view of the petal shows upper epidermal cells rectangular to squarish or radially elongated, thick walled with yellowish-brown contents; cuticle present mesophyll characterized by the compact, polygonal to, thick walled parenchymatous cells, their walls wavy showing presence of oral calcium oxalate crystals oval; vascular bundles are found at unspecific intervals in the mesophyll, much reduced, delicate vein generally consisting of a few narrow vessels with annular thickenings.

Stamen: The epidermis is single layered, thick walled and parenchymatous with cuticle; epidermal cells near the dehiscence point are small, oval to spherical but becomes gradually wider and radially elongated towards the connective, walls smooth endothecium a single layer near the dehiscence point but becomes gradually wider and radially elongated towards the connective; cells rectangular to squarish, thin walled parenchymatous and each cell contains a band of lignified thickening; pollen grains oval with smooth exine, 30-36 μ in length and 22-25 μ in width.

Hypanthium: Epidermis single layer with rectangular to squarish thin walled parenchymatous cells, cuticle present; multilayered ground tissue of thin walled, oval to polygonal, small to large parenchymatous cells, first 2-3 layers having yellowish brown contents; starch grains present; several vascular strands are found scattered in the lower part of the region.

Powder: Powder Pinkish – brown, free flowing, taste astringent, and odour pleasant; reveals the presence of fragments of floral epidermis; the cells of petal are rectangular to squarish or radially elongated with thick walls and cuticle present on outer side; hypodermis, cortical parenchyma cells containing rosette crystals of calcium oxalate or starch grains, a few thick walled parenchyma, epidermal layer with stomata, endothecium, oval pollen grains, measuring upto 36 μ in length and upto 25 μ in width, starch grains, trichomes, vessels, tracheids with pitted walls and large lumen, fibres with narrow lumen, long and lignified and xylem parenchyma.

CHEMICAL CONSTITUENTS :

Cyanidin-3.5 Digluoside B-Phenethyl-B-D glucopyranoside Citronellol, nerol, geraniol and phenyl ethanol. 2-Hydroxyursolic acid, B-amyrin and methyl-ursolate.

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 extractive	:	Not less than 20 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 33 % , Appendix 2.2.7

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

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether : Diehtyl Ether (9:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	4	0.17 0.50 0.58 0.64

TEMPERAMENT : Cold 1°, Dry 2°

ACTION : Muqawwi-e-Aza-e-Raeesa, Muqawwi-e-Badan, Muqawwi Meda, Muqawwi-e-Rahem, Oabiz, Mushil, Musakkin-e-Alam, Daf-e-Taffun

THERAPEUTIC USE : Zof-e-Aza-e-Raeesa, Zofe-e-Badan, Nafs-ud-Dam, Khafqan, Ashob Chashm, Waj-ul-uzn, Qulah

DOSE : 5-7 Masha (5-7 g)

IMPORTANT FORMULATIONS : Khameera Abresham Arshad wala, Majoon Dabeed-ul- Ward, Majoon Muqawwi-e-Rahem, Majoon Musaffi-e-Dam, Majoon-e-Ushba, Zuroor-e-Qula, Sufoof-e- Mushil, Sufoof Mulaiyin, Sufoof Chobchini, Araq Gulab, Raughan-e-Gul, Jawarish Tamar Hindi, Jawarish Zarishk, Itrifal Ustukhuddus. Itrifal Shahtara.

HUMMAZ
(Seed)

The drug Hummaz consists of dry seeds of *Rumex vesicarius* Linn. (Polygonaceae); a small, 15 to 30 cm high, annual herb found in Western Punjab and cultivated in Tripura, West Bengal and Bihar for its leaves that are used as vegetable.

OTHER NAMES :

Arabic	:	Hummaz
Persian	:	Turshah
Assamese	:	Sukhasag
Bengali	:	Chuk, Chukpal
Hindi	:	Ambari, Chuka
Kannad	:	Jussi soppu
Marathi	:	Chuka
Punjabi	:	Kattamitha, Khatbiri
Sanskrit	:	Amla, Bhedana, Churka.
Tamil	:	Shakkan Kirai
Telugu	:	Chukkakura
Urdu	:	Chuka-Ka-Sag

PART USED : Seeds

DESCRIPTION:

Macroscopic : Seeds triangular small, about 1.5 mm long and 1 mm wide, dark brown, shining, albuminous, embryo eccentric, nearly straight, cotyledons linear, taste acrid, odour not specific.

Microscopic : Cross section of seed triangular, testa sclerified, cells elongated radially like palisade, thick walled cells, lumen narrow; tegmen almost crushed, endosperm starchy, embryo parenchymatous with cells containing crystals of calcium oxalate, oil globules and aleurone grains.

Powder : Deep brown, coarse, consisting of small fragments of testa with sclerified epidermal cells showing narrow lumen, starch grains and a few small cotyledonary parenchymatous cells; aleurone grains and prismatic crystals present in endosperm cells.

CHEMICAL CONSTITUENT :

Cystine, glutamic acid, proline, phenylalanine and histidine.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Note more than 2 % , Appendix 2.2.2
Total ash	:	Note more than 3 % , Appendix 2.2.3
Acid insoluble ash	:	Note more than 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Note less than 1 % , Appendix 2.2.6

Water soluble extractive : Note 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
Toluene : Ethyl Acetate (9:1)	On spraying plate with 2% Ethanolic conc. H_2SO_4 and heated for 5 minutes at 105^0 C	5	0.14 0.28 0.42 0.50 0.57

TEMPERAMENT : Cold, Dry

ACTIONS : Habis-e-Dam, Qabiz, Musakkin

THERAPEUTIC USE : Ishal,Qurooh-e-Ama,Ghasayan,Qai,Atash-e- Mufrit,Taqteer-e-Baul..

DOSE : 3-5 g.

IMPORTANT FORMULATIONS : Majoon-e-Masikul-Baul, Qurs-e-Kahruba

ISPAST
(Seed)

The drug Ispast consists of dry seeds of *Trifolium alexandricum* Linn. (Fabaceae), a pubescent, annual herb, growing upto one meter high, having trifoliate leaves and yellowish flowers, chiefly cultivated as a fodder crop. It is an introduced plant from the Middle East.

OTHER NAMES :

English	:	Egyptian clover
Hindi	:	Berseem
Urdu	:	Ispast, Barseem

PART USED : Seeds

DESCRIPTION:

Macroscopic : Seeds small, about 2 mm long, 1 mm wide, oval, yellowish, exalbuminous, hilum elongated, embryo consists of two white fleshy cotyledons and a long curved radicle, taste slightly sweet, odour proteinaceous.

Microscopic : Testa consists of radially elongated compactly arranged palisade cells, about 30 to 40µ long, 15 to 18µ wide, and a hypodermis made up of thick walled short beaker cells; rest of the testa consists of flattened parenchymatous cells; cotyledons parenchymatous with a single epidermal layer, 2 to 3 layers of palisade like cells on the flat surface, and rest parenchymatous containing aleurone grains of about 8 to 12µ.

Powder : Seed powder creamy yellow, fine with slightly sweet taste; shows abundant aleurone grains, and elongated palisade cells, a few beaker shaped cells also present; palisade cells are compactly arranged with lignified wall and narrow lumen; testa in surface view shows irregularly thick walled closely packed, elongated cells, with a very narrow lumen and canals extending into the walls;

CHEMICAL CONSTITUENTS :

Biochanin A, genistein, kaempferol, caproic, lauric, linolenic, oleic: and palmitoleic acids.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Note more than 2 % , Appendix 2.2.2
Total ash	:	Note more than 3 % , Appendix 2.2.3
Acid insoluble ash	:	Note more than 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Note less than 3 % , Appendix 2.2.6
Water soluble extractive	:	Note 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
Toluene : Ethyl Acetate (9:1)	On spraying plate with 2% Ethanolic conc. H_2SO_4 and heated for 5 minutes at 105^0 C	9	0.16 0.23 0.29 0.43 0.56 0.61 0.72 0.75 0.82

TEMPERAMENT : Cold 2^0, Moist 2^0

Action : Muqawwi-e-Bahm, Mudirr-e-Baul

Therapeutic use : Zof-e-Bah, Ehtebas-e-Baul. Ehtebas-e-Tams, Taqteer-e-Baul, Hurqat-e-Baul.

Doses : 3-5 g.

Important formulations : Jawarish Zarooni Sada, Luboob-e-Sagheer

KANAKANA
(Stem bark)

Kanakana consists of dried bark of *Cinchona officinalis* Linn. (Rubiaceae), a tree attaining a height of 35 m or even more, cultivated in India, in the Western Ghats, and lower Himalayas, in Assam and West Bengal.

OTHER NAMES :

English : Crown bark, Pale bark
Urdu : Kanakana

PART USED : Stem bark

DESCRIPTION:

Macroscopic : Stem bark, curved pieces, and thickness up to 1.5 mm; outer surface dull brown and bearing lichens, rough with numerous small transverse cracks with recurved edges; inner surface pale in colour; fracture short in the external layers and fibrous in the inner layers; odour slight and characteristic, taste intensely bitter and astringent.

Microscopic : The transverse section of the stem bark shows an outer layer of cork, cortex and phloem along with numerous medullary rays and large phloem fibres. The cork consists of numerous layers of thin-walled, flat cells, reddish brown in colour. The cells of thin walled parenchyma of the cortex contain starch grains about 5 - 10 µm in diameter. Some cells of the cortex are filled with microcrystals of calcium oxalate; in the inner layers of cortex large secretion canals which are oval in transverse section, are present singly. In phloem large, fusiform, lignified phloem fibres with concentric striations and conspicuous tubular or funnel-shaped pits, are present. The fibres are about 600 - 790 - 1030 µm long, mostly solitary, occasionally in short radial rows of 2 to 4 fibres. The phloem parenchyma consists of cells with thin dark reddish-brown walls. The medullary rays are from 1 to 3 seriate.

Powder: Yellowish brown, parenchymatous cells containing starch grains and occasionally filled with microcrystals of calcium oxalate; large, fusiform, lignified phloem fibres with concentric striations and conspicuous tubular or funnel-shaped pits.

CHEMICAL CONSTITUENTS:

Stem bark contains about 30 alkaloids of which quinine, cinchonidine, cinchonine and quinidine, hydroquinine, hydrocinchonidine, quiniamine, cinchotine and homocinchonidine are important; a tannin cinchotannic acid; bitter amorphous glycoside quinovin; crystalline acid, quinic or kinic acid; starch and calcium oxalate (Wallis, 1985).

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 2 % , Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0 % , Appendix 2.2.4
Water soluble ash	:	Not more than 1 % , Appendix 2.2.5

Alcohol soluble extractive	:	Not less than 34 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 26 % , Appendix 2.2.7
Moisture content	:	Not more than 8.22% , Appendix 2.2.9
Total phenolics	:	Not less than 12 % , Appendix 2.2.12

Analysis of Alkaloids :

The method from European Pharmacopoeia (1997) is adopted with certain minor modifications. Weigh accurately 1gm of *Cinchona officinalis* stem bark powder in to a 250 ml conical flask and to it add 10 ml water and 7 ml of dilute HCl (10%). Heat the mixture for 30 minutes in a water bath and then allow it cool. To the above mixture add 25 ml of chloroform, 50 ml of ether and then 5 ml of 25% ammonia solution. Shake the mixture for 30 minutes. Add 3gm of CMC (Carboxy Methyl Cellulose) and shake until the mixture becomes clear. Filter through a plug of absorbent cotton. Rinse the flask and the cotton with five quantities each of 20 ml of a mixture of chloroform and ether (1 : 2). Combine the filtrate and washings, evaporate to dryness and dissolve the residue in 10 ml ethanol. Pipette out 5 ml of the solution and evaporate it to dryness. Dissolve the residue in 0.1M hydrochloric acid and dilute to 1000 ml with the same acid. Prepare two reference solutions separately, of quinine and cinchonine in 0.1M hydrochloric acid, of the concentration of 30µl/ml. Measure the absorbances of the three solutions (*viz.*, sample solution and reference solutions of quinine and cinchonine), at 316nm and 348nm.

Calculate the percentage content of alkaloids from the following equations :

$$x = \frac{[A_{316} \times A_{348c}] - [A_{316c} \times A_{348}]}{[A_{316q} \times A_{348c}] - [A_{316c} \times A_{348q}]} \times \frac{100}{m} \times \frac{2}{1000}$$

$$y = \frac{[A_{316} \times A_{348q}] - [A_{316q} \times A_{348}]}{[A_{316c} \times A_{348q}] - [A_{316q} \times A_{348c}]} \times \frac{100}{m} \times \frac{2}{1000}$$

m = mass of the drug used in grams

x = percentage content of quinine-type alkaloids

y = percentage content of cinchonine-type alkaloids

A_{316} = absorbance of the test solution at 316 nm

A_{348} = absorbance of the test solution at 348 nm

A_{316c} = absorbance of the reference solution containing cinchonine at 316 nm, corrected to a concentration of 1 mg per 1000 ml

A_{316q} = absorbance of the reference solution containing quinine at 316 nm, corrected to a concentration of 1mg per 1000 ml

A_{348c} = absorbance of the reference solution containing cinchonine at 348 nm, corrected to a concentration of 1mg per 1000 ml

A_{348q} = absorbance of the reference solution containing quinine at 348 nm, corrected to a concentration of 1mg per 1000 ml

Calculate the content of total alkaloids, (*x and y*) and the relative content of quinine-type alkaloids from the following expression:

$$\frac{100x}{x+y}$$

Alkaloids of *Cinchona officinalis* stem bark

Total alkaloids (% mean ± SD)	: 7.335 ± 0.191
Quinine type alkaloids (% mean ± SD)	: 5.222 ± 0.378
Cinchoninie type alkaloids (% mean ± SD)	: 2.113 ± 0.151

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform : Diethylamine (9.6 : 0.6)	On spraying with 10% tartaric acid in water and observing the plate at UV_{366}.	9	0.12 0.22 0.27 0.37 0.47 0.55 0.72 0.8 0.9

ACTION : Muqawwi-e-Meda, Mufarreh, Muharri-e-Isteha, Daf-e-Humma, Muqawwi-e-Bah, Daf-e-Taffun

THERAPEUTIC USE : Zof-e-Meda, Zof-e-Hazm, Huma, Pechis, Warm-e-tehal, Humma-e-Ejamia, Surat-e-Inzal

DOSE : 1-5 grain

IMPORTANT FORMULATIONS : Habb-e-Bukhar

KEORA
(Spadix)

The drug Keora consists of ripe, mature and dry spadices of male flowers of *Pandanus odoratissimus* Linn. (Pandanaceae) a densely branched, dioecious shrub with still roots found along the coasts of Indian and Andamans.

OTHER NAMES :

Arabic	:	Kazi, Kadar
Persian	:	Kadi
Bengali	:	Keya, Kedki-Keya, Keori
English	:	Screw pine
Gujarathi	:	Kewoda
Hindi	:	Kevra
Kannad	:	Tale Mara, Kyad-agigida
Malyalam	:	Kaida, Thala
Marathi	:	Keora
Punjabi	:	Kethak
Tamil	:	Tazhai
Telugu	:	Mugali, Ketaki, Gajangi
Urdu	:	Keora

PART USED : Spadix (flower)

DESCRIPTION :

Macroscopic : Spadices with numerous sub-sessile cylindrical spikes of male flowers, length 5 to 10 cm and thickness 2.5 to 3 cm enclosed in a long, ivory coioured, fragrant caudate acuminate spathes, with longitudinal striations, 25 to 30 cm in length, 2 to 5 cm in breadth, staminal column 6 to 13 mm long, anther long than the slender filament. They are very fragrant when fresh and less fragrant when dry.

Microscopic:

Spathe : Outline of Transverse section of spathe resembles of closely set, beaded chain, with alternating ridges and furrows; epidermis uniseriate, cells rectangular to squarish, outer walls showing a thin cuticle. Following epidermis in the ridges formed by veins, 4 to 5 layers of collenchymatous cells, polygonal in shape present with xylem at the central region; large tabloid crystals of calcium oxalate sporadically present throughout the collenchymatous tissue; epidermal of cell in surface view rectangular: and linearly arranged; stomata paracytic. Most of the epidermal and cells of spathe contain oil globules.

Pedicel: Transverse section somewhat circular in outline; edidermis cuticularised, cells rectangular to squarish, followed by a multilayered cortex made up of the hexagonal to polygonal and compactly arranged parenchymatous cells.

Anther: Transverse section of bithecous anther shows two sporangia: epidermis single layered, cells of edothecium showing lignification on the radial and inner tangential wills; cells of ground tissue are parenchymatous thin walled and polygonal and contain small oil globules; pollen grains thin walled, spherical with smooth exine; average about 9μ;

Powder: Brown in colour with characteristic aromatic odour; reveals the presence of fragments of epidermal tissue from spathe, endothecial cells of anther and pollen grains.

CHEMICAL CONSTITUENTS:

Methyl ether of β-phenyl ethyl alcohol (54-80%) Dipentine, d-linalool, phenyl ethylacetate, citral, phenyl ethyl alcohol, fatty acids and stearoptene

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 extractive	:	Not less than 12 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 25 % , Appendix 2.2.7

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

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether : Diehtyl Ether (9:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	6	0.32 0.50 0.58 0.70 0.76 0.85

TEMPERAMENT	:	Hot, Dry 2°
ACTION	:	Muqawwi-e-Aza-e-Raeesa, Muqawwi-e-Meda, Muqawwi-e-Basar, Musakkin-e-Aam, Musaffi-ud-Dam
THERAPEUTIC USE	:	Khafqan, Juzam, Waj-ul-Badan, Niqras, Zof-e-Qalb, Zof-e-Dimagh, Zof-e-abid, Judri, Hasba, Waj-ul-Qutu, Waj-ul-uzn
DOSE	:	Arq 30-50 ml, Sharbal 20-30 ml
IMPORTANT FORMULATIONS :		Sharbat-e-keora, Arq-e-keora

KHIRNI
(Stem bark)

Khirni consists of dried stem bark of *Mimusops kauki* (Linn.) Dub. Syn. *Manilkara kauki*, (Sapotaceae), a large spreading tree, cultivated in orchards in some parts of Peninsular India.

OTHER NAMES:

Bengali	:	Chirni, Rajani
Gujarati	:	Rayan, Khrni
Hindi	:	Khirni, Khinni
Marathi	:	Kauki
Oriya	:	Talvrynta
Sanskrit	:	Vasantaduti, Talavrinta
Tamil	:	Palai
Urdu	:	Khirni

PART USED : Stem bark

DESCRIPTION:

Macroscopic : Bark thin, occurring in quills, dark brown on the outer side and light brown on the inner side; 0.5 mm thick fracture short, taste slightly bitter, astringent, odour not specific.

Microscopic: Transverse section shows 20 - 25 layers of rectangular and tangentially elongated cork cells, 2 or 3 layers of phellogen; cortex is with thin walled parenchyma, inner layers of which contain large laticiferous cells. Secondary phloem consists of stratified layers of sclerenchyma alternating with phloem parenchyma filled with brownish contents and tannin. Parenchymatous cells containing solitary crystals of calcium oxalate prisms in tiers, one in each cell, concentrated around phloem fibres are seen in a radial section; occasional single cells with solitary prism of calcium oxalate crystal are also present in phloem. Phloem fibres abundant, in groups of 15 to 20, long, thick walled, pitted, ends pointed. They are 650 - 862 - 1008 µm long and 4 - 20 - 22 µm wide at the middle, and occasionally become elongated, or distorted sclereids; medullary rays are 2 or 3 seriate, zigzagging, and parenchymatous; laticiferous cells and unbranched laticiferous tubes containing latex and cells containing tannin are present in phloem.

Powder: Brown, non-aromatic, astringent; shows fragments of cork cells, fibres, stone cells of different sizes and shapes, rows of cells containing solitary prisms of calcium oxalate crystals associated with phloem fibres, laticiferous cells and unbranched laticiferous tubes.

CHEMICAL CONSTITUENTS:

Tannins, viscid gummy latex.

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 1 % , Appendix 2.2.4
Water soluble ash	:	Not more than 2 % , Appendix 2.2.5
Alcohol soluble extractive	:	Not less than 11 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 16 % , Appendix 2.2.7
Total phenolics	:	Not less than 5.6 % , Appendix 2.2.12

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Ethyl formate : Formic acid: Methanol (12:3.6:1.5)	On spraying 5% alcoholic ferric chloride	4	0.35 0.52 0.66 0.70

TEMPERAMENT	:	Hot Moist
ACTION	:	Mufarreh, Muqawwi-e-Qalb, Muqawwi-e-Bah, jali, Mugalliz-e-Mani
THERAPEUTIC USE	:	Jiryan, Zof-e-Qalb, Atash-e-Mufrit, zof-e-Bah.
DOSE	:	5-7 g

KHIYARZAH
(Seed)

The drug Khiyarzah consists of dried seeds of *Cucumis melo* Var. utilissimus Duthie & Fuller (Cucurbitaceae), a trailing herb found throughout hotter parts of the country, cultivated for its fruits.

OTHER NAMES :

Arabic	:	Kakri
Bengali	:	Kakur
English	:	Long melon
Gujarathi	:	Kankadi
Hindi	:	Kakri
Kannad	:	Kukri
Marathi	:	Kakadi
Sanskrit	:	Bahukanda
Tamil	:	Kakkarikkay
Urdu	:	Kakri

PART USED : Seeds

DESCRIPTION :

Macroscopic: Seeds exalbuminous, smooth, elongated but laterally flattened, about 7 to 10 mm long and 2 to 3 mm wide, tapering at one end, cream coloured; taste sweet but no specific odour.

Microscopic: Testa composed of thick walled radially elongated cells, upto 150 μ long, followed first by several layers of pitted stone cells thereafter by many layers of thin walled parenchyma; nucellus consists of just 2 or 3 layers of small cells; cotyledonary parenchymatous cells rich in aleurone grains and oil globules;

Powder: Powder creamy yellow coloured, sticky; taste sweet, odourless; consists of abundance of pitted stone cells, thin walled parenchyma cells, oil globules and aleurone grains, 5 to 10 μ; stone cells elongated with thick lignified walls and thick walled cells of testa;

CHEMICAL CONSTITUENTS:

Linoleic acid, amyrins, taraxerol, lupeol, dehydroporifer - astarol, avenasterol, clerosterol, isofucosterol, stigmasterol.

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 extractive(s)	:	Not less than 6 % , Appendix 2.2.6
Water soluble extractive(s)	:	Not less than 1 % , Appendix 2.2.7

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

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (9:1)	On spraying plate with 2% Ethanolic conc. H_2SO_4 and heated for 5 minutes at 105^0 C	3	0.14 0.26 0.33

TEMPERAMENT : Cold 2^0, Moist 2^0

ACTION : Mubarrid, Muddirr-e-Baul, Daf-e-Atash

THERAPEUTIC USE : Hurqat-e-Baul, Ehtebas-e-Tams, Atash Mufrit

DOSE : 5-10 g

IMPORTANT FORMULATIONS: Sharbat-e-Buzoori Motadil, Sharbat-e-Deenar

KHUBBAZI
(Fruit)

The drug Khubbazi consists of dried fruits of *Malva sylvestris* Linn.(Malvaceae) an erect, branched, nearly glabrous, woody biennial or perennial, 30-120 cm high, found throughout the plains of India.

OTHER NAMES:

Arabic	:	Khitmi, Khubazi
Persian	:	Khitmiikuchok, Khubazi, Nan akillgah, Nanikulagh Towdrie
Bengali	:	Khubazi cheese-flower, dock, high mellow, leaves-of-bread.
English	:	The comman mallow, mallow, marsh mallow, cheese cake,
Hindi	:	Gulkair, Khunzi, Vilayati Kangai
Kannad	:	Saunabindigegida
Kashmiri	:	Khalazi
Urdu	:	Khubbazi

PART USED : Fruits

DESCRIPTION:

Macroscopic: Fruit is a schizocarp 3.0 to 6.0 mm in diameter and 1.5 to 2.5 mm in thickness, stalk mostly 4.0 to 7.0 mm long, attached; fruit separable into 8 or 10 carpels with a depression on the top and each containing a single seed; seeds reniform to rounded, olive – brown to chocolate – brown, 1.0 to 1.8 mm across, enclosing a curved embroy, mucilagenous on chewing and slighly bitter.

Microscopic : In Transverse section fruit wall shows a pericarp consisting of an epidermis with tangentially elongated, large, rectangular, thick walled parenchymatous cells; cuticle present; trichomes abundant large, stellate with 3 to 8 branches; a few unbranched unicellular trichomes also present; stomata anomocytic; a few layers of large, rectangular to oval parenchymaotus cells present in the mesocarp; rosette crystals of calcium oxalate of 9.0 to 13.0 μ in diameter present in the lower most layer of mesocarp, followed by the inner epidermis; vascular strands consisting of xylem and pholem elements.

Mericarp: Transverse section shows cuticle; epidermis a single layer of slightly thick walled, rectangular or almost barrel shaped parenchymatous cells; mesocarp of several layer of large simple, thin walled, polygonal to oval and compact parenchymatous cells with straight walls; mucilagenous cavities present in this region; conical patches of smaller sclerenchymatous cells present adjacent to the innermost layer of mesocarp which is sclerenchymatous.

Seed: Testa shows a layer of rectangular to sqaure, slightly thick walled parenchymatous cells; a sub-epidermal palisade consisting of mostly a single layer, compact, radially elongated straight and thin walled containing a yellowish-brown substance; below this is another layer of simple, colourless, rectangular to polygonal, thin walled parenchymatous cells with yellowish brown contents which may become 2 to 3 layers at places; a cuticularised, single layer of thin walled, rectangular to square cells form the outer layer of the endosperm followed by a multiseriate zone of comparatively larger parenchymatous cells, slightly thick walled compact, polygonal to oval or rectangular, all the cells completely filled with small oval to round aleurone grains, 2.0 to 4.0 μ in diameter; cotyledon reveals a single layer of epidermis composed of slightly radially elongated, thin walled parenchymatous cells; cuticle present; two layers of radially elongated, thin walled, palisade cells present; below this region there are 3 or 4 layers of compact, polygonal, thin walled parenchymatous cells; the cells of lower epidermis are almost similar to those of upper epidermis; all cells of cotyledon are packed with small, oval to round aleurone grains.

Powder: Powder yellowish – brown, revealing fragments of fruit wall to testa, endosperm, palisade cells along with epidermis with stomata, abundant stellate and ordinary unbrabched trichomes; abundant aleurone grains intact in cell tissue from fruit wall; vessels, tracheids and fibres; in surface view the parenchymatous cells are simple, large, undulate thin walled, polygonaql to oval with aleurone grains; sub-epidermal palisade of testa usually seen isolated; thin walled with yellowish – brown contents; endospermic cells frequent in surface view, cells comparatively larger slightly thick walled, somewhat undulating and usually contain aleurone grains; a parenchymatous layer with each cell containing cluster of calcium oxalate crystals from the innermost wall of the fruit mesocarp present, a few groups of sclerenchymatous cells also seen, thick walled with broader lumen; frament of fruit tissues in surface view show epidermal layer with frequent stomata and trichomes.

CHEMICAL CONSTITUENTS:

Palmitic, myristic, stearic, oleic and lauric acids, β-sitosterol and stigmasterol found in lipid fractions of seeds.

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 7 % , Appendix 2.2.4
Acohol soluble extractive	:	Not less than 12 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 14 % , Appendix 2.2.7

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

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether : Diehtyl Ether (9:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	2	0.18 0.50

TEMPERAMENT : Cold 1°, Moist 1°

ACTION : Munzij, Mulaiyin, Radey, Muddir-e-baul, Muzliq, Muqawwi-e-Ama, Munaffis-e-Balgham.

THERAPEUTIC USE : Amraz-e-Riya, Sahaj-e-Ama, Qurooh-e-Meda, Qurooh-e-Ama, Sozish-e-Kulya, Sozish Masana, Suda, Zaheer, Waj-ul-Kabid.

DOSE : 5-7 g.

IMPORTANT FORMULATIONS : Laooq-e-Sapistan, Habb-e-Sil, Sharbat-e-Ejaz,

KISHMISH
(Fruit)

The drug Kishmish consists of dried fruits of seedless variety of *Vitis vinifera* L. (Vitaceae), cultivated in Middle East and Mediterranean regions, and mostly imported from the Middle East, chiefly Afghanistan, Iraq and Iran, into India.

OTHER NAMES :

Arabic	:	Kashmish
Persian	:	Kishmish
English	:	Raisins
Hindi	:	Kishmish, Angoor
Tamil	:	Draksha
Telugu	:	Draksha Pondu
Urdu	:	Kishmish

PART USED : Fruits

DESCRIPTION:

Macroscopic: Fruits ovoid, dark brown; 1 cm long, 0.5 cm wide soft and pulpy showing longitudinal wrinkles; taste sweet.

Microscopic: Fruit comprises of an outer epicarp which consists of a single thin epidermis followed by 3 or 4 layers of thick walled cells, which are tangentially oblong and compact; mesocarp tissue parenchymatous, homogenous, thin walled, large, less compact; scattered in the mesocarp are numerous small collateral vascular bundles, with a few xylem elements and small mass of phloem; in the central part of the fruit are two large wedge shaped collateral vascular bundles, placed just opposed with phloem abutting on each other; each bundle has a dense prominent xylem tissue with thick walled tracheary elements arranged in radial rows; phloem is also prominent consisting of tube members, companion cells and parenchyma cells; tannin filled cells abundant especially around the central vascular strands.

CHEMICAL CONSTITUENTS:

Flavonoids, tannins, sterols and sugar

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 extractive	:	Not less than 60 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 64 % , Appendix 2.2.7

TLC behaviour of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (5 : 1.5)	Dipped in Vanillin Sulphuric acid reagent and heating it in air oven at 105^0 for 10 minutes	5	0.28 0.41 0.51 0.58 0.87

TEMPERAMENT : Hot 1 °, Moist 1 °

ACTION : Mohallil, Mufatteh, Mulattif, Muqawwi-e-Bah, Muqawwi-e-Badan, Muqawwi-e-Aza-e-Raisa.

THERAPEUTIC USES : Qabz, Zof-e-Aam, Zof-e-Dimagh, Zof-e-Qalb.

DOSE : 5-9 No.

IMPORTANT FORMULATIONS : Itrifal Kishnizi, Majoon Zabeeb

KUNDUSH
(Whole Plant)

The drug Kundush consists of the dried whole plant of *Centipeda minima* Linn. Syn. *C. orbicularis* Lour. (Asteraceae), an annual or perennial herb with several spreading branches, found throughout India in moist places.

OTHER NAMES :

Arabic	:	Afkar
Persian	:	Gawejahan
Bengali	:	Mecheta
Chinese	:	Shih ha sui.
English	:	Sneeze-wort
Gujarati	:	Nakshikani
Hindi	:	Nak Chhikani
Marathi	:	Nakshikani
Sanskrit	:	Chhavak
Urdu	:	Nakachhikni

PART USED : Whole plant

DESCRIPTION :

Macroscopic :

Tap root: Cylindrical, upto 1.5 cm long, 1 mm thick, yellow, numerous lateral rootlets arising from the main root; characteristic odour and taste.

Stem : Stem sub-cylindrical, much branched and tangled, prostrate, slender, glabrous; 10 to 20 cm long, 1 to 3 mm thick; light yellow to yellowish brown; characteristic odour and taste;

Leaf: Leaves numerous, dark green, sub-sessile about 0.2 cm long and about 0.1 cm wide; puberous, oblong, margin dentate, acute apex, asymmetric base; sternutatory odour; taste bitter.

Flower: Flower minute, slight yellowish white colour, solitary, axillary, sessile heads less than 1 mm with ray and tubular florets, involucral bracts, small oblong with membranous margins.

Microscopic :

Root : Transverse section of root shows an epiblema; single outermost layer containing thin walled rectangular cells; numerous small unicellular root hairs present; below epiblema is the cortex which consists of 5 to 7 layers of oval or slightly elongated thin walled parenchyma cells with intercellular spaces; starch grains and calcium oxalate crystals absent; endodermis consists of single layer of barrel shaped cells, slightly thick walled; pericycle consists of a single layer of small and think walled cells. Radial vascular bundles around 2 to 6 in number and with exarch, xylem are present; xylem consists of tracheids, vessels, fibers andparenchyma; phloem consists of sieve tubes, companion cells and phloem parenchyma.

Stem : Transverse section shows a more or less circular of wavy outline; epedermis consisting of a single row of rectangular cells, covered by a thick and smooth cuticle; cortex consists of 2 or 3 layers of hypodermal region containing collenchymatous cells followed by a central cortex containing 4 to 7 layers of irregular parenchymatous cells; endodermis consisting of parenchymatous cells containing numerous starch grains; vascular bundles, collateral, open; phloem contains sieve tubes, companion cells and phloem parenchyma, xylem is endarch, containing xylem vessels, fibers and xylem parechyma; pith composed of thin walled parenchyma with conspicuous intercellular spaces.

Leaf : Transverse section of the leaf shows an isobilateral structure; upper epidermis is straight walled, single layered, cuticularized; composed of rectangular cells; ranunculaceous stomata present; mesophyll is differentiated into palisade and spongy parenchyma, palisade parenchyma single layered composed of compact and redially elongated cells, present on both abaxial and adaxial sides; spongy parenchyma many layered, loosely arranged with intercellular spaces, cells contain chloroplast; vascular bundles collateral, surrounded by bundlge sheath, found in the upper layers of spongy parenchyma, more or less centrally to the midrib, lower epidermis is similar to upper epidermis and has covering trichomes, uniseriate, multicellular straight and having blunt tip. The trichomes are short, stout, tip acture.

Powder : Powder is green, with a sternutator odour, bitter and slightly astringent in taste. In microscopic examination, the powder shows scalariform and reticulate vessels, uniseriate multicellular covering trichomes, and 80 to 120 μ long and 15 to 40 μ wide, ranunculaceous stomata.

CHEMICAL CONSTITUENTS:

Volatile oil, bitter principles, alkaloids, saponins flavonoids and sesquiterpene lactones.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 18 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 26 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 10 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 16 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform : Diethyl ether (8:2)	On spraying plate with Ethanoloc H_2SO_4 and heated for 10 minutes at 105^0 C	8	0.10 0.20 0.29 0.36 0.47 0.59 0.73 0.79

TEMPERAMENT : Hot 3°, Dry 3°

ACTION : Moattish, Munaqqi-e-Dimagh

THERAPEUTIC USE : Nazla, Zukam, Iltehab-e-Tajaweef-e-Anaf

DOSE : 1-3 g

MARORPHALI
(Legume)

The drug Marorphali consists of dried fruits of *Helicteres isora* Linn. (Sterculiaceae) a shrub or small tree, found in dry forests throughout central and western hills and plains in India.

OTHER NAMES :

Arabic	:	Iltwaallatu
Persian	:	Kishtburkisht, Pechaka
Bengali	:	Tmora, Antamora
English	:	Ast Indian Screw Tree
Gujarathi	:	Urdasing
Hindi	:	Arorphali, Jonkaphal, Bandhu, Kapasi, Marosi
Kannad	:	Edumuri Kavargi
Malyalam	:	Svarmuri
Marathi	:	Ewan, Kavani, Varkati
Oriya	:	Aval, Modimodi, Murimuri, Orola
Punjabi	:	Oroorphali, Kupasi
Sanskrit	:	Vartani, Mrigashinga
Tamil	:	Alampuri, Valumburikai
Telugu	:	Alvum, Nalitada
Urdu	:	Arorphali

PART USED : Fruit

DESCRIPTION:

Macroscopic : Drug consists of screw like capsules, 3.0 to 5.5 cm long and occasionally over a cm broad; yellowish-brown to blackish-brown slender, stalks nearly as long as fruit; mesocarp mucilaginous, taste slightly sweet and agreeable, no odour.

Microscopic:

Pedicel : Shows a single layered epidermis comprising of rectangular to squarish, thin walled parenchymatous cells with straight walls; cork cambium usually composed of 4 or 5 layers of brick shaped thin walled parenchymatous cells containing tannins; this is followed by several layers of secondary cortex, cells of which are thin walled, oval to round and loosely arranged parenchyma having intercellular spaces, cells in outer layers larger in size, but gradually become smaller in the layers towards the centre.

Groups of stone cells present at the periphery of the stele, forming a discontinous pericycle. Five separate vascular strands, each surrounded by groups of stone cells, present as medullary bundles. Stele traversed by uni-or biseriate medullary rays. Patches

of stone cells also present in cortex, several cells of which contain calcium oxalate crystals upto about 20 μ in length and upto 15 μ in width.

Fruit: Transverse section shows a thick cuticle, a single layer of epicarp of square shaped parenchymatous cells bearing a number of thick walled stellate trichomes having 3 to 6 unicellular arms; 18.0 to 75 μ long and 9.0 to 36.0 μ broad this is followed by several layers of mesocarpic region which consists of polygonal to oval, slightly thick walled parenchyma smaller in size towards periphery, larger towards interior; some contain a single rosette crystal of calcium oxalate, mesocarp also shows presence of several number of lysogenous mucilage cells. A multilayered band of hexagonal to polygonal, stone cells highly lignified with a narrow lumen present in the lower region of mesocrap; their size 18.0 μ long and 9.0 to 18.0 μ broad, below this are 5 or 6 layers of fibre cells with their long axis, laterally extended.

Seed: Testa shows a cuticle and a single layered epidermis which has rectangular and thin walled parenchymatous cells, followed by 3 or 4 layers of rectangular to oval, compact and slightly thick walled parenchymatous cells; beneath this is a layer of lignified palisade-like cells, radially elongated followed by two layers of rectangular to square, parenchymatous cells of endosperm; cotyledon reveals an upper and lower epidermis consisting of rectangular to barrel shaped thin walled, compact parenchymatous cells, mostly filled with small, oval to round aleurone grains.

Powder: Brown, coarse, free-flowing, revealing the presence of groups of stone cells, cork cambium, parenchyma, mesocarpic parenchyma, fibre cells, trichomes (intact and broken) palisade cells, endospermic cells, epidermis with trichomes, parenchymatous cells containing aleurone grains, fibres, tracheids and vessels. Stone cells are small, numerous, hexagonal to polygonal, highly lignified with narrow lumen but a frew also found with wider lumen. Fibres are quite long, highly lignified walls with pointed ends. Tracheids are shorter, lignified with rounded ends and having reticulate thickenings. Vessels are shorter, wider, thick walled, reticulate or spiral or scalariform. Rosette crystals of calcium oxalate are occasionally present.

CHEMICAL CONSTITUENTS:

Diosgenin

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 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 2 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 10 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform : Methanol (9:1)	On spraying plate with 5% Ethanolic conc. H2SO4	4	0.26 0.39 0.48 0.53

TEMPERAMENT : Cold, Dry 1°

ACTION : Muhallil-e-Warm, Mulattif, Daf-e-Zaheer, Mushil-e-Balgham, Jali, Musakkin

THERAPEUTIC USE : Amraz-e-Sadr, Waj-ul-Meda, Dafa-e-kirm-e-shikam, Sual, Zaheer, Muhallil-e-warm

DOSE : 4-7 g

IMPORTANT FORMULATION : Majoon Jograj Gogul

MAUZ
(Fresh Ripe Fruit)

Mauz consists of fresh ripe fruits of *Musa paradisiaca* Linn., Syn. *Musa sapientum* Kuntze. (Musaceae); a large leaved, tall, monoecious, tree like herb, cultivated all over plains of India, upto 1200 m in the hills. When employed as drug, the peel is removed and pulp is used.

OTHER NAMES:

Arabic	:	Mong, Mouz
Assamese	:	Kal, Talha
Bengali	:	Kal
English	:	Banana
Gujarati	:	Kela
Hindi	:	Kel
Kannad	:	Bale
Malayalam	:	Vazha
Marathi	:	Kela
Oriya	:	Kadali, Kadila
Punjabi	:	Kele
Sanskrit	:	Kadali, Rambha, Varana, Ambusara.
Tamil	:	Vazhai
Telugu	:	Arati, Anati
Urdu	:	Kela

PART USED : Fruits (Fresh ripe)

DESCRIPTION:

Macroscopic : Occurs in bunches, each bunch containing 10 to 15 hands and each hand bearing 2 to 3 dozens of fruits; colour ranging from greenish yellow to bright yellow with black spots, depending upon stages of ripening; peel removed easily from mesocarp; pulp yellowish to white; characteristic flavour and odour; taste sweet.

CHEMICAL CONSTITUENTS:

Sugar, starch albuminoids, fat, lime alkalies, iron, chlorine etc. vitamin 'B' and 'C'.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash on wet wt.basis	:	Not more than 1 % , Appendix 2.2.3
Acid insoluble ash on wet wt.basis	:	Not more than 0 % , Appendix 2.2.4
Alcohol soluble extractive value		

on wet wt. basis	:	Not less than 16 % , Appendix 2.2.6
Water soluble extractive value on wet wt. basis	:	Not less than 18 % , Appendix 2.2.7
Moisture content on wet wt. basis	:	Not less than 54 % , Appendix 2.2.9

TLC behaviour of Ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
N-butranol : Acetic acid : Ethyl acetate : Toluene (10 : 2 : 2 : 2)	On spraying plate with Aniline diphenyl amine H2SO4 and heating at 1050 C for 15 minutes.	3	0.33 0.61 0.68

TEMPERAMENT	:	Cold Moist
ACTION	:	Mughazzi, Musammin, Mufarreh, Qabiz, Naffakh, Muqawwi-e-Bah, Munaffis-e-Balgham
THERAPEUTIC USE	:	Zof, Loghari-e-Badan, Sual-e-Yabis Khashoonat- e-Halq
DOSE	:	Q. S.

MAUZ
(Fresh Unripe Fruit)

Mauz consists of fresh unripe fruits of *Musa paradisiaca* Linn., Syn. *Musa sapientum* Kuntze. (Musaceae); a large leaved, tall, monoecious, tree like herb, cultivated all over plains of India, upto 1200 m in the hills.

OTHER NAMES:

Arabic	:	Mong, Mouz
Assamese	:	Kal, Talha
Bengali	:	Kal
English	:	Banana
Gujarati	:	Kela
Hindi	:	Kel
Kannad	:	Bale
Malayalam	:	Vazha
Marathi	:	Kela
Oriya	:	Kadali, Kadila,
Punjabi	:	Kele
Sanskrit	:	Kadali, Rambha.
Sindhi	:	Kewiro
Tamil	:	Vazhai
Telugu	:	Arati, Anati
Urdu	:	Kela

PART USED : Fruits (Fresh Unripe Fruit)

DESCRIPTION:

Macroscopic: Occurs in bunches, each bunch containing 10 to 15 hands and each hand bearing 2 to 3 dozens of fruits; each fruit dull green in colour with characteristic odour and astringent taste; outer surface smooth, stout, 3 to 5 ridged, about 15 to 18 cm in length, 3 to 5 cm in diameter, curved to sub-cylindrical, tapering towards ends; fleshy, indehiscent, seedless berry; peel attached firmly to mesocarp, taste of flesh starchy and astringent.

CHEMICAL CONSTITUENTS :

Tannin, Chlorophyll, Carotene, Xanthophylls, Malic acid, Serotonin, Nor epinephrine.

IDENTITY, PURITY & STRENGTH :

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash on dry wt. basis	:	Not more than 5 % , Appendix 2.2.3
Acid insoluble ash on dry wt. basis	:	Not more than 1 % , Appendix 2.2.4
Alcohol soluble extractive value on dry wt. basis	:	Not less than 1 % , Appendix 2.2.6
Water soluble extractive value on dry wt. basis	:	Not less than 3 % , Appendix 2.2.7
Moisture content	:	Not less than 57 % , Appendix 2.2.9

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Dichloromethane (7:3)	On spraying plate with 10% H2SO4 and heated for 30 minutes at 1100 C	4	0.14 0.20 0.48 0.96

TEMPERAMENT : Cold, Moist

ACTION : Mughazzi, Musammin, Mufarreh, Qabiz, Naffakh Muqawwi Bah, Munaffis Balgham

THERAPEUTIC USE : Zof, Laghari-e-Badan, Soal-e-Yabis, Khashoonat Halq

DOSE : Q. S.

MAZOO
(Excrescence)

The drug Mazoo consists of dried galls, which are excrescences formed as a result of stimulus produced by the larva of the gall wasp, and found on twigs of *Quercus infectoria* Olive. (Fagaceae), a medium sized tree occurring in Greece, Bosnia, Asia Minor and Syria.

OTHER NAMES :

Arabic	:	Ufas
Persian	:	Mazu
Bengali	:	Maju phal
Englilsh	:	Dyer's Oak, Gall
Gujarathi	:	Mayaphal
Hindi	:	Mazu, Mazuphal
Kannad	:	Machi – Kayi
Malyalam	:	Maja kani
Marathi	:	Maiphala
Sanskrit	:	Maju phal
Tamil	:	Masikkai
Telugu	:	Mashi – Kaya
Urdu	:	Mazu

PART USED : Excrescence

DESCRIPTION:

Macroscopic : Galls globular in shape, 1 to 2.5 cm in diameter, bluish grey in colour, pale buff within, tough and heavy; the surface of the upper half shows 8 to 12 small blunt projections; but the lower half smooth, bearing a basal stalk; a hole of about a mm. may occasionally be present in the middle, showing that the insect has emerged; when cut in two halves gall shows a central cavity, and in those with holes, a channel from the cavity to the periphery in the region of the hole; average weight of 50 galls picked at random, should not be less than 2.5 g.; odour not specific; taste bitter and astringent.

Microscopic: Gall shows the outermost 2 or 3 layers of suberized cells; followed by a broad parenchymatous zone of thin walled cells which are smaller towards periphery but radially elongated towards interior; cells contain thin colourless angular fragments of tannin, starch grains of 19 to 28μ as well as prismatic and clustered crystals of calcium oxalate; small vascular strands found in the broad parenchymatous zone with tracheids having spiral thickening; a sclerenchymatous zone of 3 to 5 layers of lignified sclereids 35 to 260μ long. Within the sclerenchymatous zone a few parenchymatous cells containing starch grains with stellate hilum also present; galls bearing hole show a large central cavity filled with insects debris.

Powder: Powder coarse, creamy yellow coloured, having a bitter taste but no odour; consists of abundance of thin walled parenchyma, lignified stone cells, few tracheids with spiral thickening fragments of tannins, prismatic and clustered crystals; starch grains, some insect debris may be present; tissue debris with thick walled, closely packed, somewhat rounded cells, with striations seen in surface view;

CHEMICAL CONSTITUENTS:

Methyl betulate, methyl oleonolate and sitosterol[1]; syringic, gallic and ellagic acids[2]

IDENTITY, PURITY & STRENGTH:

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 2 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 65 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 55 % , Appendix 2.2.7

TLC behaviour of Acetone extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform : Methonol : (1:1)	Exposed to 1% Ethanolic ferric chloride spray	4	0.33 0.50 0.66 0.83

TEMPERATURE : Cold 2^0, Dry 2^0

ACTION : Habis, Qabiz, Mughazzi

THERAPEUTIC USE : Ishal, Zaheer, Bawaseer Damvi,

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Majoon Muqawwi Rahem

MULSARI
(Flower)

The drug Mulsari consists of dried flowers and buds of *Mimusops elengi* Linn. (Sapotaceae), a large glabrous evergreen tree, attaining a height of 12 to 15 m, distributed in Western and Eastern ghats and cultivated in the plains.

OTHER NAMES :

Bengal	:	Bakal, Bakul, Bohl, Bukal
Gujarathi	:	Borsali
Hindi	:	Bakul, Bolsari, Maulsari, Maulser, Mulsari Jara, Madhupushpa, Mukula, simhakesara, Sinha
Kannada	:	Renjee Kesara, Strimukhagandha, Strimukhamadhu
Malyalam	:	Bakulam, Elengi, Ilanni, Iranni, Mukuram Okula, Pagade, Ranjal, Ranji, Vakula
Orriya	:	Bokulo, Boulo, Khyiri.Vakulamu
Punjabi	:	Maulsari, Maulsiri
Sanskrit	:	Anangaka, Bakula, Chirapushpa, Dhanvi, Dohala, Sidhugandha, Kantha, Karuka, Keshara, Madhupan- Surabhi, Tailanga, Varalandha, Visharada
Tamil	:	Magilam, Vagulam
Telugu	:	Kesara, Nemmi, Nunni, Parijatamu, Pogado,
Urdu	:	Molsari

PART USED : Flowers

DESCRIPTION:

Macroscopic : Drug consists of dried flowers and flowering buds with pedicels ; flower white to yellowish brown, fragrant, nearly 2.5 cm across, pedicel upto 2 cm long; buds ovoid; bisexual, actinomorphic, bracteolate, sepals 4 to 12, imbricate in bud, base connate; corolla gamopetalous in 2 whorls, imbricate in buds, lobes about 8 to 10 in inner whorls and 12 to 16 in outer whorl; stamens epipetalous opposite petals in the inner walls; anthers 2 celled, style often apically lobed, ovary superior, carpels typically 4 or 5 in a range of 1 to 14, placentation axile; ovule one in each carpel, anatropous; characteristic aromatic odour and sweet acrid taste.

Microscopic :

Petal : Transverse section shows an upper and lower epidermis consisting of closely packed rectangular cells of uniform size: ground tissue irregular, spongy parenchymatous ; vascular bundles of various sizes consisting of xylem and phloem elements, surrounded by bundle sheath; upper surface in surface view shows closely packed, slightly wavy walled, thin laterally elongated epidermal cells without intercellular spaces; lower surface

in surface view shows closely packed, thick and wavy walls epidermal cells without intercellular spaces.

Sepal: Transverse section shows glandular uniseriate; 'T' shaped and multicellular trichomes on upper and lower epidermis; middle portion of the upper epidermis devoid of any type of trichomes, ground tissue parenchymatous; several conjoint, closed vascular bundles surrounded by bundle sheath present; epidermal cells in surface view are sinuous on the upper less sinuous on the lower; stomata ranunculaceous, laticifers and crystals present.

Pedicel: Transverse section shows a ridged outline, a single layer of epidermis bearing trichome similar to those on sepals; cortex consists of irregular parenchymatous and some laticiferous cells; the vascular bundles around 8, conjoint, collateral and closed, arranged in a circle, abundant prismatic and rhombohedral calcium oxalate crystals present.

Androecium : Anther lobes tetrasporangiate, dehiscence extrorse; the wall of the anther lobe consists of an epidermallayer of rectangular parenchymatous cells, followed by a layer of epithelial cells and a subsequent layer of endothecium; the pollen grains about 15 to 25 μ in diameter, single or in groups, spherical, pores four, the exine smooth and thick.

Gynoecium : The ovary is hexa to octa-carpellary, syncarpous and superior with a long style and insignificant stigma. It is covered by long 'T' shaped, branched, multicellular, uniseriate multicullular and unicellular glandular trichmomes; placentation axile, showing single large bundle in the transection; ovules anatropus;

Powder : Dark brown, shows numerous parenchymatous cells containing laticiferous cells, long 'T' shaped, branched, multicellular trichomes, uniseriate multicullular trichomes, unicellular glandular trichomes; scalariform and reticulate vessels, endothecial layer of anther and characteristic pollen grains about 15 to 35 μ in diameter; spherical, exine smooth, pores 4.

CHEMICAL CONSTITUENTS:

Triterpenoid saponin saponin and Pentacyclic triterpenes

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 extractive	:	Not less than 2 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 4 % , Appendix 2.2.7

TLC behaviour of ehanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate : Glacial Acetic acid (4:1:0.5)	On spraying plate with Ethanoloc H_2SO_4 and heated for 5 minutes at 105^0 C	7	0.26 0.39 0.49 0.60 0.70 0.76 0.87

TEMPERAMENT : Hot 1^o, Dry 2^o

ACTION : Mughalliz-e-Mani, Muallid-e-Mani

THERAPEUTIC USE : Surat-e-Inzal, Zof-e-Bah, Kasrat-e-Ehtalam

DOSE : 5 g

MULSARI
(Fruit)

The drug Mulsari consists of dried ripe fruits of *Mimusops elengi* Linn. (Sapotaceae), a large glabrous evergreen tree, attaining a height of 12 to 15 m distributed in Western and Eastern ghats and cultivated in the plains.

OTHER NAMES :

Bengal	:	Bakal, Bakul, Bohl, Bukal
Gujarathi	:	Borsali
Hindi	:	Bakul, Bolsari,Maulsari,Maulser, Mulsari Jara, Madhupushpa, Mukula, simhakesara, Sinha
Kannada	:	Renjee Kesara, Strimukhagandha, Strimukhamadhu,
Malyalam	:	Bakulam, Elengi, Ilanni, Iranni, Mukuram Okula, Pagade, Ranjal, Ranji,Vakula
Orriya	:	Bokulo, Boulo,Khyiri.Vakulamu
Punjabi	:	Maulsari, Maulsiri
Sanskrit	:	Anangaka,Bakula, Chirapushpa, Dhanvi, Dohala, Sidhugandha, Kantha,Karuka,Keshara, Madhupan-Surabhi, Tailanga, Varalandha, Visharada
Tamil	:	Magilam, Vagulam
Telugu	:	Kesara, Nemmi, Nunni, Parijatamu, Pogado,
Urdu	:	Molsari

PART USED : Fruits

DESCRIPTION:

Macroscopic :

Fruit : A berry, pedunculate, 3.0 cm long and upto 1.5 cm mid-width, ovoid, containing one seed; young fruits light green to yellow; Pinkish brown or orange when ripe; often with a thin leathery to bony outer surface; mesocarp fleshy and endocarp stony; seeds with fleshy endosperm, obliquely ovate and slightly compressed; testa shining; hilum is either and basal or elongate and lateral; slightly aromatic odour; sweet, acrid taste.

Microscopic :

Pericarp: Transverse section of the pericarp shows a thick cuticle, and a layer of tangentially elongated cells of epicarp; mesocarp made up of thin walled polygonal parenchymatous cells, with patches of sclereids at its periphery; conjoint type of vascular bundles present in mesocarp; 5 or 6 layers of cells with latex or similar secretory substance in thin walled polygonal parenchymatous cells, are present in mesocarp.

Seed : Transverse section of the seed showing thick testa distringuished into five concentric regions, outermost composed of 12 to13 layers of thick walled polygonal isodiametric, sclerenchymatous cells; the second and third region consisting of thin walled parenchymatous cells; deep reddish contents comprise the fourth region, conjoint vascular bundles of testa lie in this layer; the fifth region is composed of a few layers of round to oval brushed cells, devoid of cellular contents. The cells of the endosperm are thin walled, parenchymatous, polygonal, smaller at the periphery and larger towards the centre, containing oil globules and aleurone grains. The epidermal cells of the cotyledons are rectangular or laterally elongated. A number of vascular strands with poorly developed elements are seen in the cotyledons.

Powder : Light brown; round and elongated sclereids of mesocarp 28 to 60 μ in diameter, 150 to 250 μ in length, 40 to 60 μ in width; reticulate and scalariform vessels, latex cells, fragments of endosperm with aleurone grains and oil globules.

CHEMICAL CONSTITUENTS:

Sugars, fatty acids and saponins.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 1 % , 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 extractive	:	Not less than 3 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 2 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Cyclohexane : Ethyl Acetate : (4:1)	On spraying plate with Ethanoloc H_2SO_4 and heated for 5 minutes at 105^0 C	4	0.20 0.27 0.60 0.70

TEMPERAMENT : Hot, Dry

ACTION : Mughalliz-e-Mani, Muqawwi-e-Bah, Muwallid-e- Mani

THERAPEUTIC USE : Surat-e-Inzal, Zaf-e-Bah, Kasrat-e-Ehtelam

DOSE : 5-10 g

NEEM
(Seed)

Neem consists of seeds of *Azadirachta indica*. A. Juss. Syn. *Melia azadirachta* Linn. (Meliaceae); a large evergreen tree, 12 to 18 m in height, 1 to 3 m in girth, apparently grows wild throughout India, often cultivated in drier parts of the country.

OTHER NAMES:

Arabic	:	Neeb
Persian	:	Neeb
Bengali	:	Nim
English	:	Nim tree, Indian Lilac, Margosa tree
Gujarathi	:	Limbado
Hindi	:	Nim, Nimb
Kannad	:	Bevinamaro
Malyalam	:	Veppa
Marathi	:	Limb
Oriya	:	Nimba
Punjabi	:	Bakam, Bukhain, Drekh, Mahanim
Sanskrit	:	Arishta
Tamil	:	Vembu, Veppem
Telugu	:	Veepachettu, Yepachettu
Urdu	:	Neem

PART USED : Seeds

DESCRIPTION :

Macroscopic : Seeds are ovoid to ellipsoid, 8 to 15 mm in length and 6 mm to 10 mm diameter at center, cream to brownish in colour; rough textured, characteristic Neem odour; seed coat hard and brittle, can be decorticated with ease. cotyledons are thick, fleshy; 100 seeds weighing around 14 to 16 g.

Microscopic: Seeds oval to spherical in outline, separated into testa, tegman and cotyledon; stone celled testa is compactly packed, thick walled, without lumen, lignified, polygonal, 15 to 18 layered, hard, does not swells in glycerin-water solution: tegman cells thin walled, smooth, freely packed, parenchymatous, orange brownish in colour, 5 to 7 layered, oval shaped, averages 90 to 135 micron in length, after imbibing gets separated from the cotyledon, transparent, hyaline without inclusion, parenchymatous 2 to 3 layered nucellar cell boundary found always attached to the tegman, a continuous layer separates tegman from cotyledon; cotyledon cells are turgid with full of cytoplasm and oil globules, thin walled, compactly packed, many layered, parenchymatous cells, polygonal, polyhedral, ranges from 180 to 360 micron in diameter.

Powder: Fine, cream to brown-coloured; characteristic Neem odour, bitter in taste; oily in nature, leaves stains on paper; microscopy reveals several turgid, scattered oil globules ranging from 30 micron to 180 micron in diameter; some transparent, scanty parenchymatous cells with freely scattered entire or broken seed coat cells along with long fibres are also found. No tannin, no effervescence, fixed oil present.

CHEMICAL CONSTITUENTS:

Terpenoids, azadirachtin, fixed oils, fatty acids, aminoacids.

IDENTITY, PURITY & 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 extractive value	:	Not less than 15 % , Appendix 2.2.6
Water soluble extractive value	:	Not less than 9 % , Appendix 2.2.7
Fixed oil	:	Not less than 18 % , Appendix 2.2.8

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether : Diethyl ether : Acetic acid (80 : 20 : 1)	On spraying plate with 10% aquous H2SO4 and heated for 30 minutes at 1100 C	6	0.12 0.14 0.29 0.50 0.81 0.90

TEMPERAMENT : Hot Dry

ACTION : Musaffi-e-Dam, Moharrik, Daf-e-Humma, Dafe-Taffun, Qatil-e-Kirm

THERAPEUTIC USE : Jarb-o-Hikka, Bahaq, Bars, Namash, Awram-e-Khabisa, Busoor, Qurooh

DOSE : 5 g

IMPORTANT FORMULATIONS : Habb-e-Neeb

NEEM GUM
(Exudate)

Neem gum is the exudate from the bark of *Azadirachta indica* A. Juss., Syn. *Melia azadirachta* Linn. (*Meliaceae*), a large evergreen tree, 12 to 18 m in height, 1 to 3 m in girth, occurring wild throughout India, often cultivated as avenue tree.

OTHER NAMES:

Arabic	:	Neeb
Persian	:	Neeb
Bengali	:	Nim
English	:	Nim tree, Indian Lilac, Margosa tree
Gujarathi	:	Limbado
Hindi	:	Nim, Nimb
Kannad	:	Bevinamaro
Malyalam	:	Veppa
Marathi	:	Limb
Oriya	:	Nimba
Punjabi	:	Bakam, Bukhain, Drekh, Mahanim
Sanskrit	:	Arishta
Tamil	:	Vembu, Veppem
Telugu	:	Veepachettu, Yepachettu
Urdu	:	Neem

PART USED : Exudate

DESCRIPTION:

Microscopy: Found as small tears or vermiform pieces; surface cracked or fissured, darkening with age; fresh gum has Pink to bright amber colour, semi-transparent; characteristic odour and not bitter to taste; hard to fracture; mixes with water and forms gum paste; along with Neem gum, bark remnants are also found; soluble in hot boiling water, dilute. HCl and dilute H_2SO_4; in conc. HNO_3 it becomes yellowish brown and jelly like.

Microscopy: Under microscope it shows multifaced, solid fragments, some are transparent with longitudinal glistening striations on surface; yellowish brown coloured, thick fibre bundles varying in length found along with dark brown coloured cells from bark.

Colour Tests for Identification of Neem Gum:

1. Heat a solution of Neem gum in test tube with an equal volume of conc. HCl containing a little phloroglucinol, violet colour is produced (Distinction from Kateera Gum)
2. Heat a solution of Neem gum in a test tube with Resorcinol-HCl (Selivanoff's Reagent); a brown coloured precipitate formed which dissolves in alcohol. (Distinction from Kateera Gum)
3. Boil Neem gum in 10 ml H_2O, add a mixture of 2 ml each of Fehling's solution A & B; a green colour is obtained. (Distinction from Kateera Gum)
4. Shake 1 gm. of the Neem gum powder with 100 ml of water and titrate with 0.01N sodium hydroxide, using methyl red solution as an indicator. Not more than 11 ml. is required to change the colour from red to yellow.
5. Prepare an original solution of Neem Gum as follows: Boil 1 g of Neem gum powder with 10 ml of Conc. HCl for 5 min. cool, filter and make up the volume to 100 ml with distilled water.

a. To 5 ml of the original solution of Neem Gum add gradually, while shaking, 10 ml. of Alcohol (60%). No cloudy solution is obtained; add to this clear solution 0.5 ml acetic acid, no white precipitate obtained; add 50 ml. of ammonium oxalate solution: the solution does not become cloudy. (Distinction from Kateera gum)

b. To the original solution of Neem gum, add Barium chloride solution, no white precipitate of barium sulphate is obtained (Distinction from agar).

c. To the original solution of Neem gum add Iodine solution, no blue or brown colour is obtained, but red colour is obtained. (absence of starch and dextrin).

CHEMICAL CONSTITUENTS:

L-arabinose, L-fructose, D-galactose and D-glucuronic acid, Idobiuronic acid, 4-0-(D-glucopyranosyl uronic acid)-d-galactopyranose, D-glucosamine.

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 extractive value	:	Not less than 2 % , Appendix 2.2.6

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl acetate : Formic acid (40 : 25 : 0.4)	On exposure to Iodine vapours	3	0.29 0.46 0.83

TEMPERAMENT : Hot Dry

ACTION : Musaffi-e-Dam, Moharrik, Dafe-Humma, Daf-e-Taffun Qatil-e-Kirm

THERAPEUTIC USE : Jarb, Hikka, Bahar, Bars, Namsh Awram e-Khabeesa, Basoor, Qurooh

DOSE : 2 g

OOD-E-SALEEB
(Tuber)

The drug Ood-e-Saleeb consists of dried root tubers of *Paeonia emodi* Wall. (Ranunculaceae), an erect, stout, leafy, perennial herb or under shrub; found in Western Himalayas from Kashmir region.

OTHER NAMES :

Bengali	:	Oode Salam
Persian	:	Fadania
English	:	Himalayan Peoni
Hindi	:	Ood Salap
Punjabi	:	Mamekh
Urdu	:	Ood-e- Saleeb

PART USED : Root

DESCRIPTION :

Macroscopic : Tuberous roots are light brownish grey in colour; upto 8 cm long, and 3 cm wide, spindle shaped; surface deeply furrowed and shrunken longitudinally; fracture tough and granular; faint odour, taste sweet later on bitter.

Microscopic: Transverse section of root tuber shows a circular outline with a wavy margin; multi-layered periderm consisting of 2 or 3 layers of tangentially elongated rectangular cork cells on the outer side and phelloderm of 2 or 3 layers of parenchymatours cells tangentially elongated; stone cells isolated and in groups found, scattered in the cortex; phloem consisting of several layers of parenchyma with starch grains and cluster crystals of calcium oxalate; xylem with tracheids and parenchyma; vessels pitted, occuring more or less in groups distributed throughout; xylem fiber thick walled; medullary rays uni seriate or multiseriate 2 to 6 cell wide and 5 to 13 cells in height; pith cells thin walled, circular.

Powder: Creamish-white; shows patches of cork cells, numerous stone cells 20 to 90 µ in diameter, isolated and in groups with narrow lumen, very thick walls showing pit canals,cluster crystals of calcium oxalate 2 to 7 µ in size; pitted, reticulate, and scalariform vessels; fragments of medullary rays; starch grains having diameter 4 to 30 µ.

CHEMICAL CONSTITUENTS :

Glucosides, essential oil, fixed oil, tannins, and terpenes

IDENTITITY, 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 extractive	:	Not less than 15 % . Appendix 2.2.6
Water soluble extractive	:	Not less than 14 % , Appendix 2.2.7

TLC behaviour of methanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Ethanol : Cylco hexane (8:4)	On spraying plate with Ethanoloc H_2SO_4 and heated for 30 minutes at 105^0 C		0.23 0.31 0.66

TEMPERAMENT : Hot 3°, Dry 3°

ACTION : Daf-e-Sara, Daf-e-Tashannuj, Muqawwi-e-Asab

THERAPEUTIC USE : Sara, Tashannuj, Ehtanaqur-e-Reham, Zof-e-Asab

DOSE : 3-5 g

IMPORTANT FORMULATIONS: Khameera Gaozaban Ambri Jadwar Ood Saleb Wala

PETHA
(Seed)

The drug Petha consists of the seeds of *Benincasa hispida* Thunb. (Cucurbitaceae); a large trailing or climbing herb, cultivated as a vegetable all over India upto 1200 m.

OTHER NAMES:

Arabic	:	Majdab
Persian	:	Majdab
Bengali	:	Chalkumra, Kumra
Hindi	:	Golkaddu, Kondha, Kudimah, Kumra, Petha, Phuthia Karkotika, Kumbhanda, Kunjaphala, Kushmanda, Kushmandaka, Kushmandi, Nasapushpaphala, Pitapushpa, Pushpaphala, Shikhivardhaka, Suphala, Timisha
Malyalam	:	Kumpalam, Kumpalanna
Marathi	:	Kohala
Punjabi	:	Chalkumra, Golkaddu, Petha
Sanskrit	:	Brihatapha, Garmyakarkaki, Ghrinavasa, Karkaru,
Tamil	:	Kalyanappushinikkay, Pusanikkai, Pushini
Telugu	:	Budidegummadi, Burdogumldu, Pendligummadikaya
Urdu	:	Petha

PART USED : Seeds

DESCRIPTION:

Macroscopic : Seed shiny; smooth to touch; about 1.5 cm long and about 1 cm broad; ellipsoid; compressed and corrugated at the margins; pale yellow to light brown; taste starchy; odourless.

Microscopic: Testa consists of three layers, with an external cuticle; epidermis columnar, containing mucilage; a Middle Palisade layer of thin walled, polygonal parenchymatous cells and inner layer consists of compactly arranged sclerenchymatous stone cells. Tegmen is one or two layered, parenchymatous. Cotyledons are made up of an outer single layered epidermis and a middle layer of elongated polygonal parenchymatous cells. Seed is exalbuminous. The cells are filled with oil droplets, aleurone grains. Oval or circular simple starch grains having hilum in centre with a few striations. size 4 to 11μ in diameter.

Powder: Powder dirty white in colour, oily with sweet aroma. Under microscope it shows fragments of stone cells, palisade cell, columnar epidermal cells and polygonal parenchymatous cells; epidermis of testa and cotyledons are also seen in surface view. In addition to this oil droplets, aleurone grains and starch grains are observed.

CHEMICAL CONSTITUENTS:

Arachidic acid, Linoleic acid, Linolenic acid, Oleic acid, Palmitic acid, Stearic acid, β-sitosterol.

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 extractive(s)	:	Not less than 19 % , Appendix 2.2.6
Water soluble extractive(s)	:	Not less than 4 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Diethyl ether : Acetic acid (80:20:1)	On spraying plate with 10% Methonolic H_2SO_4 and heated for 5 minutes at 105^0 C	10	0.9 0.13 0.16 0.21 0.25 0.29 0.50 0.66 0.81 0.89

TEMPERAMENT : Cold 2^0 Moist 2^0

ACTION : Musakkin-e-Hararat, Mudir-e-Baul, Habis ud Dam, Mubarrid, Qat-e- Bah

THERAPEUTIC USE : Atash, Sozish-e-Baul, Khafqan, Nafsu-d-dam.

DOSE : 2-3 g

IMPORTANT FORMULATIONS : Majoon Hamal Ambari Alvi Khani.

PISTA
(Seed)

The drug Pista consists of seeds of *Pistacia vera* Linn. (Anacardiaceae), a small deciduous tree up to 10 m in height, native to and commercially cultivated in Mediterranean region, Middle East and Central Asia and imported into India, shelled or unshelled.

OTHER NAMES :

Arabic	:	Fistak
Persian	:	Fistak
Bangali	:	Getela, Pista.
English	:	Pistachia nut
Hindi	:	Guli pistah, Buzaganja.
Marathi	:	Pista
Tamil	:	Pista
Urdu	:	Pista

PART USED : Seed

DESCRIPTION:

Macroscopic: Seeds red purple, having a marked depression at one end; 1.4 to 2 cm in length, 0.6 to 1.2 cm in width and 0.5 to 1.0 cm in thickness; cotyledons two, green, plano-convex; short radicle at the end of embryo; odour, aromatic; taste, sweet.

Microscopic: Transverse section shows two layered testa; outer layer of collapsed cells, some cells containing reddish purple pigment; inner layer of 2 or 3 cells, consisting of large, irregular, compactly arranged cells: cotyledons two, epidermis single layered; ground tissue parenchymatous, cells oval to polygonal, filled with abundant oil droplets and aleurone grains; vascular bundles simple, consisting of xylem and phloem.

Powder: Green; shows groups of palisade parenchymatous cells, filled with oil globules and aleurone grains measuring 2 to 4 μ in diameter; in surface view cells of seed coat polygonal in shape, thick walled and filled with reddish purple pigment.

CHEMICAL CONSTITUENTS:

Cyanidin-3-O-galactoside; 6-alkyl (III, IV) & cisalkenyl (V) salicylic acids, anacardic acids. Nut oil contains – myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid.

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 extractive(s)	:	Not less than 14 % , Appendix 2.2.6
Water soluble extractive (s)	:	Not less than 9 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Diethyl ether : Acetic acid (80:19:1)	On spraying plate with 10% Methonolic H_2SO_4 and heating it for 5 minutes at 105^0 C	5	0.09 0.13 0.15 0.20 0.46

TEMPERAMENT : Hot 2^0 Moist 2^0

ACTION : Muqawwi-e-Qalb, Muqawwi-e-Dimagh, Muqawwi-e-Meda, Musammin, Muwallid-e-Mani.

THERAPEUTIC USE : Zof-e-Qalb, Zof-e-Dimagh, Zof-e-Hafiza Laghari-e-Badan, Zof-e-Aam, Huzal-e-Kulya, Zof-e-Bah, Riqqat-e-Mani, Surat-e-Inzal.

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Luboob-e-Kabeer, Majoon Supari Pak.

QIRFA
(Leaf)

The drug Qirfa consists of dried leaves of *Cinnamomum cassia* Blume. Syn. *Cinnamomum aromaticum* Nees & Eberm. (Lauraceae); an evergreen tree, indigenous to Indo-China and Southern China, cultivated in other parts of southern Asia.

OTHER NAMES :

Arabic	:	Qirfah, Qirfa
Persian	:	Saleekha
Bengali	:	Dalchini, Daruchini
English	:	Cassia, Chinese Cinnamon
Gujarathi	:	Taj
Hindi	:	Dalchini, Daruchini
Kashmiri	:	Dalchini, Daruchini
Malyalam	:	Kulit-manis
Marathi	:	Dalchini
Punjabi	:	Kirfa
Sanskrit	:	Gudatvak
Urdu	:	Taj

PART USED : Leaves

DESCRIPTION :

Macroscopic : Leaves petiolate; petiole 1.5 to 2 cm long and swollen at the base; exstipulate, dorsiventral, olive green; variable in size, 8 to 12 cm long and 2.5 to 5 cm broad at center; oblong, tapering at base, acute or obtuse at apex, entire, very smooth, shining and green above, dull and glaucous with very minute tomentum beneath and finely reticulate; strongly three nerved, two lateral one united with the midrib for a short distance from the base and reaching at the apex of the leaves; odour aromatic, pleasant like a mixture of clove and cinnamon, taste slightly sweet, mucilagenous.

Microscopic :

i) Petiole- Transverse section of petiole shows single layered epidermis consisting of squarish cells covered with thick cuticle. Epidermis is followed by single layered collenchyma with distinct angular thickenings; cortex is divided into upper loose parenchymatous cortex with elongated cells containing starch grains and lower compact parenchymatous cortex containing simple, spherical starch grains 10μ to 30 μ size with hilum at the center and isolated prismatic crystals; 45μ to 50 μ in size, lignified, inner and radial walls with thick striations visible; schizogenous cavities present. Stele somewhat 'C' shaped; vascular bundle consists of xylem and phloem ; xylem vessels arranged in radial rows transversed by medulary rays.

ii) Midrib - Transverse section of midrib shows single layered upper and lower epidermis covered with cuticle; straight anticlinal walls; and a few cells containing mucilage; hypodermis of 2 or 3 layers of collenchyma present adjacent to both sides; parenchymatous cells of ground tissue isodiametric to circular with intercellular spaces; starch grains abundant, simple, spherical 20μ to 30μ in size and acicular crystals; stele crescent-shaped; vascular bundle surrounded by 2 or 3 layered sclerenchymatous sheath centering and/or contain simple spherical starch grains measuring 10μ to 20μ in size.

iii) Lamina - Dorsiventral shows single layered upper and lower epidermis covered with cuticle; some epidermal cells contain mucilage; mesophyll 1 or 2 layered; single palisade layer interrupted by oil cells followed by multilayered and distinct spongy parenchyma; traces of vascular tissue; only lower epidermis shows paracytic stomata, stomatal index 16.

Powder : Powder olive green in colour; shows fragments of epidermis with stomata; collenchyma, parenchyma, spongy parenchyma, palisade cells, xylem and phloem; starch grains simple, spherical with hilum at the center; sclerids, calcium oxalate crystals of acicular and prismatic type.

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 1 % , Appendix 2.2.4
Alcohol soluble Extractive(s)	:	Not less than 3 % , Appendix 2.2.6
Water soluble Extractive(s)	:	Not less than 5 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Petroleum ether : Ethyl acetate (60:25:15)	On spraying plate with 10% Methonolic H_2SO_4 and heated for 5 minutes at 105^0 C	5	0.05 0.40 0.53 0.73 0.83

TEMPERAMENT : Hot 2^0 Dry 2^0

ACTION : Mulattif, Mohallil-e-waram, Muqawwi-e-Aza-e-Raisa, Mudirr-e-Baul, Daf-e-Nazla, Daf-e-Zukam.

THERAPEUTIC USE : Sual, Warm-e-Reham, Ehtebas-e-Baul, Ehtebas-e-Tams, Salabat-e-Reham, Waja-ul- Mafasil, Nazla, Zukam.

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Raughan-e-Surkh

QIRFA
(Stem bark)

The drug Qirfa consists of dried stem bark of *Cinnamomum cassia* Blume. Syn. *Cinnamomum aromaticum* Nees & Eberm. (Lauraceae); an evergreen tree, indigenous to Indo-China and southern China, cultivated in other parts of southern Asia; commonly known as Chinese cinnamon.

OTHER NAMES

Arabic	:	Qirfah, Qirfa
Persian	:	Saleekha
Bengali	:	Dalchini, Daruchini.
English	:	Cassia, Chinese Cinnamon
Gujarati	:	Taj
Hindi	:	Dalchini, Daruchini
Kashmiri	:	Dalchini, Daruchini
Malyalam	:	Kulit-manis
Marathi	:	Dalchini
Punjabi	:	Kirfa
Sanskrit	:	Gudatvak
Urdu	:	Taj

PART USED : Stem bark

DESCRIPTION :

Macroscopic : Pieces of bark vary from 5 to 40 cm in length, average 1 to 2 cm in width and 3 to 5 mm thickness, channeled; or single quill of dark, earthy brown colour and smooth, but greyish cork persists; inner surface lighter brown: fracture is short, granular in outer part and fibrous in inner part; odour and taste resemble cinnamon, but less delicate and more mucilaginous and astringent in taste.

Microscopic : Transverse section shows lenticels; periderm consists of few layers of polygonal-tubular cork cells arranged in alternating layers of thick-walled and thin-walled cells with red-brown contents, thick walled cork cells lignified; phellogen and phelloderm are not separable; cortex 12 to 15 layered, parenchymatous with abundant simple starch grains upto 20 μ; scattered stone cells with more lignified and pitted tangential and lateral walls; pericycle fibers of 25 μ to 40 μ in width, in tangential rows embedded among stone cell groups; sclerenchymatous, lignified, pitted, inner and radial wall thick, striation usually visible; secondary phloem parenchymatous with starch grains and acicular crystals; oil cells, thin, large, oval, associated with thin walled parenchyma and medullary rays; medullary rays narrow on inner side and wider towards periphery, pits absent from wall: containing starch grains and small acicular crystals of calcium oxalate; phloem in isolated groups along with isolated or short tangential rows of thick fibers, less than 30 μ in width and 300μ to 700 μ in length; lignified and striated with narrow lumen; mucilage cells scattered in ground parenchyma .

Powder: Powder yellowish in colour, oily in nature with typical sweet smell of orange, Under microscope fragments of epidermis, parenchymatous tissue having some part of oil gland and traces of vascular bundles are seen; oil droplets, starch grains, solid yellowish green bodies, calcium oxalate and hesperidine crystals are seen scattered.

CHEMICAL CONSTITUENTS :

Cinnamaldehyde, cyclic glycerol 1-3 acetal and its cis isomer, syringaresinol; cinnazeylanine, cinnzeylanol, cinncassiol A & its glycoside, anhydrocinnzeylanine, anhydrocinnzeylanol, Trans-cinnamic acid, coumarin, diterpenoids-cinncassiols A,B& C, Cinncassiol C1,β -sitosterol, protocateachuic acid. Barkoilcontents – Cinnamaldehyde, eugenol, cinnamic acid, cinnamyl acetate, salicyaldehyde, O-methyl-coumaraldehyde, benzaldehyde,methyl salicylate,cuminaldehyde, α-pinene, 1-8cineol,A-Terpineol, guiacol.

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 Extractive	:	Not less than 4 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 7 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Acetone : Methonol (75:25:3)	On spraying plate with 10% Methonolic H_2SO_4 and heated for 5 minutes at 105^0 C	8	0.05 0.15 0.21 0.25 0.36 0.45 0.65 0.78

TEMPERAMENT : Hot 2^0, Dry 2^0

ACTION : Mulattif, Mohallil-e-waram, Muqawwi-e-Aza-e-Raisa, Mudirr-e-Baul, Daf-e-Nazla, Dafe Zukam.

THERAPEUTIC USE : Ehtibas-e-Tams, Sual, Warm-e- Reham, Ehtebas-e-Baul, Nazla Zukam

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Roughan-e-Surkh

QURTUM
(Flower)

The drug Qurtum consists of flowers of *Carthamus tinctorius* Linn. (Asteraceae); an erect plant about half meter in height with spinous leaves; orange red flowers in large terminal heads; cultivated in India for the seed which yield edible as well as commercial oil.

OTHER NAMES :

Arabic	:	Qirtum, Qurtum
Persian	:	Khasakdana, Kajirah, Kazirrha
Bengali	:	Kajirah, Kusamphul, Kusum
English	:	Safflower
Hindi	:	Barre, Karrah, Kasumba, kussum Kamalottara, Kamalottam, Kukkutashikha, Aginishika.Maharajana, Padmottara, Papaka,
Malayalam	:	Chenurakam
Marathi	:	Kudaya, Kararhi, Kardai, Kasdi, Kurdi, Shumba
Punjabi	:	Kar, Karar, Kurtam, Kusam, Kushumbha.
Sanskrit	:	Pita, Rakta, Vasrsranjana, Kusumbha, Lohita,
Tamil	:	Chendurakam, Sendurakam
Telugu	:	Agnisikha, Kushumba, Kusumba
Urdu	:	Karha, Kusum

PART USED : Flowers

DESCRIPTION :

Macroscopic : The terminal capitulate heads measure 2 to 4 cm in length; bracteate, outer involucral bracts leafy, ovate oblong, constricted above the base, green, usually spinous; inner involucral bracts ovate-oblong, acute; flower, bisexual, sessile; colour orange red to yellow; pappus absent; corolla gamopetalous: 5 lobed, tube slender and lower part embedded in a dense mass of fringed scale; stamens epipetalous, 5, syngenecious; anther basifixed; carpels 2, syncarpous; stigma, bifid and curved; style longer than the staminal tube; ovary inferior, unilocular; basal placentation.

Microscopic :

Bract - Shows outer single layer of epidermal cells with cuticle and multicellular, unbranched trichomes present only on upper epidermis; followed by 2 to 3 layered collenchymatous cells. Middle layer consists of irregular spongy parenchymatous zone along with oil cells and collateral vascular bundle; lower epidermis consisting of irregular, single layer cells covered with cuticle.

Corolla - Shows outer layer of single layered parenchymatous cells; irregularly elongated middle layer parenchymatous, cells consisting of oil cells and cuboid calcium oxalate crystals; lower layer parenchymatous, small, irregular with acicular crystals.

Anther - Anther lobes 4 and anther wall 1 to 2 layered, parenchymatous cells with dispersed acicular crystals.

Powder: Reddish brown, shows fragments of small and large, elongated and irregular parenchymatous cells; scattered cuboid and acicular calcium oxalate crystals; starch grains simple, spherical, 5µ to 15µ in size. Petal epidermis wavy with anticlinal walls in surface view. Antheridial tissue shows fibrous layer of anther with reticulated cell wall pattern in surface view. Pollen grains spheroid, 3-colporate, 70µ to 90µ in size; exine spinate, 2µ thickness, spins blunt: intine smooth walled.

CHEMICAL CONSTITUENTS :

Carthamine, neocarthamine, kaempferol-3-rhamnoglucoside, Kaempferol glycoside, tracheloside, steroids, cellobioside, luteolin, luteolin-7-O glycoside, B-sitosterol & its glycoside, polyacetylenes, acylserotonins, nonacosane, palmitic acid, lauric acid, myristic acid.

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 extractive	:	Not less than 5 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 27 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Chloroform : Acetone (70:20:10)	On spraying plate with 10% Methanolic H_2SO_4 and heated for 5 minutes at 105^0 C	5	0.05 0.40 0.53 0.73 0.83

TEMPERAMENT : Hot 2^0 Dry 2^0

ACTION : Munaffis-e-Balgham, Mulattif, Muhallil-e-Waram

THERAPEUTIC USE : Waram-e-Reham, Waram-e-Ahsha, Warame- Kabid

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Ranghan -e- Qurtum, Majoon -e - Qurtum.

RATANJOT
(Root)

The drug Ratanjot consists of dried roots of *Onosma hispidum* wall. ex D. Don. Syn. *O. echioides* C.B. Clarke non Linn. (Boraginaceae); a perennial erect herb found in Himalyas from Kashmir to Kumaon at altitudes of 2,000 to 4,500 m.

OTHER NAMES :

Arabic	:	Abu Khilsa
Persian	:	Shankar-o-choba
Assamese	:	Kapotabana, Nalika, Nalini, Nartakki, Nati
Bengali	:	Ratanjot
Hindi	:	Ratanjot
Punjabi	:	Laljari, Koame, Maharanga, Ratanjot
Sanskrit	:	Adhanani, Anjanakeshi, Dhamani, Nali
Urdu	:	Ratanjot

PART USED : Root

DESCRIPTION :

Macroscopic: Dried roots tapering, light in weight, reddish brown, fractured, twisted or straight with blunt apices; presence of layers of loose papery pieces in outer region. Individual piece is papery, thin, smooth, delicate and easily detachable from central wood; odour, disagreeable; taste; nil; imparts stain to fingers when handled.

Microscopic :

Root - The transverse section of the root is more or less circular in outline; epidermis and cortical region are completely obliterated as they get exfoliated in the form of papery layers and are cut off from the axis; the remaining outer most layer of cells become further suberised and form 1 to 2, rows of cork tissue; such cells are compactly arranged, thick-walled, rectangular, somewhat irregular in shape and consisting of reddish-brown matter; endodermis and pericycle not defined; the central portion of vascular elements are highly diffused, woody, obliterating primary stellar structure and pith; phloem indistinguishable; the vessels of secondary xylem are distributed singly or in groups; variable in lumen size; scattered among xylem parenchyma; ray parenchyma distinct; occasional scattered xylem fibres are aseptate and lignified as seen in longitudinal section.

Powder : Reddish-brown; fragments of loose papery layer in surface view consisting of tangentially elongated thick-walled cork cells; crystals of calcium oxalate; vessel of variable size, about 37.0 to 104.0 μ in length and 58.0 to 83.0 μ in width; lumen large; pits simple and fairly numerous. Xylem fibers are stout, long, varying in size, about 139.0 to 177.0 μ in length and 3.0 to 4.0 μm in width; lumen narrow, aseptate, fairly thick-walled, lignified; ends plain and pointed. Powder imparts reddish-brown colour to cold

and hot water as well as oils.

Chemical Test : One gram powder extracted with absolute alcohol (4.20%), petroleum ether (2.70%), chloroform (4.50%) and benzene (4.80%), the extract turns blue when 20% aqueous potassium hydroxide is added to it.

CHEMICAL CONSTITUENTS :

Alkannin and aliphatic ketones

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 7 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 15 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 5 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate : Methanol (95:5:0.5)	On spraying plate with 2% Ethanolic H_2SO_4 and heated for 5 minutes at 115^0 C	3	0.33 0.50 0.90

TEMPERAMENT : Cold 2^0, Dry 2^0

ACTION : Qabiz, Mujaffif Jaali

THERAPEUTIC USE : Qurooh–e–Khabeesa, Harq, Bard, Namla, Zof–e–Basar

DOSE : 3 – 5 g

IMPORTANT FORMULATIONS : Marham–e–Jadwar; Marham- e–Khanazeer; Raughan – e – Surkh

SALAB MISRI
(Root tuber)

The drug Salab Misri consists of dried root tubers of *Orchis mascula* Linn. (Orchidaceae), a terrestrial erect orchid, found in Himalayas and Western Tibet at altitudes of upto 3600 m and having entire oblong or palmately lobed tubers.

OTHER NAMES :

Arabic	:	Khusyatus salab, Salab misri
Persian	:	Khana rubah
Bengali	:	Salamisri.
English	:	Salep, Saloop
Hindi	:	Salam panja, Salab misri
Marathi	:	Sala misri
Orissa	:	Sala misri
Sanskrit	:	Mujjatak
Tamil	:	Sala misri
Telugu	:	Goru-chettu
Urdu	:	Salab misri

PART USED : Root

DESCRIPTION :

Macroscopic : Root tubers palmate or simple, the simple ones creamish-white in colour, 5 cm in length and upto 3 cm wide, oblong, often pointed at the lower end and rounded at the upper, where occurs a depressed scar, left by the remains of the stem; generally shrunken, contorted, covered with a rough granular skin, translucent, very hard and horny; fracture is short and granular; fractured surface is shiny, yellowish-white; palmate tubers yellowish white to deep yellow in colour, having 3 to 5 digits, usually broken; odour acetonic, sweet and salty taste with a mucilaginous feel.

Microscopic :

Unprocessed tuber: Transverse section shows an outermost indistinct dark brown layer of epiblema, followed by a few layers of hypodermis, distinct, made up of slightly elongated parenchymatous cells, cortex consisting of 6 to 10 layers of large, thick walled, loosely arranged, mucilagenous parenchymatous cells; with aerenchyma; abundant starch grains are present within the parenchymatous cells; vascular bundles conjoint, collateral, closed, around 4 to 6 in number; bundles sheath well marked.

Powder: Creamish-yellow, shows circular to polygonal yellow coloured mucilagenous parenchyma; reticulate vessels and starch grains.

Note : In "processed" tubers starch grains appear completely gelatinized, but gives the reaction with iodine, although individual grains cannot be made out. Otherwise, they are similar to "unprocessed" tubers.

CHEMICAL CONSTITUENTS :

Glucosides, bitter principles, starch,mucilage, sugar albumin, and trace of and volatile oil.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 % , Appendix 2.2.2.
Total ash	:	Not more than 2 % , Appendix 2.2.3
Acid Insoluble ash	:	Not more than 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not more than 1 % , Appendix 2.2.6
Water soluble extractive	:	Not more than 30 % , Appendix 2.2.7

TLC behaviour of methanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroformte : Methanol :Glacial acetic acid (6:3:1)	On spraying plate with Ethanolic H_2SO_4 and heated for 30 minutes at 105^0 C	6	0.11 0.19 0.26 0.37 0.45 0.56

TEMPERAMENT	:	Hot 2^0, dry 2^0
ACTION	:	Mughalliz-e-Mani, Moallid-e-Mani, Mumsik
THERAPEUTIC USE	:	Surat-e-Inzal, Zof-e-Bah, Jiryan, Qillat-e-Mani, Qillat-e-Haiwanat-e-Manviya
DOSE	:	3-5 g
IMPORTANT FORMULATIONS	:	Safoof Salab, Majoon-e-flasfa

SANBHALU
(Fruit)

The drug Sanbhalu consists of fruits of *Vitex negundo* Linn. Syn. *Vitex bicolor* Willd. (Verbenaceae); a small tree or shrub, 4 to 5 m in height, found throughout India, fairly common in waste land, on road side, on the bank of streams or in moist places near deciduous forests and also cultivated in garden as a hedge plant.

OTHER NAMES :

Arabic	:	Aslaq, Fanjangasht
Persian	:	Banjangasht, Panjangasht, Sisban
Bengali	:	Nisinda, Samalu, Nirgundi
English	:	Negundo
Gujarti	:	Nirgari, Nagoda
Hindi	:	Nisunda, Nishinda, Nirgunda, Shiwari, Shambalu
Kannad	:	Lakki-gida, Lakki, Lakkle
Malayalam	:	Nocci, Karunocci, Vennocci
Marathi	:	Nirgundo, Nirgur, Nirguda, Marwan, Mawa, Marwana
Oriya	:	Beyguna, Beguniya
Punjabi	:	Moraun Sandbhalu, Mewari, Shiwali
Sanskrit	:	Indranika, Indrasurasa, Nilapuspa, Nirgundi, Sindukah, Sinduvarah, Shveta-surasa, Svetavuspah, Vrikshaha
Tamil	:	Nocci, Karunocci, Menocci
Telugu	:	Tella-vavili, Vavili, Veyali, Vavali-padu
Urdu	:	Kumaon-Shiwa, Shiwari, Simali

PART USED : Fruit

DESCRIPTION :

Macroscopic: Fruit a drupe about 3 mm in size, ovoid, light brown to black in colour, tough,shiny and slippery, having four vertical ridges, dividing fruit in four halves; calyx gamosepalous, persistent, whitish brown, 5 sepals; pungent, aromatic odour and no specific taste.

Microscopic: Pericarp consists of a single layered epidermis, with wavy cuticle; epicarp 2 or 3 layered, parenchymatous slightly elongated cells; mesocarp parenchymatous, 10 to 12 layered; starch grains present at definite intervals; groups of xylem cells seen; endocarp parenchymatous 2 to 4 layers fused with testa of the seed.The fruit wall encloses 4 seeds and seeds are separated by a false septum which is parenchymatous and is filled with aleurone grains. The seed is covered by testa and tegmen which are fused with each other. The outer cells of the testa are parenchymatous and inner cells are collenchymatous, whereas, the cells of tegmen are made up of single layered elongated cells. The cells of testa and tegmen contain cluster of starch grains which are simple,

spherical, having hilum at the center, with no striations, size 5 µm diameter. Calcium oxalate crystals are rhomboid, cuboid, hexagonal or prismatic in shape, ranging from 4 to 7 µ in length and 4 to 6 µ in width.

CHEMICAL CONSTITUENTS :

n-tritriacontane, n-nonacosane, p-hydroxybenzoic acid, n-hentriacontane, β-sitosterol, 3,4 dihydroxy benzoic acid, n-pentatriacontane.

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 extractive	:	Not less than 2 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 5 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Aetone : Methanol (75:24:1)	On spraying plate with 10% Methanolic H_2SO_4 and heated for 5 minutes at 105^0 C	4	0.09 0.13 0.17 0.43

TEMPERAMENT : Hot 2^0, Dry 2^0

ACTION : Qatil Kiram, Daf-e-Taaffun, Mohallil-e-Warm, Muqawwi Basar.

THERAPEUTIC USE : Kirm-e-Shikam, Indemal-e-Qurooh, Wajaul Halq, Qula, Warm-e-Reham, Warm-e-Khusyatain, Warm-e-Miqad.

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Raughan-e-Haft-e-Barg Sufoof-e-Fanjankusht.

SANGTARA
(Flower)

The drug Sangtara consists of dried flowers of *Citrus reticulata* Blanco. (Rutaceae), an evergreen, bushy, moderate-sized tree with aromatic yellowish-white flowers, cultivated throughout India in plains and higher elevations for its fruits.

OTHER NAMES :

Arabic	:	Naranj
Persian	:	Narang
Bengali	:	Kamal lebu
English	:	Mandarin, Tangerine
Hindi	:	Santra
Kannad	:	Kittale
Kashmiri	:	Soh-niamta
Malayalam	:	Madhura naranga
Marathi	:	Santra
Oriya	:	Kamala, Santra
Punjabi	:	Santara
Sanskrit	:	Airavata
Tamil	:	Kamala, Kudagu
Telugu	:	Kamalapandu
Urdu	:	Narangi

PART USED : Flower

DESCRIPTION:

Macroscopic: Inflorescence axillary cymes; individual flowers pedicellate, hypogynous, solitary, ebracteate, actinomorphic, complete, pentamerous, bisexual; sepals 5, gamosepalous, cup-shaped, 4-cleft with short, acute teeth, thick, pale green, imbricate; petals 5, polypetalous, oblong, thick and fleshy, blunt, yellowish-white with yellow dots on the back, imbricate; stamens 20 to 25, polyadelphous, filament flattened, fused at the base; anthers oblong-linear, introse, basifixed bright yellow; carpels 10, syncarpous; ovary superior, cylindrical, surrounded at the base by a swollen, prominent rounded annular cup-shaped disk, 10 celled with several anatropous ovules in each cell, attached in 2 rows, axile placentation; style erect, single and short, deciduous, thick, nearly as long as the stamens; stigma capitate; fragrance sweet.

Microscopic:

Pedicel- Transverse section of pedicel shows single layered epidermis covered with cuticle; parenchymatous ground region consists of more or less isodiameteric rounded cells; oil present in a large lysigenous cavity; vascular bundles arranged in a ring.

Sepal- Transverse section shows upper and lower epidermis, covered with cuticle, between these 10 or 11 layers of undifferentiated loosely arranged isodiameteric cells of mesophyll, interspered with rows of vascular strands; large lysigenous cavities ful of oil are seen in mesophyll cells; unicellular, non-glandular trichomes present on both epidermis: stomata present on upper epidermis.

The surface view of both the upper and lower epidermis shows compactly arranged, polygonal, straight-walled parenchymatous cells containing simple starch grains, unicellular, non-glandular trichomes.

Petal - Transverse section shows an irregular outline, with upper epidermis made up of rectangular cells, covered with striated cuticle; the mesophyll consists more or less isodiameteric, parenchymatous cells arranged loosely, with intercellular spaces; lower epidermis made up of rectangular cells, interrupted with sunken oil glands; vasculature consists of a large vein and small veinlets.

The surface view of the upper epidermis shows compactly arranged, polygonal, straight-walled parenchymatous cells containing simple starch grains, paracytic stomata. The lower epidermis shows compactly arranged, polygonal, straight-walled parenchymatous cells containing simple starch grains.

Androecium- Transverse section of filament shows single layered epidermis covered with striated cuticle; followed by parenchymatous isodiameteric cells; vascular bundle simple.

Transverse section of anther shows four chambers, two on either side, connected by parenchymatous cells which encloses a vascular bundle; anther consists of a single layer of epidermis, composed of thin walled, rectangular, parenchymatous cells followed by endothecium of thin walled fibrous cells; pollen sac contains pollen grains. Pollen grains 35 to 45 μ in diameter, spheroid; exine not more than 4μ thick, reticulate, germ pores 4.

Ovary- Transverse section of ovary shows outer part of solid mass of parenchymatous tissue, embedding large oil cavities and vascular bundles; ovary consists of 10 locules, each locule contains many ovules; axile placentation.

Powder: Creamy white with typical citrus smell; shows fragments of parenchymatous cells, epidermis of petal and sepal in trichomes, fibrous endothecium of anther, pollen grains and starch grains measuring 15 to 25μ in diameter.

CHEMICAL CONSTITUENTS :

Neohesperidin, naringin glycosides, desmosterol and ergoterol lucosides, resins, β-sitosterol and tannins.

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 extractive	:	Not less than 7 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 27 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Diethyl Ether (80:20)	On spraying plate with 10% Methanolic H_2SO_4 and heated for 5 minutes at 105^0 C	5	0.10 0.16 0.50 0.60 0.72

TEMPERAMENT : Cold 2^0, Moist 2^0

ACTION : Muqawwi Qalb, Muqawwi-e- Meda, Musakkin, Daf-e-Ufoonat, Jali, Muqawwi-e-Dandan.

THERAPEUTIC USE : Zof-e-Meda, Zof-e-Qalb, Atash Mufrit, Lissa-e- Damia, Kalaf, Bahaq.

IMPORTANT FORMULATIONS : Arq-e-Sangtara

SANGTARA
(Fruit pericarp)

The drug Sangtara consists of rind of fruit of *Citrus reticulata* Blanco. Syn. *Citrus aurantium* L. (Rutaceae); an evergreen bushy moderate sized tree; cultivated throughout India in plains and higher elevations fruits are globose or sub-globose with thin tight or loose rind.

OTHER NAMES :

Arabic	:	Naranj
Persian	:	Narang
Bengali	:	Kamal lebu
English	:	Mandarin, Tangerine
Hindi	:	Santra
Kannad	:	Kittale
Kashmiri	:	Soh-niamta
Malayalam	:	Madhura naranga
Marathi	:	Santra
Oriya	:	Kamala, Santra
Punjabi	:	Santara
Sanskrit	:	Airavata
Tamil	:	Kamala, Kudagu
Telugu	:	Kamalapandu
Urdu	:	Narangi

PART USED : Fruit Pericarp

DESCRIPTION:

Macroscopic: The dried orange rind in pieces measuring up to 0.3 cm in thickness; colour variable, but generally reddish to brown; brittle and tough when dried, but supple when moist; outer surface rugged and marked by numerous minute pits corresponding to the sub adjacent oil glands; inner surface whitish, 'zest' somewhat lacunose (pithy); odour aromatic and taste bitter.

Microscopic: Epidermis single layer of small cells covered with thin cuticle; with paracytic stomata; followed by parenchymatous tissue which encloses large oil glands made up of oil cells containing oil droplets. Prismatic Calcium oxalate crystals present, up to 115 μ long and 25 μ broad, found scattered. Outer parenchymatous layer contains numerous solid yellow bodies; inner layer is made of loosely packed parenchyma consisting of branched cells separated by intercellular spaces; a few vascular bundles seen in this layer, mostly surrounded by cells containing calcium oxalate crystals, hesperidine crystals and small simple starch grains.

Powder : Powder yellowish in colour, oily in nature with typical sweet smell of orange. Fragments of epidermis, parenchymatous tissue having some part of oil gland and traces of vascular bundles are seen; oil droplets, starch grains, solid yellowish green bodies, calcium oxalate and hesperidine crystals are seen scattered.

CHEMICAL CONSTITUENTS :

Tangeretin, 5-O-dimethyl citromitin, Cholesterol, Citromitin, Linalool, Campesterol, Hesperidin, Limonene, Stigmasterol, Neohesperdin, α-Pinene, Terpinolene, α-terpinene, β-pinene, Sabinene ρ-cymene, β -sitosterol, Myrcene, α -teripieol, Dimethyl anthranilate.

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 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 10 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 31 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Aetone : Methonol (75:24:1)	On spraying plate with 10% Methonolic H_2SO_4 and heated for 5 minutes at 105^0 C	4	0.16 0.22 0.49 0.89

TEMPERAMENT : Cold 2^0, Moist 2^0

ACTION : Muqawwi-e-Qalb Muqawwi-e-Meda, Musakkin, Daf-e-Ufoonat, Jali, Muqawwi Dandan.

THERAPEUTIC USE : Zof-e-Meda , Zof-e-Qalb, Atash Mufrit, Lissa Damia, Kalaf, Bahaq.

DOSE : Q. S.

IMPORTANT FORMULATIONS : Sufoof Sangtara

SAZAJ HINDI
(Stem Bark)

The drug Sazaj Hindi consists of dried stem bark of *Cinnamomum tamala* (Buch. Ham.) Nees and Eberm. (Lauraceae); a small ever green tree upto 7.5 m high and occurs in tropical, sub tropical Himalayas between 900-2300 m often raised in nursery.

OTHER NAMES :

Arabic	:	Ternelly
Persian	:	Sazaj-e-Hindi
Assamese	:	Tejpat; Mahpat
Bengali	:	Tejpatra; Tejpata
English	:	Indian cassia
Gujarathi	:	Tamalapatra
Hindi	:	Tejpat (Leaves) Dalchini (Bark)
Kannad	:	Tamalpatra; Dalchini Etc.
Kashmiri	:	Dalchinipan ; Tajpatra
Malayalam	:	Karuvapatta patram
Marathi	:	Tamalpatra
Oriya	:	Tejapatra
Punjabi	:	Tajpater
Sanskrit	:	Tejpatra; Tanalpetra
Tamil	:	Lavangapatri
Telugu	:	Talisapatri
Urdu	:	Tezpat

PART USED : Stem bark

DESCRIPTION:

Macroscopic : Bark is flat or slightly curved; 2 to 11.0 cm in length, 1 to 2.0 cm in width, 0.3 to 1.2 cm thick, hard, outer surface rough, dark brown, having patches of cork; inner surface brown, smooth with some depression at places; fracture short odour less aromatic than *C. zeylanicum* and *C. cassia*; taste sweet with a warm sensation.

Microscopic : Transverse section of the bark shows about 7 to 10 layers of cork; cells are compactly arranged, thick-walled, rectangular and reddish-brown; epidermis obliterated; cork followed by a large zone of cortical; the outer three or four layers of cells are suberized where the outer most layer cells have thickened outer walls; the inner cortex consists of irregularly arranged and generally tangentially elongated parenchyma cells; primary phloem cells not distinct; at places sclerenchyma cells show uniformly thickened walls; sclereids are widely distributed singly or in small group of various sizes and shapes, of about 15 to 81 μ in length and 12 to 42 μ in width with ramified pits and narrow lumen; almost uniformly thickened or in dome, U-shaped; phloem fibers numerous, measuring about 390 to 550 μ in length and 30 to 32 μ in width at the middle; pointed ends, heavily thickened, aseptate, lumen narrow; medulary ray consists of

roughly radially elongated parenchyma cells; acicular crystals of calcium oxalate measure about 5 to 8 μ in length; spherical starch grain is of about 6 to 10 μ in diameter; at places oil cells and oil droplets are frequently present.

The fragments of the bark in surface view show numerous cork-tissue; cells are rectangular, thick-walled, suberized and reddish-brown.

Powder : Brown, fragrant, less aromatic than *C. zeylanicum* or *C. cassia*, taste sweet and hot; shows sclereids of various sizes; oil cells, starch grains, acicular crystals, abundant oil droplets, cork- tissue and fibers of variable length are present.

CHEMICAL CONSTITUENTS :

Essential oil and Diterpines

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 3 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 22 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 5 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Petroleum ether : Diethyl ether : Ethyl Acetate (80:18:2	On spraying plate with Vaniline H_2SO_4 and heated for 5 minutes at 105^0 C	3	0.26 0.48 0.60

TEMPERAMENT : Hot 3^0, Dry 2^0

ACTION : Muqavvi-e-dimagh , Mufarreh-e-Qalb Muqavvi-e-Qalb , Muqavvi-e-medah Kaasir-e-Riyah ,Moharrik ,Mudir-e-baol Mushtahi ,Mudir-e-Haiz

THERAPEUTIC USE : Sual, Nafkh-e-Shikam, Soo-e-Hazm Khafqan, Wajaul Qalb, Yarqan

Dose : 3 – 5 g

Important Formulations : Dawa-ul-Misk Motadil, Dawa-ul-Misk Motadil Jawahar Wali, Dawa-ul-Kurkum Kabir, Dawa-ul-Kurkum Saghir, Halwa-e-Chobchini.

SHALGUM
(Seed)

The drug Shalgum consists of dried seeds of *Brassica rapa* Linn. (Brassicaceae), an erect, annual herb with a swollen tuber; cultivated for its napiform tuberous root used as vegetable.

OTHER NAMES :

Arabic	:	Luft
Persian	:	Shalghum
Assamese	:	Salgam.
Bengali	:	Shalgum
English	:	Turnip
Hindi	:	Shalghum
Kannad	:	Turnip
Marathi	:	Salgum
Oriya	:	Salgum
Punjabi	:	Gonglu, Thipper
Sanskrit	:	Bhuitagama, Duradharsha, Ugragandha
Tamil	:	Seemamullangi
Telugu	:	Turnip
Urdu	:	Shalgum, Shaljam

PART USED : Seed

DESCRIPTION :

Macroscopic : Seeds small, black to brown, spherical, 1.5 to 2 mm in diameter; testa thin, brittle, surface minutely reticulate; taste sharp and bitter.

Microscopic :Transverse section of seed shows embryo and two cotyledons enclosed in a testa. The testa is single layered, well developed, formed of polygonal tabular cells completely filled brownish content; hypodermis 2-3 layered, consists of large empty and flattened cells, few cells contain oil globules; mucilage present below the hypodermis; cotyledons two, large, consist of oval to polygonal, thin-walled parenchymatous cells containing aleurone grains and oil globules; embryo conduplicate, consists of thin walled parenchymatous cells.

Powder : Brownish-yellow; fragments of testa with thin-walled hexagonal epidermal cells in surface view, filled with brown content; group of thin walled palisade parenchymatous cells, filled with oil globules and aleurone grains are visible.

CHEMICAL CONSTITUENTS:

L-arabinose, D-galactose, D-glucuronic acid, 3-butenyl iso-thiocynate, 2-phenyl ethyl iso-thiocynate, phenyl acetonitrile, D-galactosyl-myo-inositol.

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 extractive	:	Not less than 17 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 17 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene: Chloroform : Methanol (90:7.5: 2.5)	On spraying plate with 10% Methanolic H_2SO_4 and heated for 5 minutes at 105^0 C		0.16 0.22 0.49 0.89

TEMPERAMENT : Cold 2^0, Moist 2^0

ACTION : Mudirr-e-Haiz, Mudirr-e-Baul, Mughazzi, Mushtahi, Daf-e-Sual.

THERAPEUTIC USE : Sual, Laghari, Zof-e-Ishtiha, Ehtebas-e-Baul, Ehtebas-e-Haiz.

DOSE : 3g

IMPORTANT FORMULATIONS : Luboob-e-Kabeer, Laboob-e-Sagheer

SHALGUM
(Tuber)

The drug Shalgum consists of dried, sliced pieces of tuber of *Brassica rapa* Linn. (Brassicaceae), an erect, annual herb with a swollen tuber; cultivated for its napiform tuberous root used as vegetable.

OTHER NAMES :

Arabic	:	Luft
Persian	:	Shalghum
Assamese	:	Salgam
Bengali	:	Shalgum
English	:	Turnip
Hindi	:	Shalghum
Kannad	:	Turnip
Marathi	:	Salgum
Oriya	:	Salgum
Punjabi	:	Gonglu, Thipper
Sanskrit	:	Bhuitagama, Duradharsha, Ugragandha
Tamil	:	Seemamullangi
Telugu	:	Turnip
Urdu	:	Shalgum, Shaljam

PART USED : Tuber

DESCRIPTION :

Macroscopic: Whole, dried tuber or dried sliced pieces of variable sizes, pieces with outer epidermis intact reddish-brown, smooth except for protuberances at a few places, cut surface creamy-white, difficult to break, pliable; edges curly; scars of rootlets or occasionally a few rootlets present. Taste is sweet; odour not distinct.

Microscopic : Transverse section of tuber shows outer single layered epiblema, cells small, rectangular; cork a few layers of slightly compressed, irregularly arranged, tangentially elongated cells filled with dark-reddish brown content; cortex consists of isodiameteric, thin walled parenchymatous cells containing circular to oval, simple starch grains with hilum at the center, 5 to 10 μ in diameter; phloem present on outer side of the cambium, sieve elements usually crushed; cambium consists of thin walled cells, 2 to 3 layered; meduallary rays distinct, up to 5 cells in width, few cells containing small prism of calcium oxalate crystals; xylem consists of vessels, (30 to 40μ in diameter) and fibers; primary xylem located at the center; pith absent.

Powder : Light brown in colour; shows fragments of parenchymatous cells, cork cells, xylem fibers 600 to 800μ in length, scalariform- reticulate, scalariform and helical vessels, starch grains 8 to 15 μ in diameter and crystals of calcium oxalate.

CHEMICAL CONSTITUENTS: Reducing sugars, flavonoids, saponins.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 14 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 10 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 7 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 38 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Benzene : Chloroform : Methanol (90:7.5: 2.5)	On spraying plate with 10% Methanolic H_2SO_4 and heated for 5 minutes at 105^0 C	4	0.20 0.27 0.70 0.76

TEMPERAMENT : Cold 2^0, Moist 2^0

ACTION : Muqawwi-e-Bah, Hazim, Mudirr-e-Baul, Mudirr-e-Haiz.

THERAPEUTIC USE : Sual, Laghari, Zof-e-Ishteha, Ehtebas-e-Baul, Ehtebas-e-Haiz.

DOSE : Q. S.

SHAQAQUL-MISRI
(Rhizome)

The drug Shaqaqul-Misri consists of dried "rhizome" of *Pastinaca secacul* Linn. (Apiaceae); a herb found in Middle East and Southern Europe and imported into India.

OTHER NAMES :

Arabic	:	Shaqaqul, Shiqaqul, El - Shiqaqul
Persian	:	Shaqaqul, Gazardasti
Bengali	:	Satmuli
English	:	Parsnip
Gujarathi	:	Sufed or Safeta Musli, Satavar
Hindi	:	Satavar, Safed Musli, Dudhali, Satali, Sabali
Malayalam	:	Shedeveli
Marathi	:	Safeda-musali
Tamil	:	Shadavari
Telugu	:	Shatavari
Urdu	:	Shaqaqulmisri, Jangalgajar

PART USED : Rhizome

DESCRIPTION:

Macroscopic : Pieces of the drug are slender; varies from 1.0 cm to 6.0 cm in length and 0.5 to 1.0 cm in diameter; brown and blackish brown in colour; wrinkled; hard when dry; show branches and bear clear nodes and internodes, from the nodes arise lateral roots against each groove, internodes show clear vertical striations; lateral roots arise from the nodes in a ring particularly against each groove; when it is kept in water for sometime the striations disappear; the material becomes cylindrical, flexible and fleshy; sweet in smell.

Microscopic :

Root : Transverse section is almost circular and wavy. Single layered epidermis consists of small rectangular cells with slightly suberized outer surface; followed by a single layer of large thin-walled parenchymatous cells of hypodermis having rectangular shape. Cortex is about 5 to 6 layered consisting of normal parenchymatous cells; at places mucilage cells are present; some cells are occupied by bundle of acicular crystals of calcium oxalate. Vascular strands are surrounded by a layer of endodermis and pericycle. There are a number of exarch vascular bundles alternating with radially oriented phloem strands. The distinct pith consists of thin-walled parenchymatous cells. The orientation of vascular bundles clearly indicates the monocot root structure.

Rhizome: Transverse section of the drug is almost circular or wavy in outline; enclosed by single layered isodiametric to tangentially elongated, thick-walled epidermal cells having thick cuticle; older part consists of obliterated epidermis. The cortical tissue is parenchymatous; sclerenchyma totally absent. Entire tissue system is traversed by mucilaginous cells of varying dimensions, frequency of which are comparatively higher

in peripheral region; bundles of acicular crystals of calcium oxalate are frequently present; lateral roots are developing opposite to the vascular bundle; the outer cork cells are irregular, loosely arranged, while the inner layers are radially arranged and tangentially elongated, suberized and brown; number of layers varies from 2 to 25, endodermis absent. Vascular bundles are collateral, concentric and scattered all over. Most of the vascular bundles peripherally placed are collateral and towards the centre majority of them are concentric amphivasal; vascular bundles are of varying sizes; the inner ones are bigger in size; tend to form tangential ring clearly showing collateral structure with endarch xylem; bundle sheath not distinguishable; some vascular bundles are represented only by phloem or xylem.

Powder: Brownish with spicy odour and bitter in taste; stickiness felt in mouth; plenty of parenchymatous cells of various sizes, fragments of brown cork cells, vessel of different lengths having annular thickenings; fibers numerous, thick-walled and lumen of varying width are present.

CHEMICAL CONSTITUENTS:

Volatile oil, protein, sterols, terpenes, coumarins

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 5 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 24 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 43 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Butanol : Acetic acid: Water (4:1: 5)	On spraying plate with Vanilline Sulphuric acid reagent and heated for 5 minutes at 115^0 C		0.27 0.38 0.55 0.75

Temperament	:	Hot 2^o, Dry 2^o
Action	:	Muwallid –e- mani, Mughalliz -e- mani, Mufriz - e -sheer
Therapeutic Use	:	Zof-e-Bah, Jiryan, Ehtelaam, Surate-e-inzaal
Dose	:	3-5 g powder
Important Formulations	:	Laboob-e-Kabir, Majoon-e-Talmakhana, Majoon-e-Saalab. Yaqooti.

SUMAQ
(Fruit)

The drug Sumaq consists of dried fruit of *Rhus coriaria* Linn. (Anacardiaceae); commonly found in Persia and imported into India.

OTHER NAMES :

Arabic	:	Gardah-e-Sumaq, Timtima, Tamtam
Persian	:	Samaka, Samak, Sumaq
Bengali	:	Sumok
English	:	Sumach, Sumak
Hindi	:	Tatrak, Raitung
Kashmiri	:	Samak, Chokmusur
Marathi	:	Sumak
Punjabi	:	Minas, Ninawa, Samakdana, Tungla
Sanskrit	:	Tandidik
Urdu	:	Sumaq

PART USED : Fruit

DESCRIPTION:

Macroscopic :

Fruit – Small, dark brown, hairy, hard, laterally compressed drupe; 3.5 to 4.0 cm in length and 2.0 to 2.5 cm in width; persistent calyx.

Seed – Small, 0.3 to 0.5 cm in length and 0.2 to 0.3 cm in width; brown, polished and hard; odour spicy.

Microscopic :

Fruit: Transverse section shows cuticle and a single layered epidermis with characteristic horn-shaped multicellular trichomes; mesocarp 5 or 6 layered cells are thin walled, parenchymatous, filled with oil bodies and tannin; endocarp tissue crushed.

The fragments of the epidermal fruit wall cells in surface view are polygonal and moderately thick walled; show the presence of abundant, small, circular cicatrices with the epidermal cells radiating around it.

Seed : Transverse section of mature seed shows testa differentiated into a radially much elongated thick walled outer layer of palisade cells filled with some brownish contents; followed by a layer of elongated but much smaller radial cells with lignified walls; the inner integumentary cells are also composed of radially much elongated thick-walled palisade cells, similar to outer layer; endosperm tissue with numerous oil globules

followed by tissues of the embryo present. The fragments of the dark brown testa in surface view show uniformly thick-walled, almost square or rectangular cells.

Powder : Powder is dark-brown, bitter in taste; shows characteristic horn-shaped multicellular trichomes, large and small palisade cells from testa, fragments of fruit walls with cicatrices; testa of the seed; embryo and oil globules.

CHEMICAL CONSTITUENTS :

Tannins and Fatty acids

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 extractive	:	Not less than 55 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 19 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl acetate: Formic acid (90:8.5: 1.5)	On spraying plate with Phosphomolybdic acid reagent H_2SO_4 and heated for 5 minutes at 110^0 C	7	0.15 0.23 0.30 0.35 0.43 0.70 0.82

TEMPERAMENT : Cold 2^0, Dry 2^0

ACTION : Musakkin, Qabiz

THERAPEUTIC USES : Ishal-e-Safrawi, Zaheer,Ghsayan,Qai, Zalaqul Ama

DOSE : 3 – 5 g

IMPORTANT FORMULATIONS : Anooshdaru Sada, Anoshdaru Luluvi; Habb-e- Sumaq

TALMAKHANA
(Seed)

The drug Talmakhana consists of dried seed of *Asteracantha longifolia* Nees. Syn. *Hygrophila spinosa* T. Andres. (Acanthaceae); a small, spiny weed found in moist places throughout India.

OTHER NAMES :

Assamese	:	Kulekhara
Bengali	:	Tuliakhara, Kamlakalika, Kuliakhara Bhikshu, Shrigali, Pushpa
Gujarathi	:	Ekharo, Gokhru
Hindi	:	Talmakhana, Gokhula - Kanta, Gokshura
Kannad	:	Kolayalike
Kashmiri	:	Talmakhana, Talimakhana
Malayalam	:	Vayalculli
Marathi	:	Talimakhana
Oriya	:	Koillekha, Koilrekha
Punjabi	:	Talmakhana, Talimakhana
Sanskrit	:	Kakilaksha, Kolistha, Ikshugandha, Atichhatra
Tamil	:	Nirmuli
Telugu	:	Neerugubbi
Urdu	:	Talmakhana

PART USED : Seeds

DESCRIPTION:

Macroscopic:

Seed - Small, brown, 4.0 to 6.0 mm long and 2.5 to 3.5 mm wide, much flattened and truncated at the base, ovate-cordate in appearance, smooth when dry; if soaked in water and examined immediately under low power, adpressed trichomes start spreading and radiate all around the seeds except at the truncated part.

Microscopic:

Seed : shows a single layered epidermis; covered with a thin cuticle; bunch of unicellular trichomes are arising from epidermal cells where mucilaginous substance is produced; each trichome measures over a mm in length, pointed at the apex and consisting of annular thickenings; epidermis is followed by 1 or 2 layers of almost tangentially elongated parenchymatous cells where the innermost cells are crushed; disintegrated endosperm consist of oval to polygonal, thin-walled, parenchymatous cells with oil globules.

When seen in surface view the fragments of the epidermis of testa are composed of rectangular to polygonal prenchymatous cells; cell walls are slightly thickened. The mucilaginous trichomes which are abundant form mat like covering and remain attached to the epidermis of the seed.

Powder : Brown; odour spicy; shows mucilaginous unicellular, uniseriate, trichomes with annular thickenings, fragments of embryo, numerous parenchyma cells and oil globules.

CHEMICAL CONSTITUENTS : Alkaloids, and fatty acids

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 25 % , Appendix 2.2.3
Alcohol soluble extractive	:	Not less than 7 % , Appendix 2.2.4
Water soluble extractive	:	Not less than 6 % , Appendix 2.2.6

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform : Methanol : Acetic acid : Water (85:2.5:3:0.5)	On spraying plate with Analdehyde H_2SO_4 and heated for 5 minutes at 110^0 C	8	0.18 0.21 0.35 0.40 0.62 0.67 0.75 0.97

TEMPERAMENT : Cold 2^o, Moist 2^o

ACTION : Mudirr-e- Baul, Muqawwi-e- Bah, Mughalliz-e-Mani

THERAPEUTIC USE : Waj-ul-mafasil, Suzaak, Hasat-e-Kulliya, Hasat-e- Masana, Istisqa

DOSE : 5-10 g

IMPORTANT FORMULATIONS : Halwa-e-Supari Pak; Safoof-e-Beejband; Safoof-e-Jiryan Khas; Safoof-e-Maghz-e-Kanwal Gatta

TURANJ
(Pericarp)

The drug Turanj consists of dried pericarp of *Citrus medica* Linn. (Rutaceae), an evergreen shrub, 1.8 to 3.6 m high, found wild in Kumaon, Panchmarhi, Sikkim, Garo Hills, Khasia Hills, Chittagong, East Dehradun, Satpura Hills; also cultivated.

OTHER NAMES :

Arbic	:	Utraj
Persian	:	Turanj
Bengal	:	Bara Numbu, Begpura, Bijaura, Honsanebu, Lebu, Bijapur, Bijapurana, Dantura Chhada, Jantughna,
English	:	Citron.
Gujarathi	:	Bijora, Turanj.
Hindi	:	Bara, Nimbu,Bijapura, Kutla, Limbi, Turanj.
Malayalam	:	Gilam, Matalanarakam, Rusakam, Sholangam.
Marathi	:	Limbu,Mahalunga, Mavalung.
Punjab	:	Bajauri, Nimbu.
Sanskrit	:	Amlakeshara,Begapura, Bijaka, Bijaphalaka,
Tamil	:	Kadarangai, Turunji.
		Tawoh.
Telugu	:	Lungamu.
Urdu	:	Turanj.

PART USED : Pericarp

DESCRIPTION :

Macroscopic: Pericarp bright yellow; pieces of about 7 cm long and about 5 cm in width; surface rugged with raised oil glands, clear to naked eye in sections, the inner surface bears a small amount of white 'zest'; fracture is short and granular, fractured surface is yellowish white in colour; characteristic aromatic odour and slightly bitter taste.

Microscopic :

Pericarp: Transverse section of pericarp shows a thick cuticle and a layer of tangentially elongated cells of epicarp; mesocarp consisting of irregular loosely arranged parenchymatous cells containing crystals of calcium oxalate, masses of large oil glands, circular to oval in shape arranged in a row, numerous sclerified fibers and vascular elements.

Powder: Light pale yellow; shows thin walled irregular parenchyma cells, crystals of calcium oxalate 16 to 24 μ in diameter; fibers 180 to 250 μ in length and 45 to 70 μ wide and reticulate vessels.

CHEMICAL CONSTITUENTS:

Essential oils

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 3 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 3 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 22 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Chloroform: Ethyl Acetate (4:1)	On spraying plate with Ethanolic H_2SO_4 and heated for 10 minutes at 105^0 C	8	0.11 0.17 0.24 0.29 0.43 0.54 0.76 0.83

TEMPERAMENT : Cold, Moist

ACTION : Daf-e-Qai, Daf-e-Ghasyan, Qat-e-Safra

THERAPEUTIC USE : Qai, Ghasyan, Humma-e-Safrawi, Ghasyan-e-Harkati

DOSE : 3-5 g

IMPORTANT FORMULATIONS : Anushdaru Lului, Jawarish Tamar Hindi, Jawarish Zarishk, Khamirah Abresham Hakim Arshad wala

USHAQ
(Oleogum resin)

Ushaq consists of oleogum resin obtained by exudation from the stem of the flowering and fruiting plant of *Dorema ammoniacum* Don. (Apiaceae), a native of Iran, as a result of insect injury; exudate dries into tears on the stems or falls to the ground and hardens into lumps.

OTHER NAMES:

Arabic	:	Ush-shaq, Ush-shaj
Persian	:	Ush-shah, Kailyani
English	:	Gum Ammoniac, Ammoniac
Hindi	:	Ushak, Ushuk, Kandar
Tamil	:	Gamanayakam
Telugu	:	Gamanayakam
Urdu	:	Ushaq

PART USED : Oleogum resin

DESCRIPTION :

Macroscopic :

Nodular masses or large lumps, greyish green in colour, darkens with age, as well as big lumps, occasionally mixed with broad, flat mericarps of the fruit and a few pieces of stem; brittle when cold but softens when warmed; freshly fractured surface brown or pale grey; odour balsamic; taste bitter, acrid; partially soluble in water giving turbid solution and slightly soluble in 10% HCl giving a light yellow solution, both solutions show very light blue fluorescence in UV 366nm; completely soluble in 10% H_2SO_4 giving a brown colour solution; partially soluble in ethyl acetate, chloroform and alcohol giving a turbid solution which give blue fluorescence in UV 366nm; insoluble in n-hexane and petroleum ether (60-80°C).

Identification tests:

1. Take 1.0 gm of drug and triturate with water, and to one part of the white emulsion thus obtained, add a few drops of a solution of chlorinated soda; a deep orange colour develops.
2. Add a few drops of ferric chloride solution to the other part of the emulsion. A transient faint violet colour develops.
3. Ushaq complies with the test for freedom from umbelliferone when tested as follows: Boil 0.2 gm of drug powder for a few minutes with 2ml of HCl and the dilute with

equal volume of water, filter, make the filtrate alkaline with dilute ammonia solution and observe it under UV light; the solution should not show blue fluorescence.

CHEMICAL CONSTITUENTS :

Ushaq gum consists of volatile oil, resin and gum. The main constituent of the resin is a phenolic substance, ammoresinol. The other chemical constituents include doremone A, ammodoremin and free salicylic acid (Arnone et al. 1991; Evans, 1996; Wallis, 1985); The volatile oil contains various terpenoids with ferulene as major component (Evans, 1996). It does not contain umbelliferone.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 13 % , Appendix 2.2.3
Acid-insoluble ash	:	Not more than 5 % , Appendix 2.2.4
Water soluble ash	:	Not more than 2 % , Appendix 2.2.5
Alcohol soluble extractive	:	Not less than 68 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 14 % , Appendix 2.2.7
Moisture content	:	Not less than 3.69% , Appendix 2.2.9
Total phenolics	:	Not less than 0.9 % , Appendix 2.2.12

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
n-hexane : Ethyl acetate : Methanol (3.5 : 1.5 : 0.2)	On spraying with 5% alcoholic ferric chloride solution	6	0.10 0.40 0.50 0.64 0.76 0.90

TEMPERAMENT : Hot Dry

ACTION : Mohallil, Daf-e-Taaffun, Munaffis-wa-Mohrrik-e- Balgham

THERAPEUTIC USE : Khanazeer, Salabat-e-Mafasil, Awram-e-Maghabin, Wajaul Mafasil, Sual-e-Muzmin, Zeequn nafas

DOSE : 2 g

IMPORTANT FORMULATIONS : Zimad-e-Ushaq

ZAQOOM
(Fresh latex)

Zaqoom consists of the fresh latex obtained by giving longitudinal incisions to the stem and branches of *Euphorbia royleana* Bioss. (Euphorbiaceae); a shrubby or small tree like spurge, growing upto 15 feet high, common on outer dry slopes of Western Himalayas at an altitude of 3000 to 5000 feet; latex collected from younger stem.

OTHER NAMES:

Arabic	:	Zaqoom, Jakum, Jaurlkalb
Bengali	:	Manasasij, Mansa, Gacchar.
English	:	Common milk hedge
Gujarati	:	Thor Kantalo
Hindi	:	Thor, Shankerpitan-suli.
Marathi	:	Nivdung, Kate nivdung.
Punjabi	:	Donda Thor, Shankerpitan
Sanskrit	:	Snuhi, Snuk, Guda, Sudha, Sehund, Vajri, Mahavriksha.
Urdu	:	Zaqoom

PART USED : Latex

DESCRIPTION :

Macroscopic :

Whitish, viscous liquid; coagulates on standing and when dried yields a pale brown coloured powder; fresh miscible in water; has a rich sweet odour and characteristic taste.

Microscopic :

Latex when mounted in water shows oval to elongated transparent bodies, some dumbbell shaped; occur singly or in cluster, size ranges from 3 to 56 micron in length and 2 to 25 micron in breadth, found scattered.

CHEMICAL CONSTITUENTS:

Caoutchouc, Euphorbin and Calcium.

IDENTITY, PURITY & STRENGTH:

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 2 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 1 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 13 % , Appendix 2.2.6

Water soluble extractive	:	Not less than 9 % , Appendix 2.2.7
Moisture content	:	Not less than 71 % , Appendix 2.2.9

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate : Hexane (3 : 1 : 1)	On spraying plate with 10% H_2SO_4 and heated for 30 minutes at 110^0 C	6	0.14 0.30 0.37 0.48 0.61 0.67

TEMPERAMENT	:	Hot Dry
ACTION	:	Mohammir-e-Jild, Mohallil, Muqarreh, Munaffis-e-Balgham
THERAPEUTIC USE	:	Wajaul-Mafasil, Niqras, Irqun-Nisa Falij, Laqwa, Soal-e-Muzmin, Zeequn-Nafas, Dard-e-Gosh, Atishak, Istisqa, Juzam
DOSE	:	½ to 1 drop
IMPORTANT FORMULATIONS	:	Habb-e-Suranjan Habb-e- Deedan, Itrifal Habbul Qara

ZAQOOM
(Leaves)

Zaqoom consist of the leaves of *Euphorbia royleana* Bioss. (Euphorbiaceae) a shrub or tree like spurge growing upto 15 feet high, common on outer dry slopes of Western Himalayas at altitude of 3000 to 5000 feet.

OTHER NAMES:

Arabic	:	Zaqoom, Jakum, Jaurlkalb
Bengali	:	Manasasij, Mansa, Gacchar,
English	:	Common milk hedge
Gujarathi	:	Thor Kantalo
Hindi	:	Thor, Shankerpitan-suli.
Marathi	:	Nivdung, Kate nivdung.
Punjabi	:	Donda Thor, Shankerpitan
Sanskrit	:	Snuhi, Snuk, Guda, Sudha, Sehund, Vajri, Mahavriksha.
Urdu	:	Zaqoom

PART USED : Leaves

DESCRIPTION :

Macroscopic :

Exstipulate, petiolate, petiole tough, greenish, more or less cylindrical, 1 to 1.5 cm long and 0.4 to 0.5 cm in diameter, extends as midrib in lamina, tapering, toward apex in a line; mid-rib greenish prominent, rather flat on the upper surface of lamina and ridge like on the lower surface, secondary veins alternate; leaf base tapered, lamina glabrous, greenish on upper surface and pale yellow on lower surface; about 25 to 30 cm in length, spathulate, spirally arranged on the fleshy axis; leaf margin reflux very slightly; apex acute.

Microscopic :

Petiole: Transverse section shows a more or less cylindrical outline; cuticle present; epidermal cells barrel shaped, single layered ; trichomes absent; multilayered cortex chlorenchymatous towards periphery and parenchymatous towards stele; cells compactly packed, oval; three closed vascular bundles triangularly arranged, with phloem outside and xylem divided into 5 or 6 radial groups of vessels.

Mid-rib: Transverse section more or less triangular in out-line; epidermis, single layered, cells barrel shaped, covered by thin cuticle; hypodermis of 5 or 6 layers, polygonal, chlorenchymatous; cortical cells parenchymatous, polygonal, compact, concave arc like

vascular cylinder centrally situated, vessels thick walled, spirally thickened, phloem cells also seen.

Lamina: Transverse section shows dorsiventral structure, cuticle present, single layered epidermis on both sides, trichomes absent, palisade cells one or at places in two layers, stomata absent on upper surface but present on lower epidermis; paracytic; mesophyll cells compactly arranged, 2 to 3 layer, polygonal cells of spongy parenchyma in the lower part, vascular cylinder ectophlolic, xylem with spirally thickened vessels, polygonal thick walled phloem cells present. Stomatal index 8.3 to 12.5, vein islet ratio 5 to 7; pallisade ratio 3 to 5.

Powder: Pale green in colour, characteristic odour and taste; under microscope shows remnants of thick walled xylem vessels with spiral thickenings; barrel shaped epidermal cells; thick walled cortical cells are also found.

CHEMICAL CONSTITUENTS:

Phorbal ester, euphol triterpene.

IDENTITY, PURITY & STRENGTH:

Foreign matter	:	Not more than 2 % , Appendix 2.2.2
Total ash	:	Not more than 16 % , Appendix 2.2.3
Acid insoluble ash	:	Not more than 2 % , Appendix 2.2.4
Alcohol soluble extractive	:	Not less than 9 % , Appendix 2.2.6
Water soluble extractive	:	Not less than 20 % , Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl acetate (9:1)	On exposure to Iodine vapours	5	0.38 0.54 0.64 0.88 0.94

TEMPERAMENT : Hot Dry

ACTION : Mohammir-e-Jild, Mohallil, Moqarreh, Munaffis-e-Balghum

THERAPEUTIC USE : Wajul-Mafasil, Niqras, Irqun Nasa Falij, Laqwa, Sual-e-Muzmin, Zeequn-Nafas, Dard-e-Gosh, Atishak, Istisqa, Juzam

DOSE : ½ to 1 drop

IMPORTANT FORMULATIONS : Ayarij-e-Logha

APPENDICES

CONTENTS OF APPENDICES

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.

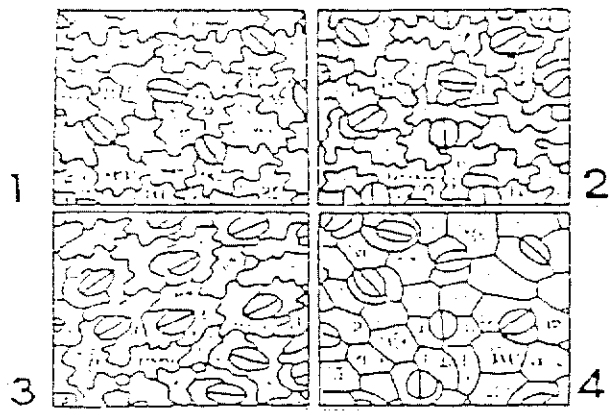

Fig. 1 Various types of stomata

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.

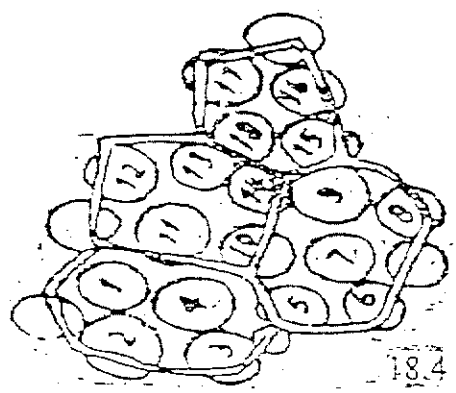

Fig. 2. Palisade ratio $\frac{18.4}{4} = 4.5$

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° 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*, not darker than that produced in the *standard solution.*

Method B

Standard Solution : Proceed as directed under Method A.

Test Solution : Weigh in a suitable crucible the quantity of the substance specified in 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 It angle to the rod. The inner tube with its jacket is supported centrally in a l-liter beaker containing a suitable cooling !iquid 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° $\pm$ 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°C	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 'α' 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* $(\alpha)_D^{25}$ 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* $(\alpha)_D^{25}$ 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 :

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

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

Where

a = corrected observed rotation, in degrees, at 25°
D = D line of sodium light (λ=589.3 mm)
l = length of the polarimeter tube in dm.
d25/25 specific gravity of the liquid or solution at 25°
c = 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 ; $(CH_3)_2$ CO=58.08.

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

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

Distillation Range - Not less than 96 per cent distils between 55.5°. 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_4Cl=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_2O_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 - $BaCl_2, 2H_2O$=244.27.

Description - Colourless crystals.

Solubility - Freely soluble in water.

Lead - Dissolve 1g in 40ml of recelty boiled and cooled water, add 5 ml of *lead-free acetic acid*, render alkaline with *lead-free ammonia solution* and add 2 drops of *lead-free sodium sulphide solution;* not more than a slight colour is produced.

Nitrate - Dissolve 1g in 10ml of *water*, add 1ml of *indigo carmine solution* and 10 ml of *nitrogen free sulphuric acid* and heat to boiling; the blue colour does not entirely disappear.

Barium Chloride Solution - A 10 per cent w/v solution of *barium chloride* in water.

Bismuth Oxynitrate : Bismuth Oxide Nitrate contains 70 to 74 per cent of Bi.

Description - White, micro crystalline powder.

Solubility - Practically insoluble in *water* in *alcohol*: freely soluble in *dilute nitric acid and* in *dilute hydrochloric acid.*

Assay - Weigh accurately about 1g and dissolve in a mixture of 20ml of *glycerin* and 20 ml of *water*. Add 0.1g of *sulphuric acid* and *titrate* with 0.05 *M disodium ethylene diamine tetra acetate*,using *catechol violet solution* as indicator. Each ml of 0.05 *M disodium ethylene diamine tetra acetate* is equivalent to 0.01045 g of Bi.

Borax - Sodium Tetraborate, $Na_2\ B_4\ O_7\ 10H_2O = 381.37$ 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 VS* is required to change the colour to yellow.

Bromothymol Blue – 4,4' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-6 dibromothymol) SS-dioxide $C_{19}H_{19}Br_4O_5S$=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 hydrochloric acid* has been added is yellow. Not more than 0.10 ml of 0.1 *N Sodium hydroxide* is required to change the colour to bluish violet.

Bromothymol Blue - 6,6' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-bromothymol) SS-dioxide $C_{19}H_{19}Br_4O_5S$=624.

Gives a yellow colour in weakly acid solutions and a blue colour in weakly alkaline solutions. Neutrality is indicated by a green colour (pH range, 6.0 to 7.6).

Bromothymol blue solution - Warm 0.1g of *bromothymol blue* with 3.2 ml of 0.05 *N Sodium hydroxide* and 5 ml of *alcohol* (90 per cent); after solution is effected add sufficient *alcohol* (20 per cent) to produce 250 ml.

Complies with the following tests:

Sensitivity - A mixture of 0.3 ml of the solution and 100ml of *carbon dioxide - free water* is yellow. Not more than 0.10 ml of 0.2 *N Sodium hydroxide* is required to change the colour to blue.

Cadmium Iodide - CdI_2 = 366.23.

Description - Pearly white flakes or a crystalline powder.

Solubility - Freely soluble in water.

Iodate - Dissolve 0.2 g in 10 ml of *water*, and add 0.5g of *citric acid* and 1 ml of *starch solution* no blue colour is produced.

Cadmium Iodide Solution - A 5.0 per w/v solution of *cadmium iodide* in water.

Calcium Carbonate - $CaCO_3$ = 100.1

Analytical reagent grade of commerce.

Calcium Chlordie - $CaCl_2H_2$ O=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 - Ca SO_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 - $C_{10}H_8O_8S_2 2H_2O$=356.32.

Description - White to brownish powder. It is usually available as its sodium salt, $C_{10}H_8O_8S_2Na_2$, which is yellow to light brown in colour.

Solubility - Soluble in water; sodium salt is freely soluble in water.

Sensitivity - Dilute exactly 0.5ml of *formaldehyade solution* with water to make 1000ml. dissolve 5mg of *chromotropic acid* or its sodium salt, in a 10ml of a mixture of 9 ml of *suphuric acid* and 4 ml of water. Add 5ml of this solution to 0.2 ml of the *formaldehyde solution*, and heat for 10 minutes at 60 a violet colour is produced.

Chromotropic acid solution - Dissolve 5 mg of *chromotropic acid sodium* salt in 10 ml of a mixture of 9 ml of *sulphuric acid* and 4 ml of water.

Citric Acid - $C_6F_8O_7 7H_2$,O = 210.1

Colourless, translucent crystals, or a white, crystalline powder, slightly hygroscopic in moist air and slightly efflorescent in warm dry air; odourless, taste, strongly acid.

Analytical reagent grade.

Citric Acid, iron free - Citric acid which complies following additional test :

Dissolve 0.5 g in 40 ml of *water*, add 2 drops of *thioglycollic acid*, mix make alkaline with *iron free ammonia solution* and dilute to 50 ml with *water*; no pink colour is produced.

Copper Acetate - Cu $(C_2H_3O_2)$ H_2O = 199.65.
Contains not less than 98.0 per cent of C_4 H_6 O_4 Cu H_2 O

Description - Blue-green crystals or powder, having a faint odour of acetic acid.
Solubility - Soluble in *water*, yielding a clear solution.

Chloride - 3g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 3g complies with the *limit test for Sulphates*. Appendix 2.3.6

Assay - Weigh accurately about 0.8 g and dissolve in 50 ml of *water*, add 2 ml of *acetic acid* and 3 g of *potassium iodide*, with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator, until only a faint blue colour remains; add 2 g of *potassium thiocyanate* and continue the titration until the blue colour disappears. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.01997 g of C_4 H_6 O_4 Cu H_2 O

Copper Acetate, Solution - 0.5 per cent w/v of copper acetate in water.

Cooper Sulphate - Cu SO_4 $5H_2O$ = 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, $Fe(NH_4)(SO_4)_2\ 12H_2O = 482.18$.

Contains not less than 99 per cent and not more than the equivalent of 101 per cent of $Fe(NH_4)(SO_4)_7$, $12\ H_2O$.

Description - Pale violet crystals, or a nearly colourless crystalline powder.

Solubility - Soluble in *water*, yielding a clear yellow or brown solution.

Ferrous Ion - Dissolve 1 g in 50 ml of *water*, add 1 ml of *dilute hydrochloric acid* and ml of *potassium ferricyanide solution*; no green or blue colour is produced.

ASSAY - Weigh accurately about 2g, dissolve in 10 ml of *dilute hydrochloric acid* and dilute to 50 ml with water, add 3 g of *potassium iodide*, allow to stand for ten minutes titrate the liberated iodine with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of titration Each ml of 0.1 *N Sodium thiosulphate* is equivalent to 0.04822 g of $Fe(NH_4)(SO_4)_2\ 12\ H_2O$.

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 $Fe(NH_4)(SO_4)_2\ 12\ H_2O$.

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 $FeC1_3$.

Description - Clear, Yellowish-brown liquid.

Assay - Dilute 2 ml with 20 ml of *water*, add 1 ml of *sulphuric acid* and 0.1 *N potassium permanganate* drop by drop unitl a pink colour persists for five seconds. Add 15 ml of *hydrochloric acid* and 2 g of *potassium iodide*, allow to stand for three minutes, and titrate with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of titration. Each ml of 01. *N Sodium thiosulphate* is equivalent to 0.01622g of $FeC1_3$.

Ferrous Sulphate - $FeSO_4.\ 7H_2O = 278.0$

Description - Transparent, green crystals, or a pale bluish-green, crystalline powder; odourless; taste, metallic and astringent, Eflorescent in dry air. On exposure to moist air, the crystals rapidly oxidise and become coated with brownish yellow basic ferrous sulphate.

Solubility - Freely soluble in water, very soluble in boiling water, practically insoluble in alcohol.

pH - Between 3 and 4, determined in a 5 per cent w/v solution, Appendix 3.1.3.

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Copper, Zinc And Lead - Dissolve 8 g in 40 ml of *hydrochloric acid.* Add 10 ml of *nitric acid* and 15 ml of *water*, boil gently for five minutes and cool. Shake with four quantities, each of 30 ml of *solvent ether* and discard the ether. Heat the acid solution on a water-bath to remove dissolved ether, cool and add sufficient *water* to produce 100 ml (solution A).

Copper - To 10 ml of solution A obtained in the test for Copper, Zinc and Lead, add1 g of *citric acid*, make alkaline with *dilute ammonia solution* and add 25ml of *water* and 5 ml of *sodium diethyldithiocarbamate*.

Ferrous Sulphate Solution - A 2 per cent w/v solution of *ferrous sulphate* in freshly boiled and cooled water.

Ferrous Sulphate Solution must be fre'hly 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 - HC1=36.46
Concentrated Hydrochloric Acid.

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

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

Heavy Metals - Not more than 5 parts per million, determined by method A on a solution prepared in the following manner : Evaporate 3.5 ml to dryness on a water-bath, add 2 ml of *dilute acetic acid* to the residue, and *water* to make 25 ml. Appendix 2.3.3.

Bromide and Iodide - Dilute 5 ml with 10 ml of *water*, add 1 ml of *chloroform*, and add drop by drop, with constant shaking, *chlorinated lime solution*; the chloroform layer does not become brown or violet.

Sulphite - Dilute 1 ml with 10 ml of *water*, and add 5 drops of *barium chloride solution* and 0.5 ml of 0.001 *N iodine*; the colour of the iodine is not completely discharged.

Sulphate - To 5 ml add 10 mg of *sodium bicarbonate* and evaporate to dryness on a water-bath; the residue, dissolved in *water*; complies with the *limit test for sulphates*, Appendix 2.3.6

Free Chlorine - Dilute 5 ml with 10 ml of freshly boiled and cooled *water*, add 1 ml of *potassium iodide solution*, and shake with 1 ml of *chloroform*; the chloroform layer does not become violet within one minute.

Sulphated Ash - Not more than 0.01 percent, Appendix 2.2.11

Assay - Weigh accurately about 4 g into a stoppered flask containing 40 ml of *water*, and titrate with *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.0364 g of 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:- $NH_2.OH,HC1$ = 69.49.

Contains not less than 97.0 percent w/w of $NH_2.OH,HC1$

Description – Colourless crystals, or a white, crystalline powder.

Solubility – Very soluble in *water*; soluble in *alcohol*.

Free Acid – Dissolve 1.0 g in 50 ml of *alcohol*, add 3 drops of *dimethyl yellow solution* and titrate to a full yellow colour with *N sodium hydroxide*; not more than 0.5 ml of *N sodium hydroxide* is required.

Sulphated ash – Not more than 0.2 percent, Appendix 2.2.11

Assay – Weigh accurately about 0.1 g and dissolve in 20 ml of *water*, add 5 g of *ferric ammonium sulphate* dissolved in 20 ml of *water*, and 15 ml of *dilute sulphuric acid*, boil for five minutes, dilute with 200 ml of *water*, and titrate with 0.1 *N potassium permanganate*. Each ml of 0.1 *N potassium permanganate* is equivalent to 0.003475 g of $NH_2OH.HC1$.

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

* **Indigo Carmine** C1 730 15; $C_{16}H_8N_2Na_2O_8S_2$=466.4

Analytical regent grade.

A deep blue powder, or blur granules with a coppery lustre.

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 $C_4H_6O_4Pb,3H_20$.

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.IN: I=126.90; 12.69 g in 1000 ml

Dissolve about 14 g of *iodine* in a solution of 36 g of *potassium iodide* in 100 ml of water, add three drops of *hydrochloric acid*. dilute with water to 100 ml and standardize the solution as follows.

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; $[(H_2NC_6H_4)_2C{:}C_6H_3(CH_3){:}\ NH_2{+}]CI=337.85$

The hydrochloride of rosaniline of such a purity that when used in the preparation of Decolourised solution of Magenta, a nearly colourless solution is obtained.

Description - Dark red powder, or green crystals with a metallic lustre.

Solubility - Soluble in *water*, giving a deep reddish-purple solution.

Sulphated Ash - Not more than 5 percent, Appendix 2.3.6

Magenta solution, Decolorized- Dissolve 1 g of *basic magnenta* in 600 ml of *water* and cool in an ice-bath; add 20 g of *sodium sulphite* dissolved in 100 ml of *water*; cool in an

ice-bath and add, slowly with constant stirring, 10 ml of *hydrochloric acid*; dilute with *water* to 1000 ml.

If the resulting solution of turbid, it should be filtered and if brown in colour, it should be shaken with sufficient *decolourising charcoal* (0.2 to 0.3 g) to render it colourless and then filtered immediately. Occasionally it is necessary to add 2 to 3 ml of *hydrochloric acid*, followed by shaking, to remove the little residual pink colour. The solution resulting from any of the foregoing modifications should be slowed to stand over-night before use.

Decolourised Magenta Solution should be protected from light.

Magnesium Carbonate - Light hydrated basic grade of commerce containing 42 to 45 percent of MgO and complying with the following test.

Ammonia - Dissolve 0.50 g in 4 ml of 2 *M hydrochloric acid*, boil to remove *carbon dioxide*, and dilute with *water* to 95 ml. Add 5 ml of 5 *M Sodium hydroxide* and allow to stand for one hour. Dilute 40 ml of the clear liquid to 50 ml with water and add 2 ml of *alkaline potassium-mercuric iodide solution.* Any yellow colour produced is not deeper than that produced by adding 2 ml of *alkaline potassium mercuric iodide solution* to a mixture of 44 ml of water, 2 ml of *ammonium chloride solution*, 2 ml of 2 *M hydrochloric acid*, and 2 ml of 5 *M sodium hydroxide*.

Magnesium Sulphate: $MgSO_4.7H_2O$-246.47

Description - Colourless, crystals, usually needle-like, odourless, taste, cool, saline and bitter. Efflorescence in warm dry air.

Solubility - Freely soluble in *water*; sparingly soluble in *alcohol*. Dissolves slowly in *glycerin*.

Acidity Or Alkalinity - 1 g dissolved in 10 ml of water is neutral to *litmus solution.*

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Iron - 2 g dissolved in 20 ml of *water* complies with the *limit test for iron*, Appendix 2.3.4.

Heavy Metals - Not more than 10 parts per million, determined by method A on a solution prepared by dissolving 2 g in 10 ml of *water*, 2 ml of *dilute acetic acid* and sufficient water to make 25 ml. Appendix 2.3.3.

Zinc - Dissolve 2 g in 20 ml of *water* and acidity with 1 ml of *acetic acid*. No turbidity is produced immediately on the addition of few drops of *potassium ferrocyanide solution.*

Chloride - 1 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Loss on Ignition : Between 48 percent and 52 percent determined on 1 g by drying in an oven at 105^0 for two hours and igniting to constant weight at 400^0.

Assay - Weigh accurately about 0.3 g and dissolve in 50 ml of *water*. Add 10 ml of *strong ammonia-ammonium chloride solution*, and titrate with 0.05 *M disodium ethylenediaminetertraacetate* using 0.1 g of *mordant black II mixture as indicator*, until the pink colour is discharged from the blue. Each ml of 0.05 *M disodium ethylenediaminetertraacetate* is equivalent to 0.00602 g of $MgSO_4$.

Storage - Store in well-closed container.

Magnesum Sulphate - $MgSO_4$. $7H_2O$ -246.8

Analytical reagent grade of commerce.

Magnesium Sulphate, Dried, $MgSO_4$aq

Dried, general reagent grade of commerce.

Magnesium sulphate solution, ammonical - Dissolve 20 g of *magnesium sulphate* and 20 g of *ammonium chloride* in 80 ml of *water*, and add 42 ml of 5 *M ammonia*. Allow to stand for a few days in a well-closed container; decant and filter.

Mercuric chloride: $HgCl_2$=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 1 ml with 20 ml of *water*, and add a slight excess of *dilute ammonia solution*; the mixture does not become blue. Pass *hydrogen sulphide*; a precipitate is not produced.

Iron - 0.5 ml 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 I percent w/v solution of *phloroglucinol* in *alcohol* (90 percent).

Phosphoric Acid - H_3PO_4=98.00

(Orthophosphoric Acid; Concentrated Phosphoric Acid).

Description - Clear and colourless syrupy liquid. Corrosive.

Solubility - Miscible with water and with *alcohol*.

Hypophosphorous and Phosphorous Acids - To 0.5 ml add 10 ml of water and 2 ml of *silver nitrate solution* and heat on a water-bath for five minutes; the solution shows no change in appearance.

Alkali Phosphates - To 1 ml in a graduated cylinder add 6 ml of *solvent ether* and 2 ml of *alcohol*; no turbidity is produced.

Chloride - 1 ml complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 0.5 ml complies with the *limit test for sulphate*, Appendix 2.3.6

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 10 parts per million, determined by Method A on a solution prepared by diluting 1.2 ml with 10 ml of *water*, neutralizing with *dilute ammonia solution*, adding sufficient *dilute acetic acid* to render the solution acidic and finally diluting to 25 ml with water, Appendix 2.3.3.

Iron - 0.1 ml complies with the limit test for iron, Appendix 2.3.4.

Aluminium and Calcium - To 1 ml add 10 ml of water and 8 ml of *dilute ammonia solution* the solution remains clear.

Assay - Weigh accurately about 1 g and mix with a solution of 10 g of *sodium chloride* in 30 ml of water. Titrate with *N sodium hydroxide*, using *phenolphthalein* solution as indicator. Each ml of N sodium hydroxide is equivalent to 0.049 g of H_3PH_4.

Storage - Store in a well-closed glass containers.

Phosphoric Acid, xN

Solutions of any normality, xN may be prepared by diluting 49Xg of *phosphoric acid* with water to 1000 ml.

Phosphoric Acid, Dilute
Contains approximately 10 percent w/v of H_3PO_4.
Dilute 69 ml of *phosphoric acid* to 1000 ml with water.

Piperazine Hydrate - $C_4H_{10}N_2$, $6H_2O$=194.2.
General reagent grade of commerce.
Colourless, glossy, deliquescent crystals, melting point, about 44^0.

Potassium Antimonate - KSb_{03}, $3H_2O$=262.90
Contains not less than 40 percent of Sb.

Description - White, crystalline powder.

Solubility - White, crystalline Sparingly soluble in *water* very slowly soluble in cold, but rapidly soluble on boiling.

Assay - Weigh accurately about 0.3 g, and dissolve in 100 ml of water, add 2 ml of dilute hydrochloric acid, and pass in *hydrogen sulphide* until the antimony is completely precipitated. Add 2 ml of *hydrochloric acid* and again pass in *hydrogen sulphide*. Boil, filter, was the precipitate with hot water saturated with *hydrogen sulphide*, and dissolve the precipitate in 25 ml of *hydrochloric acid*. Boil to remove *hydrogen sulphide*, and dilute to 50 ml with *water*. Add 2 g *of sodium potassium tartrate*, neutralize carefully with *sodium carbonate*, add 2 g sodium bicarbonate, and titrate with 0.1 *N iodine*, using *starch solution* as indicator. Each ml of 0.1 *N iodine* is equivalent to 0.006088 g Sb.

Potassium Antimonate Solution - Boil 2 g of *potassium antimonate* with 95 ml of *water* until dissolved. Cool rapidly and add 50 ml of *potassium hydroxide solution* and 5 ml of *N sodium hydroxide*. Allow to stand twenty-four hours, filter and add sufficient water to produce 150 ml.

Sensitivity to Sodium - To 10 ml add 7 ml of 0.1 *M sodium chloride*, a white, crystalline precipitate is formed within fifteen minutes.

Potassium Antimonate Solution should be freshly prepared.

Potassium Bisulphate - Potassium Hydrogen Sulphate; $KHSO_4$=136.16.

Contains not less than 98.0 percent and not more than the equivalent of 102 percent of $KHSO_4$.

Description - Fused, white lumps; hygroscopic.

Solubility - Very soluble in *water*, giving an acid solution.

Iron - 2 g complies with the *limit test for iron*, Appendix 2.3.4.

Assay - Weigh accurately about 4.5 g, dissolve in 50 ml of *water* and titrate with *N sodium hydroxide* using *methyl red solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.1362 g of $KHSO_4$.

Potassium Bromate - $KbrO_3$=167.00

Contains not less than 99.8 percent of $KbrO_3$, calculated with reference to the substance dried to constant weight at 105^0.

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

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

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 13 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 $C_4H_4O_6KNa, 4H_2O$.

Sodium Sulphide - Na_2Saq.

Analytical reagent grade. Deliquescent, crystalline masses turning yellow on storage.

Sodium Sulphide Solution - Dissolve with heating, 12 g of *sodium sulphide* in a mixture of 10 ml of *water* and 25 ml of *glycerol* cool and dilute to 100 ml with the same mixture.

Sodium Sulphite, Anhydrous: Na_2SO_3=126.06

Description - Small crystals or powder.

Solubility - Freely soluble in *water*, soluble in *glycerin*; almost insoluble in *alcohol*.

Sodium Thiosulphate - $Na_2S_2O_3$, $5H_2O$=248.17

Description - Large colourless crystals or coarse, crystalline powder; odourless, taste, saline, deliquescent in moist air and effloresces in dry air at temperature above 33^0.

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 - Cl 26100; Sudan III; Solvent Red 23; 1-(4-phenylazophenylazo)-2-naphthol; $C_{22}H_{16}N_4O$=352.40

Description: Reddish-brown powder.

Solubility - Insoluble in *water*; soluble in *chloroform*, in glacial acetic acid; moderately soluble in *alcohol*, in solvent *ether* and in *acetone*.

Sulphamic Acid - NH_2SO_3H=97.09.

Contains not less than 98 percent of H_3NO_3S.

Description - White crystals or a white crystalline powder.

Solubility - Readily soluble in *water*.

Melting Rang - 203^0 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) Bhilawan

After removing the cap (thalamus) of the Bhilawan fruits, the juicy contents (Asal-e-Bhilawan) are squeezed out completely with the help of a red hot tongs. Thereafter, Bhilawan fruits are boiled in fresh water at least for three times. Lastly, the fruits are boiled in milk, washed with water and dried. Precaution must be taken not to touch the juice with hands as the juice is toxic.

(viii) Habb-us-Salateen (Jamalgota)

25 grams of the kernels of Jamalgota is tied in a cloth bag and boiled in one litre of Cow's milk giving sufficient time till the milk becomes dense. When cooled, the kernels are

taken out from the bag and the embryo part (pitta) of the seeds is removed to obtain jamalgota Mudabbar.

(ix) Chaksu

Chaksu is kept in a cloth bag and tied from the mouth. It is then soaked in a vessel of water containing Badiyan (Fennel) equal tohalf the weight of Chaksu or Barg-e-Neem Taza (fresh Neem leaves) equal in weight of Chaksu. The water is boiled for half an ahour and then the cloth bag is removed and allowed to cool. Chaksu is then removed from the bag and rubbed between the palms to remove the outer coverings to get Chaksu Mudabbar.

(x) Azaraqi

70 grams of Azaraqi is buried in Peeli Matti (yellow clay) and water is poured over it daily for ten days. The Azaraqi is then removed and washed. The outer covering (testa) is peeled off with knofe and the cotyledons of Azaraqi are separated after removing the embryo part (pitta). Only the healthy Azaraqi is sorted out for use. It is then washed with hot water and tied in a clean cloth bag. The bag is immersed in a vessel containing two litres of milk. The milk is then boiled till it evaporates, care being taken that the bag does not touch the bottom of the vessel. Thereafter, Azaraqi is removed from the bag and washed with water to obtain Azaraqi Mudabbar.

(xi) Kibreet (Gandhak)

One part of Gandhak Amlasar and two parts of Raughan (Ghee) are taken in a Kadeha (laddle) and kept on a low fire. When Gandhak is melted, four parts of the milk is added. This process is repeated at least three times changing the fresh Ghee and Milk each time to obtain Gandhak Mudabbar.

(xii) Samm-ul-Far (Sankhiya)

Fine powder of Sankhiya is immersed in sufficient quantity of fresh Aab-e-Leemu (Lemon juice) and ground in a mortar of China clay or glass till the juice is completely absorbed. This process is repeated seven times to obtain Samm-ul-Far or Sankhiya Mudabbar.

(xiii) Shingraf

Shingraf is ground with fresh Aab-e-Leemu (Lemon Juice) till it is absorbed and a fine powder is obtained. This process is repeated three times to obtain Shingraf Mudabbar.

(xiv) Seemab

There are three following methods of purifying Seemab :

(a) Seemab is ground with half burnt brick pieces for 12 hours. It is then washed with water and Seemab is separated. The whole process is repeated three times.

(b) Seemab is kept in a four layered thick cloth bag (50 count) and squeezed out by pressing with hands. This process is repeated till the blackish tinge of Seemab is completely disappeared.

(c) Seemab is ground with Turmeric Powder as long as the powder does not change its original colour. The resultant product is called Seemab Mudabbar.

(xv) Khabs-ul-Hadeed

(a) Small pieces of Khabs-ul-Hadeeb are heated red hot in Charcoal fire and then immersed in Aab-e-Tirphala or Sirka Naishakar (Sugarcane Vinegar) by holding each piece with a tongs. The whole process is repeated seven times.

(b) In this process Khabs-ul-Hadeeb is ground to powder form and kept immersed in Sirka Naishakar (Sugarcane Vinegar) or Sharab-e-Angoori (Brandy). The level of either of the two should be 5 cms. above the level of the powder. After 14 days, the Sirka Naishakar or Sharab-e-Angoori is decanted, the powder is dried and fried in Raughan-e-Badam.

(xvi) Beesh (Bachnak or Meetha Telia)

30gms. of Beesh is cut into small pieces, tied in a bag of clean fine cloth and dipped in a vessel containing milk so that the bag is completely immersed without touching the bottom. When the milk is completely evaporated, the pieces of Beesh are removed and washed well with water to obtain Beesh Mudabbar.

(xvii) Hartal

Juice of 5 Kg. of Petha (White Gourd Melon) is taken and kept in a vessel. Sixty grams of Hartal (small pieces) is put in clean, soft cloth bag and immersed in Petha juice without touching the bottom of the vessel and boiled. When the Petha juice is completely evaporated the Hartal pieces are removed and washed with water thoroughly to obtain purified Hartal or Hartal Mudabbar.

(xviii) Sang-e-Surma

There are four following methods of purifying Sang-e-Surma:

(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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