THE UNANI PHARMACOPOEIA OF INDIA

PART - I

VOLUME - IV

सत्यमेव जयते

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

THE UNANI PHARMACOPOEIA OF INDIA

PART - I
VOLUME - IV

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

On behalf of : Government of India, Ministry of Health & Family Welfare

Published by : Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry of Health & Family Welfare, Government of India

August 2007, 5000 copies

Price: Inland – Rs. 230/-
Foreign – US $ 46/-

ISBN: 81-901151-8-9

Printed by : Central Council for Research in Unani Medicine,
Department of AYUSH, Ministry of Health & Family Welfare, Government of India at Rakmo Press Pvt. Ltd., C-59, Okhla Industrial Area Phase-I, New Delhi - 110 020

CONTENTS

सत्यमेव जयते

अनिता दास
ANITA DAS

जय हिन्द

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

FOREWORD

The national policy on Indian systems of medicine recognizes Unani Medicine as well as Ayurveda, Yoga & Naturopathy, Siddha and Homoeopathy as an integral part of the country's health care delivery organization. The Government of India has, since Independence, been extending increasing funds and support for the multifaceted development of these systems. The 11th Five-year Plan has newer schemes for the all round growth of Unani Medicine along with other indigenous systems of healthcare. And at present India is the world leader as far as Unani Medicine is concerned. The country with the largest network of educational, research and healthcare institutions of this system is in a position to cater to the growing international demand for the system as well as the products used therein.

The system uses drugs of natural origin, majority of which come from plants. It also employs drugs of animal and mineral origin. The drugs used in Unani system are devoid of any major side-effects and therefore are safe for use and are cost-effective too. However, there is a need to maintain purity, quality and safety of Unani as well as other traditional medicines through rigorous scientific testing and standardization. It is absolutely essential to lay down pharmacopoeial standards for both single and compound drugs to bring them within the purview of the Drugs and Cosmetics Act, 1940, as amended in 1964.

The Government had set up the Unani Pharmacopoeia Committee (UPC) in 1964 to lay down principles and standards for the preparation of Unani drugs, and also tests of identity, quality and purity of these drugs, leading to the preparation of the official Unani Pharmacopoeia of India. In 1970, a Pharmacopoeial Laboratory for Indian Medicine (PLIM) was also established at Ghaziabad (U.P.) mainly to work for evolving standards for Ayurveda, Unani and Siddha drugs. Concerned with the qualities of AYUSH products it has recently been made mandatory to test all formulations for their heavy metal contents and for microbial contaminants.

The work relating to development of standards for Unani drugs was taken up by the different Drug Standardization Research Units (DSRUs) of the Central Council for Research in Unani Medicine (CCRUM). The CCRUM has over the past 28 years of its functioning grown into an apex body of research and development in Unani Medicine. Now that the CCRUM has also been declared secretariat for the UPC, the Council is expected to contribute significantly to the Unani Pharmacopoeia of India.

So far three volumes of the first part of the *Unani Pharmacopoeia of India* have been brought out containing 45, 50 and 53 drugs, respectively. The present fourth volume carries pharmacopoeial standards for 50 other Unani single drugs.

I place on record my appreciation to the Directors and scientific staff of PLIM, Ghaziabad and CCRUM, and the experts associated with the Unani Pharmacopoeia Committee for their contribution in bringing out these volumes of the *Unani Pharmacopoeia of India.* I hope, the work regarding compound drugs would now be taken up in a time bound manner.

(Anita Das)

23rd August, 2007

PREFACE

Unani System of Medicine has distinction of being a scientific system and its practitioners have been innovative in therapeutics and carried out clinical trials out of the local flora from the countries it has passed through and discovered newer medicines and added to the classical literature. In ancient times, practitioners used to write prescriptions exclusively for a patient based on their diagnosis. At that time it was customary to prepare the formulation either by the practitioner himself or by his pharmacist ("athar" in Arabic). Extreme care was taken regarding the ingredients used in the medicinales to maintain best quality. They were quite selective and had attached great importance regarding the origin of medicinal substances in order to have maximum potency of the resultant formulations. Gradually this established practice was changed.

Urbanization led to neglect of development and maintenance of forest and intern the availability of rich flora. A new trend was setup; agencies for supply of crude drugs were established. In this setup the Unani practitioners could no longer process and prepare their own medicines but started depending on pharmaceutical houses run commercially and on supplier of crude drugs to the extent they needed. The introduction of this new trend in the manufacturing of such type of products has influenced the quality of products tremendously. There was not any government control on the manufacturer of pharmaceutical houses to ensure the quality of the medicines marketed. Now the concept of GLP/GMP/ GCP has already been made mandatory for the manufacture of Unani formulations in order to ensure their quality

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, control over collection and distribution of crude drugs and made positive recommendation for compilation of pharmacopoeias. After independence not only the Unani education, but also Unani drugs, their marketing and manufacturing was given a concrete shape. In compliance with the recommendation of various committees constituted by Union Government, the Central Council for Research in Indian Medicine and Homoeopathy (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 divided into four research Councils and the research work in Unani System of Medicine was entrusted to Central Council for Research in Unani Medicine.

The Pharmacopoeial Laboratory of Indian Medicine (PLIM), Ghaziabad was established in 1970 for testing and standardization of single drugs and compound formulations of Indian System of Medicine. Unfortunately, till date there is no component for Unani System of Medicine at this laboratory. Despite repeated efforts by Unani Pharmacopoeia Committee and individual Unani experts at various levels. Central Council for Research in Unani Medicine, for the first time initiated standardization work on single and compound Unani Drugs through its six smaller Units.

The Government of India has brought the manufacture and sale of Unani Drugs under the purview of drugs and cosmetics Act of 1940. 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 and 2002 under the Chairmanship of Dr. Hussain Zaheer, Dr. Mohd. Yusufuddin Ahmed, Dr. A.U. Azmi, Prof. Syed Khaleefathullah and Dr. Sajid Husain respectively undertaking the work of Unani Pharmacopoeia of India.

In view of multiplicity of combination of different polypharmaceuticals formulations, the first task finalized by UPC has been deciding on one set of combination for each formulation for purpose of standardization of a product. In this area four volumes containing 441, 202, 103 and 166 have already been finalized by UPC and published by Govt. of India. The Govt. of India took this initiative to ensure that there should be uniformity in the Unani Medicine marketed in so far as their identity, strength and purity are concerned and to assure the quality of the medicine, through proper drug control measures.

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 Institute/Units of Central Council for Research in Unani Medicine. 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, II, III & IV. The Unani Pharmacopoeia of India Part I, Vol. I, II & III comprise 45, 50 & 53 monographs respectively, each of single drugs of plant origin which are used in one or more formulations enlisted in the National Formulary of Unani Medicine. In compiling the monographs the title of each drug has been given as in the Unani Literature. The definition of the drug giving its identities in scientific nomenclature and very brief information about its source, occurrence, distribution etc. has been given. 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 in powder form. Each monograph also gives the details of chemical constituents' physico-chemical standards and an assay, pH value, extractive valves and TLC behaviour of petroleum ether (60-80°) 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 has been mentioned even though there is no specific established experimental method to quantify them is available for the time being.

Vigorous attempts were made to draw analogy from the modern tools of quality management in order to fix the protocol for determination of the shelf life of each of formulation. Finally, it is suggested that the relative humidity chamber be used for this purpose. Discussions were also held periodically to evolve a methodology to find out the quantum of dose for each formulation scientifically and also to check the toxicity effects, if they existed.

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 equipments, 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 Unani Pharmacopoeia of India – Part-I Vol IV comprising 50 single drugs of herbal origin, the format and procedure has been laid down and their should not be any difficulty for the researchers and pharmaceutical houses to plan the research so that the out put of work could be accelerated.

Stupendous efforts were made by the committee to prepare Unani pharmacopoeial document on modern lines which may pave the way for its globalization. However, I strongly believe that there is ample scope for improvement. It is recommended that Director CCRUM in one of his laboratories, establish techniques such as DNA finger printing. This would be helpful in sorting out spurious species from genuine ones.

Unani Pharmacopoeias is a collection of quality standards. It would be used by individuals and organizations involved in pharmaceutical research, development, and manufacture and testing. Pharmacopoeias standards would be publicly available at the designated agencies and legally enforceable standards of quality for medicinal products and their constituents. The pharmacopoeias is an important document in the control of Unani medicines which compliments and asserts the licensing and inspection process of the medicines and health care products by the regulatory agencies of the Government of India.

Pharmacopoeial standards are compliance requirements that provide the means for an independent quality of each article and apply through out the shelf life of a product.

The Unani Pharmacopoeia Committee requests the Government of India to pass an Ordinance/ Act for the adoption of the Unani Pharmacopoeia of India Volume-IV, and bring it under the purview of the Drug and Cosmetics Act, 1940.

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, Pharmacopoeial Laboratory of Indian Medicine (PLIM), Ghaziabad, Central Council for Research in Unani Medicine (CCRUM), New Delhi, Scientists and 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 would not have seen the light of the day.

I place on record my sincere thanks to Dr. Mohammed Khalid Siddiqui, Director, CCRUM, Dr. Anis Ahmad Ansari, Formerly Advisor (Unani), Dr. Asad Pasha, Dy. Advisor (Unani), Dr. Jalees Subhani, Assistant Advisor (Unani), Dr. Mukhtar Qasmi, Assistant Advisor (Unani), Dr. Shamshad Ahmad Khan, Asst. Director (Chem.), Mr. Shamsul Arfin, Research Officer (Chem.) and Mr. Aminuddin, Research Officer (Bot.) of CCRUM.

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

(Dr. Sajid Husain)
Chairman
Unani Pharmacopoeia Committee

New Delhi
Dated: Sept. 01, 2007

LEGAL NOTICES

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

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

In general, the Drugs & Cosmetics Act, 1940 (subsequently amended in 1964 and 1982), the Dangerous Drugs Act, 1930, the Poisonous Act, 1999 and the rules framed there under should be consulted.

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

GENERAL NOTICES

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

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

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

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

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

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

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

Metric measures are required by the Pharmacopoeia to be graduated at 25^0C and all measurements involved in the analytical operations of the Pharmacopoeia are intended, unless otherwise stated to be made at that temperature.

Identity, Purity and Strength : Under the heading "Identity" wherever it comes, tests are provided as an aid to identification and are described in their respective monographs.

The term "foreign matter" is used to designate any matter which does not form part of the drug as defined by the monograph. Vegetable drugs used as such or in formulations should be duly identified and authenticated and be free from insects, pests, fungi, micro-organisms, pesticides and other animal matter including animal excreta and be within the permitted and specified limits for lead, arsenic and heavy metals and not showing abnormal odour, colour, sliminess, mould or other evidence of deterioration.

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

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

Standards : For statutory purpose, statements appearing in the UPI, part I, Vol IV, under Description, those of definition of the part and source plants, and Identity, Purity and Strength, shall constitute standards.

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

Quantities to be weighed for assays and tests : In all descriptions quantity of the substances to be taken for testing is indicated. The amount stated is approximate but the quantity actually used must be accurately weighed and must not deviate by more than 10 per cent from the one stated.

Constant weight : The term "Constant Weight" when it refers to drying or ignition means that two consecutive weighing do not differ by more than 1.0 mg. per g. of the substance taken for the determination, the second weighing may follow after an additional hour of drying on further ignition.

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

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

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

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

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

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

Percentage of alcohol : All statements of percentage of alcohol (C_2H_5OH) refer to percentage by volume at 15.56 ^{0}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 a general sense irrespective of concomitant chemical changes.

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

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

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

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

The following table indicates the meaning of such terms:-

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

Therapeutic uses and important formulations : Therapeutic uses and important formulations mentioned in this Pharmacopoeia are, as provided in recognized Unani classics and in the National Formulary of Unani Medicine (Part-I, II, III & IV).

Doses : The doses mentioned in each monograph are in metric system of weights which are the approximate conversions from classical weights mentioned in Unani texts. A conversion table is

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

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

INTRODUCTION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.	Dr. Mohd. Yusufuddin Ansari, Prof. & Head, Department of Pharmacology, M.R. Medical College, Gulbarga, Karnataka.	Chairman.

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

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

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

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

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

Keeping in view the vacancy in the post of Dy. Advisor (Unani) in the Ministry of Health & F.W., the Govt. of India decided that Research Officer (Unani) shall function with immediate effect as Member Secretary of Unani Pharmacopoeia Committee reconstituted vide this Ministry's order no.U.20012/1/87-APC dated 13/15-6-1988, till such time the post of Dy. Advisor/Advisor (Unani) is filled up.

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

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

9.	Hakim Mohd. Khalid Siddiqui, Director, CCRUM, 61-65, Institutional Area, Janakpuri, New Delhi-110 058.	Member.
10.	Hakim M.A. Wajid, C.R.I.U.M., Opp. E.S.I. Hospital, Eragadda, Hyderabad (AP).	Member.
11.	Hakim (Mrs.) Ummul Fazal, Dy. Director, CCRUM, 61-65, Institutional Area, Janakpuri, New Delhi-110 058.	Member.
12.	Prof. M.S.Y. Khan, Deptt. of Pharmaceutical Chemistry, Jamia Hamdard, Hamdard Nagar, New Delhi.	Member.
13.	Dr. S.S. Handa, Deptt. of Pharmaceutical Chemistry, Patiala University, Patiala, Punjab.	Member.
14.	Dr. R.U. Ahmed, Director, P.L.I.M., C.G.O. Complex, Kamala Nehru Nagar, Ghaziabad.	Member.
15.	Prof. Wazahat Hussain, Chairman, Deptt. of Botany, A.M.U., Aligarh - 202 001 (UP).	Member.
16.	Hakim (Mrs.) Aliya Aman, Dy. Advisor (Unani), Deptt. of ISM & H, Ministry of Health & F.W., Red Cross Bldg., Annexe, New Delhi.	Member-Secretary.

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

i.	Dr. Sajid Hussain, Hyderabad	Chairman

ii.	Prof. Hkm. S. Zillur Rehman, Aligarh	Member
iii.	Prof. Hkm. M.A. Jafry, Bangalore	Member
iv.	Hkm. S. Jaleel Hussain, Hyderbad	Member
v.	Prof. Hkm. Naim A.Khan, Aligarh	Member
vi.	Prof. Dr. M .S. Y. Khan, New Delhi	Member
vii.	Dr. M. Sajid Anasari, Ghaziabad	Member
viii.	Prof. Dr. S. H. Afaq, Aligarh	Member
ix.	Dr. Yatender Kumar Singh Rathore, New Delhi	Member
x.	Prof. Hkm. Jamil Ahmed, New Delhi	Member
xi.	Mr. Asad Mueed, Delhi	Member
xii.	Hkm. Farooqi, Ghaziabad	Member
xiii.	Prof. Wazahat Hussain, Aligarh	Special Invitee
xiv.	Hkm. Mohd. Iqbal, New Delhi	Special Invitee
xv.	Deputy Adviser (Unani), New Delhi	Member
xvi.	Drug Controller General of India, New Delhi	Member (Ex-Officio)
xvii.	The Director, PLIM, Ghaziabad	Member (Ex-Officio)
xviii.	The Director, CCRUM, New Delhi	Member Secretary

The functions of the committee shall be as follows:-

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

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

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

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

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

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

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

CHAIMAN
UNANI PHARMACOPOEIA COMMITTEE

NEW DELHI.

ABBREVIATIONS OF TECHNICAL TERMS

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

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

MONOGRAPHS

AAM
(Stem Bark)

The drug Aam consists of stem bark of *Mangifera indica* Linn. (Fam. Anacardiaceae), a tree found wild or cultivated throughout the country.

OTHER NAMES:

Urdu	:	Aam
Arabic	:	Anbaj
Persian	:	Anbah
English	:	Mango
Hindi	:	Ama
Beng	:	Ama, Am
Gujarati	:	Aambo
Kan.	:	Mavu
Tamil	:	Mamaram
Malayalam	:	Mavu
Marathi	:	Amba
Oriya	:	Am, Amba
Punjabi	:	Amb
Telugu	:	Amaramu

DESCRIPTION:

Macroscopic: Drug occurs in pieces of variable size and thickness, surface rough due to longitudinal cracks, fissures and scattered, raised lenticels, grayish to dark brown externally and yellowish-white to reddish internally; odour, pleasant; odour, pleasant; taste, astringent.

Microscopic: Mature bark, shows a wide cork consisting of tangentially elongated cells, a few outer layers brown and inner lighter in colour, at a few places lenticels appear. Secondary cortex almost absent. Secondary phloem wide, consisting of sieve elements, parenchyma and phloem fibres, traversed by medullary rays, acrid jucie canals and yellow coloured elongated tannin sacs abundantly scattered throughout phloem region. Stone cells thick walled, rectangular with wide lumen also present in single or in groups. Starch grains and prismatic crystals of calcium oxalate present in number of phloem cells; phloem fibres in groups composed of 2-15 or more cells, long and thick walled. Phloem rays 1-3 seriate, 3 seriate rays more common, somewhat wavy, thin-walled, radially elongated and filled with crystals of calcium oxalate and simple, round starch grains, measuring 12-16 μ in diameter.

Powder: Brown; shows fragments of cork cells, stone cells, single or in groups. Phloem fibres, prismatic crystals of calcium oxalate; simple, spherical to elliptical, starch grains measuring 12 –16 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 9 per cent, Appendix 2.2.3.

Acid-insoluble ash	:	Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 14 per cent, Appendix 2.2.7.

T.L.C :

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid : Water (4 : 1 : 5) shows under U.V. light (366 nm) three violet spots at Rf. 0.12, 0.73 and 0.87. On exposure to Iodine vapour four yellow color spots appear at Rf. 0.33, 0.51, 0.74 and 0.88. On spraying with 5% ethanolic Sulphuric acid reagent and after heating the plate for about ten minutes at 105^0 C, three grey spots appear at Rf. 0.49, 0.69 and 0.88. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Tannins – protocatechuic acid, catechin, mangiferin, alanine, glycine, α -aminobutyric acid, kinic and shikimic acids.
TEMPERAMENT	**:**	Cold and dry
ACTION	**:**	Naf-e-Sozak, Qabiz, Habis, Mudammil-e-Qurooh
THERAPEUTIC USES	**:**	Sozak, Ishal, Bawasir Damvi, Qurooh
DOSE	**:**	5-10 g

ABHAL
(Fruit)

The drug Abhal consists of dried fruit of *Juniperus communis* Linn (Fam. Cupressaceae); a dense, more or less procumbent shrub, rarely a small tree, found in the Himalayas from Kumaon westwards ranging from the altitude of 1500-4250 m.

OTHER NAMES:

Urdu	:	Abhal
Arabic	:	Habb-ul-Arar
Persian	:	Sarv Kohi
English	:	Juniper Berry, Common Juniper
Hindi	:	Havuber, Havubair
Bengali	:	Hayusha
Gujarati	:	Palash
Kannad	:	Padma Beeja
Marathi	:	Hosh
Punjabi	:	Havulber
Telugu	:	Hapusha

DESCRIPTION:

Macroscopic : Fruit sub-spherical, berry like, purplish- black, occasionally showing a 'bloom', about 0.5-1.0 cm in diameter, apex shows triradiate mark and depression indicating the su-ture of three fleshy-bracts. At the base are six small, pointed bracts arranged in 2 whorls, but occasionally 3 or 4 whorls present. Three hard, triangular seeds are em-bedded in the fleshy mesocarp, each with a woody testa bearing large partly sunk resinous duct. Odour terebinthine and taste bitter.

Microscopic: Outer layer of fruit shows 3-4, large, cubic or tabular cells having thick, brown porous walls externally covered by single layered, colourless cuticle; sarco-carp consists of large, elliptical, thin-walled, loosely coherent cells, containing drops of essential oil and prismatic crystals of calcium oxalate; oval to elongated, elliptical, triangular or irregular shaped cells abundant in this region. Seed coat shows 2 or 3 layers of tabular, thin-walled cells covered externally by a thin cuticle and followed internally by a wide zone of thick-walled polygonal sclerenchymatous cells. En-dosperm and embryo not distinct.

Powder: Brown, shows oval to elongated, elliptical and irregular shaped, thick-walled stone cells; rectangular to hexagonal, straight, thick walled epidermal cells in surface view; prismatic crystals of calcium oxalate and oil globules.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 12 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 9 per cent, Appendix 2.2.7

T.L.C. :

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) shows under UV (366 nm) three fluorescent zones at Rf. 0.11 (light blue), 0.20 (light blue) and 0.58 (blue). On exposure to Iodine vapour ten spots appear at Rf. 0.17, 0.25, 0.30, 0.36, 0.46, 0.58, 0.64, 0.67, 0.90 and 0.96 (all yellow). On spraying with Va-nillin Sulphuric acid and heating the plate for ten minutes at 110°C twelve spots appear at Rf. 0.11, 0.17, 0.25, 0.30 (all brown), 0.36 (light brown), 0.46, 0.52 (both brown), 0.58 (dirty yellow), 0.64 (brown), 0.73 (light brown), 0.90 (light brown) and 0.96 (brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential oil and flavonoids.
TEMPERAMENT	**:**	Hot and Dry.
ACTION	**:**	Mohallil-e-Qawi, Mujaffif, Mulattif, Jali, Mufatteh, Qabiz Khafeef, Kasir-e-Riyah, Muqawwi-e-Meda, Mudirr, Musqit-e-Janeen, Qatil-e-Kirm-e-Shikam.
THERAPEUTIC USES	**:**	Ehtabas-e-Baul wa Haiz, Falij, Istirkha, Usr-e-Tanaffus, Qaraqar-e-Shikam, Sangrehni, Deedan-e-Ama.
DOSE	**:**	3 to 5 g
IMPORTANT FORMULATION	**:**	Majoon Mudirr-e-Tams, Sharbat Mudirr-e-Tams.

ADRAK
(Rhizome)

The drug Adrak consists of fresh rhizome of *Zingiber officinale* Rosc. (Fam. Zingibera-ceae); a herbaceous rhizomatous perennial, reaching up to 90 cm in height, widely culti-vated in India. Rhizomes are dug in January-February, buds and roots are removed and washed well.

OTHER NAMES :

Urdu	:	Adrak
Arabic	:	Zanjabeel Ratab
Persian	:	Zanjabeel Taza
English	:	Ginger
Sansk.	:	Kaubhadra, Srngavera
Hindi	:	Adarakha
Bengali	:	Ada
Gujarati	:	Adu
Kannad	:	Alla, Hasishunti *Kash*
Tamil	:	Inji, Injee, Allam, Lakottai
Malayalam	:	Inchi
Marathi	:	Ardrak, Ale
Punjabi	:	Adi, Adrak
Telugu	:	Allamu, Allam

DESCRIPTION:

Macroscopic : Drug occurs as entire rhizome or in pieces, rhizome laterally compressed bearing flattish ovate, oblique branches on upper side, each having a depressed scar at its apex, pieces 5-15 cm long, 1.5-6.5 cm wide (usually 3-4 cm) and 1-1.5 cm thick, fracture, short with projecting fibers, transversely cut surface shows a wide central stele having numerous grayish cut ends of fibers and yellow secreting cells; odour, ginger taste, pun-gent.

Microscopic: Rhizome shows a few layered, irregularly arranged, tangentially elongated, brown cells of outer cork and 6-12 rows of thin-walled, colourless, radially arranged cells of in-ner cork. Secondary cortex consisting of hexagonal to polygonal, isodiametric, thin walled, parenchymatous cells containing numerous circular to oval starch grains with striations and hilum at one end with clear concentric striations, measuring 5-25 μ in diameter. Idioblasts containing large yellowish to brownish globules of oleo-resin; walls of oil cells suberised; numerous closed, conjoint, collateral, cortical fibro-vascular bundles scattered throughout cortical zone, greater number occurring in inner cortical region. Larger bun-dles consist of 2-7 vessels, small cells of sieve tube, polygonal cells of phoelm parenchyma and group of fibres; vessels showing reticulate, scalariform and spiral thickening. Xylem fibres sep-tate with a few oblique pores on their walls; endodermis single layered, free from starch; pericycle single layered enclosing central stele; pith consisting of thin-walled polygonal, isodiametric cells of parenchyma, filled with abundant starch grains, oleo-resin cells similar to those present in cortex. Fibrovascular bundles of two types, those arranged along pericycle in a definite ring are smaller in size and devoid of fibres, vessels 2-5 in number, larger bundles found scattered throughout stele, composed of xylem, phloem, parenchyma and bundle sheeth.

Powder: Light yellow; shows thin-walled parenchymatous cells, septate fibres with oblique, elongated pits on their walls, reticulate and spiral vessels, oleo-resin cells abundant, single starch grains of varying shapes with eccentric hilum, measuring 5-25 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 8 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 2 per cent, Appendix 2.2.7
Moisture content	:	Not More than 90 per cent, Appendix 2.2.9

T.L.C.: -

T.L.C. of alcoholic extract of drug on Silica gel 'G' plate using Benzene: Ethy-lacetate (9:1) in visible light four spots are seen at Rf. 0.16, 0.35, 0.63 & 0.69 (all light yellow). Under U.V. (366 nm) three fluorescent zones appear at Rf. 0.16 (blue), 0.63 (grey) & 0.69 (grey). On exposure to Iodine vapour eleven spots appear at Rf. 0.03, 0.08, 0.13,0.16,0.35,0.47,0.63, 0.69, 0.76, 0.83 & 0.92 (all yellow). On spraying with Vanillin sulphuric acid reagent and heating the plate for ten minutes at 110°C eight spots appear at Rf. 0.08 (violet),0.16 (brownish violet), 0.35 (light violet), 0.47 (light violet), 0.63 (light violet), 0.69 (light violet), 0.76 (violet) & 0.92 (violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Volatile Oil containing Cineole zingiberol, and Sesquiterpene like zingiberene, bisobolene and sesqui phellandrene, gingerosl in the oleo-resin
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Hazim**,** Kasir-e-Riyah**,** Muqawwi-e-Asab, Muharrik.
THERAPEUTIC USES	**:**	Zof-e-Meda, Su-e-Hazm, Nafkh-e-Shikam, Falij, Laqwa
DOSE	**:**	1- 1.5 g
IMPORTANT FORMULATION	**:**	Habb-e-Adrak, Jawarish Zanjabeel, Majoon Zanjabeel, Safoof-e-Hazim.

AKHROT
(Fruit kernel)

The drug Akhrot consists of kernel of fruit of *Juglans regia* Linn. (Fam. Juglandaceae); a large deciduous, monoecious tree with tomentose shoots, found throughout the Himala-yas upto an altitude of 900-3300 m.

OTHER NAMES:

Urdu	:	Maghz Akhrot
Arabic	:	Jauz
Persian	:	Girdagaan
English	:	Walnut
Sansk.	:	Akhota, Sailabhava, Karparala
Hindi	:	Akharot
Bengali	:	Aakharotu
Gujarati	:	Akharoda
Kannad	:	Akrod pappu
Tamil	:	Akrotu
Malayalam	:	Akrottu
Marathi	:	Akrod
Oriya	:	Akhrot
Punjabi	:	Akharota
Telugu	:	Akrotu

DESCRIPTION :

Macroscopic : Cotyledons available in 2-3 cm long, slightly curved, coriaceous, irregularly cor-rugated, broken pieces, creamish-brown, odour not distinct; taste, oily sweet.

Microscopic: Endosperm mostly single layered; cotyledons con-sisting of a wide zone of oval to polygonal, thin-walled, radially elongated parenchymatous cells; small al-eurone grains and fat present in endosperm and cotyledons.

Powder: Cream coloured; shows groups of cells of cotyledon, abundance of round oil globules.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 2 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 10.0 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 7.0 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS	**:**	Walnut oil and Tannin.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Aza-e-Raeesa, Muqawwi-e-Aasab, Mullaiyin, Mulattif
THERAPEUTIC USES	**:**	Zof-e-Bah, Zof-e-Dimagh, Suda, Zof-e-Hafiza, Naqahat-e-Umoomi.
DOSE	**:**	10 – 20 g
IMPORTANT FORMULATION	**:**	Luboob-e-Kabir, Luboob-e-Sagheer.

ANAR
(Seeds)

The drug Anar consists of dried seeds of *Punica granatum* Linn. (Fam. Punicaceae); a large deciduous shrub or a small tree, found growing wild in the warm valley, outer hills of Himalayas between 900-1800 m and cultivated in many parts of the country.

OTHER NAMES:

Urdu	:	Anar
Arabic	:	Rumman
Persian	:	Anar
Sanskrit	:	Dadimacchada, Lohitapuspa, Dantabija
Hindi	:	Anar
Bengali	:	Dadima
Gujarati	:	Dadama
Kannad	:	Dalimba
Tamil	:	Madalai, Maadalai, Madalam.
Malayalam	:	Matalam
Marathi	:	Dadima
Punjabi	:	Anar
Telugu	:	Danimma

DESCRIPTION:

Macroscopic : Seeds brown, angular, wedge-shaped, 0.5-0.6 cm long, 0.1-0.2 cm wide; taste, sweetish-sour.

Microscopic: Seed **s**hows testa consisting of thin-walled, parenchymatous cells followed by stony stegmen consisting of lignified, round, oval, triangular and rectangular, thick-walled stone cells having narrow and wide lumen; beneath this, reddish-brown pigmented layer present; endosperm absent; cotyledons coiled, consisting of oval to polygonal, thin-walled, parenchymatous cells, containing a few oil globules; starch grains present in testa, round to oval, simple, measuring 3-17 µ in diameter.

Powder: Reddish-brown shows stone cells and a few simple rounds to oval starch grains measuring 3-17 µ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.6
Water-soluble extractive	:	**N**ot less than 35 per cent, Appendix 2.2.7

T.L.C.:

T.L.C of alcoholic extract of the drug on silica gel 'G' plate using Chloroform: Ethylacetate: Formic acid (5:4:1) v/v three spots at Rf. 0.62, 0.87 (both grey) and 0. 97 (pink) are seen in visible light. Under U.V. (366 nm) four fluroscent zones are visible at Rf. 0.12 (sky blue), 0.45 (Sky blue), 0.62(blue) & 0.87(blue). On exposure to Iodine vapour three spots appear at Rf.0.62, 0.87 & 0.97 (all yellow). On spraying with 5% Methanolic – Sulphuric acid reagent and heating the plate for about ten minutes at 110^0 C three spots appear at Rf. 0.62, 0.87 (both violet) and 0.97 (grayish blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Sugars, Vitamin C, Sitosterol, Ursolic acid, Protein, Fat and Mineral matters, Nicotinic acid, Pectin, Riboflavin, Thiamine, Delphinidin diglycodise, Aspartic, Citric, Ellagic, Gallic and Malic acids, Glutamine, Isoquercetine, Estrone and Punicic acid.
TEMPERAMENT	**:**	Cold and Moist
ACTION	**:**	Muqawwi-e-Qalb-wa-Jigar,Mulaiyin-e-Sadr, Musakkine-e-Hararat, Mudirr-e-Baul Khafeef
THERAPEUTIC USES	**:**	Zof-e-Qalb wa Jigar, Khushunat-e-Sadr wa Halaq, Yarqan, Khafaqan, Qai, Is-hal.
DOSE	**:**	5-10 g
IMPORTANT FORMULATION	**:**	Jawarish Anarain, Jawarish Podina

ARJUN
(Stem bark)

The drug Arjun consists of the stem bark of T*erminalia arjuna* W. & A. (Fam. Combretaceae); a large deciduous tree, commonly found throughout the greater parts of the country.

OTHER NAMES:

Urdu	:	Arjun
Hindi	:	Arjuna
Bengali	:	Arjuna
Gujarati	:	Sadad, Arjuna, Sajada
Kannad	:	Matti, Bilimatti, neermatti, Mathichakke, Kudare Kivimase
Tamil	:	Marudam
Malayalam	:	Nirmasuthu, Vellaamaruthi, Kellemasuthu, Mattimora, Torematti
Marathi	:	Arjuna, Sadada
Oriya	:	Arjuna
Punjabi	:	Arjon
Telugu	:	Maddi

DESCRIPTION :

Macroscopic : Bark available in pieces, flat, curved, recurved, channeled to half quilled, 0.2-1.5 cm thick, market samples upto 10 cm in length and upto 7 cm in width, outer surface somewhat smooth and grey, inner surface somewhat fibrous and pinkish, transversely cut smoothened bark shows pinkish surface, fracture, short in inner and laminated in outer part; taste, bitter and astringent.

Microscopic: Mature stem bark shows cork consisting of 9-10 layers of tangentially elongated cells, a few outer layers filled with brown colouring matter; cork cambium and secondary cortex not distinct and medullary rays observed traversing almost upto outer bark. Secondary phloem occupies a wide zone, consisting of sieve tubes, companion cells, phloem parenchyma and phloem fibres, traversed by phloem rays, usually uniseriate but biseriate rays also occasionally seen in the middle and outer phloem region, sieve tubes get collapsed. Phloem fibres distributed in rows and present in groups of 2-10. Rosette crystals of calcium oxalate measuring 80-180 μ in diameter present in most of the phloem parenchyma, alternating with fibers. Idioblasts consisting of large cells having aggregates of prismatic and rhomboidal crystals of calcium oxalate in row throughout the zone measuring 260-600 μ in diameter. Starch grains, mostly simple, compound of 2-3 components, sometimes upto 5 components, round to oval, elliptical, measuring 5-13 μ in diameter. Distributed throughout the tissue in a tangential section the uniseriate phloem rays 2-10 cells high and biseriate, 4-12 cells high; in longitudinal section rosette crystals of calcium oxalate found in the form of strands in phloem parenchyma.

Powder : Reddish-brown; shows fragments of cork cells, uniseriate phloem rays, fibres, a number of rosette crystals of calcium oxalate, a few rhomboidal crystals. Starch grains simple and compound, round to oval, elliptic, having 2-3 component with concentric striations and small narrow hilum, measuring 5-13μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 25 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS **:** Tannins.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Qabiz, Muraqqiq-e-Dam, Daf-e-Humma

THERAPEUTIC USES **:** Zof-e-Qalb, Khafaqan, Warm-e-Qalb, Fasad-e-Dam, Ishal, Sangrahni, Hummiyat-e-Muzmina

DOSE **:** 3-5 g

BALADUR
(Fruit)

The drug Baladur consists of mature fruit of *Semecarpus anacardium* Linn. (Fam. Anacardiaceae),a medium sized tree found in moist deciduous forests all over the country.

OTHER NAMES:

Urdu	:	Baladur, Bhilavan
Arabic	:	Habb-ul-Fahm/Habb-ul-Qalb
Persian	:	Baladur
Hindi	:	Bhilawa
Bengali	:	Bhela
Gujarati	:	Bhilamu
Kannad	:	Bhallataka
Tamil	:	Tatamkottai, Scramkotati
Malayalam	:	Chera
Marathi	:	Bibba
Orissa	:	Bhollataki, Bholai
Punjabi	:	Bhilawa
Telugu	:	Nallajidi, Nallajidiginga

DESCRIPTION

Macroscopic: Fruit laterally flattened, drupe, dark brown, 2.5-3 cm long, obliquely ovoid, smooth, shining with residual receptacle.

Microscopic:

Fruit– Pericarp differentiated into epicarp, mesocarp and endocarp; in longitudinal section pericarp shows outer epicarp consisting of single layer of epidermal cells which are elongated radiameter lly and lignified, characteristic glands found in pericarp which exude oil globules are arise as small protuberances in epircarp and due to pressure exerted by cells of mesocarp, some of epidermal cells and cuticle rupture and oil globules exude from oil glands; mesocarp a very broad zone, 30-40 layers thick, composed mostly of parenchymatous cells having lysigenous cavities and fibro-vascular bundles, below epidermis a few outer cells of parenchyma smaller as compared to rest; rosette crystals of calcium oxalate found scattered in parenchymatous cells, some cells get dissolved and form lyscgenous cavities which increase in size with maturity of fruit, cavities do not have any special lining and contain an acrid and irritant yellowish oily secretion; endocarp consists of two distinct layers, innermost prismatic, very much elongated radiameter l walls, being highly thickened, outer layer shorter and thinner than prismatic layer but cells similar to the former; number of mesocarp parenchyma contain rosette crystals of Calcium oxalate and oil drops in oil glands; lysigenous cavities of mesocarp contain oily vesicating substance, insoluble in water and soluble in alcohol, ether and chloroform.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 per cent, Appendix 2.2.2
Total ash	:	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 11 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 05 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS : A Tarry Oil containing Anacardic Acid, Non-Volatile Alcohol (Cardol).

TEMPERAMENT : Hot and Dry

ACTION : Muqawwi-e-Asab, Muqawwi-e-Zahn wa Hafiza, Muqawwi-e-Qalb, Daf-e-Amraz-e-Balghami.

THERAPEUTIC USES : Zof-e-Asab, Zof-e-Hafiza, Zof-e-Qalb, Falij, Laqwa

DOSE : 125 mg

IMPORTANT FORMULATION : Anqaroya Kabir, Anqaroya Sagheer, Majoon Baladur.

BED ANJEER

(Seeds)

The drug Bed Anjeer consists of mature and dried seeds of *Ricinus communis* Linn. (Fam. Euphorbiaceae); a tall glabrous shrub or almost small tree, 2-4 m high; found throughout India, mostly growing wild on waste land and also cultivated for its oil seeds.

OTHER NAMES:

Urdu	:	Arand
Arabic	:	Khirwa
Persian	:	Bed Anjeer
English	:	Castor Oil Plant
Hindi	:	Erand, Rendee, Andeo
Bengali	:	Bherenda
Gujarati	:	Erando
Kannad	:	Harlu
Tamil	:	Amanakku
Malayalam	:	Abanakka, Avanakku
Marathi	:	Erand, Erandee
Oriya	:	Bheranda
Punjabi	:	Erand
Telugu	:	Amudamu, Amudmuchetu

DESCRIPTION:

Macroscopic : Seeds oblong, one face convex and the other slightly flattened, 1-1.5 cm long, 0.6-0.9 cm wide, 0.4-0.8 cm thick, testa hard, glossy, smooth, grey or brown to red-dish-brown or black and may be variously marbled or striped, raphe extends from the caruncle to chalaza. Odour not distinct; taste weakly acrid.

Microscopic: Seed shows a hard testa, membraneous tegmen, a fleshy endosperm, and thin embryo with flat, broad leafy cotyledons; testa consists of hard, single layered epidermis, radially elongated, compactly arranged; slightly curved tabular cells, having reddish -brown contents followed by 8-10 layered, tangentially elongated parenchymatous cells, most of them containing oil globules Fibro-vascular bundles found scattered in this zone; endosperm consisting of oval, irregular cells filled with oil globules, abun-dant aleurone grains, measuring 8.2 - 13.75 μ in diameter; cotyledons thin, flat and leafy.

Powder: Dark brown, oily; shows fragments of numerous elongated thick-walled, polygonal cells of testa, reddish-brown tabular cells, thin-walled oval to round parenchyma-tous cells of endosperm. Oil globules numerous aleurone grains measuring upto 13.75 μ in diameter and including crystalloids and globoids within.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 36 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.7
Fixed Oil	:	Not less than 37 per cent, Appendix 2.2.8

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Chloroform: Ethy-lacetate (95 : 5) shows under U.V.(366 nm) a fluorescent spot at Rf. 0.95 (sky blue). On exposure to Iodine vapour seven spots appear at Rf. 0.39,0.50,0.64,0.72,0.80,0.89 and 0.95 (all yellowish brown). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for about ten minutes at 105° C seven spots appear at Rf. 0.39, 0.50, 0.64,0.72,0.80,0.89 and 0.95 (all brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mohallil, Musakkin, Jali, Mudirr-e-Haiz, Qatil-e-Kirm-e-Shikam.
THERAPEUTIC USES	**:**	Waja-ul -Mafasil, Falij, Laqwa, Deedan-e-Ama, Ehtebas-e-Haiz, Sual.
DOSE	**:**	7-10 g
IMPORTANT FORMULATION	**:**	Raughan -e-Bedanjeer

BEESH
(Root)

The drug Beesh consists of dried roots of *Aconitum chasmanthum* Stapf. ex Holmes Syn. *A. Nepellus* (Fam. Ranunculaceae); plant is an erect, perennial herb, occurs in sub alpine and alpine zones of the western Himalayas, in high plateaus between 2000-4000 m, roots are generally collected late in September.

OTHER NAMES:

Urdu	:	Bachhnak, Mithatelia
Arabic	:	Beesh, Khaniq-uz-Ziib
Persian	:	Beesh Naag
English	:	Indian Nepellus
Hindi	:	Bisa, Meethabisha, Bachnaag, Teliya Bish
Bengali	:	Kathvish
Gujarati	:	Vachhanaag, Basanaag
Kannad	:	Basanalli, Vatsanabha, Vatsanabhi, Vachanaga
Tamil	:	Vasanaavi, Vatsanabhi, Nabhi, Vasanabhi
Malayalam	:	Vatsanabhi
Marathi	:	Bachnaga
Oriya	:	Tahara, Mahura, Mithvisa
Punjabi	:	Mitha Visha, Mithatelia
Telugu	:	Vatsanaabhi, Naabhi

DESCRIPTION:

Macroscopic: Root usually paired, occasionally separated due to breakage, ovoid, conical, small portions of stem sometimes attached, tapering downwards to a point, 2-4.5 cm, rarely 5 cm long, 0.4-1.8 cm thick, gradually decrease in thickness towards tapering end; wrinkled longitudinally and transversely, rough due to root scar; dark brown to blackish-brown. Fracture hard and white within the cambium ring and brownish outside, coriaceous, cambium. Odour indistinct, taste slightly bitter followed by a strong tingling sensation, poisonous.

Microscopic: Root shows epidermis 1-3 layered, suberised, papillose on outside. Primary cortex consisting of 8-10 layers of oval to tangentially elongated, thin-walled parenchymatous cells, without or with a few intercellular spaces, a few rectangular stone cells in singles found scattered in this zone. Primary cortex separated by distinct endodermis; inner bark parenchymatous, consisting of round to oval cells, containing a few groups of phloem strands, occupying more than half the radius. Cambium having 6-10 angles; xylem vessels arranged almost in a ring, some scattered, often forming 'V' shaped structure, enclosing xylem parenchyma in older portions; bundles compact often wedge-shaped having acute apex. Xylem exarch, metaxylem vessels met in center; starch grains simple measuring 6-18 μ in diameter and compound grains consisting of 2-5 components with hilum in center, present in cortical cells, phloem parenchyma and xylem parenchyma.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 5.5 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 8 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 24 per cent, Appendix 2.2.7.

T.L.C. :

T.L.C. of alcoholic extract of the drug on silica gel 'G' plate using Chloroform: Methanol (90:10) shows six spots at Rf. 0.10, 0.20, 0.39, 0.59, 0.74 and 0.96 (all yellow) on exposure to Iodine vapour. On spraying with Dragendorff reagent two spots appear at Rf. 0.39 and 0.96 (both orange). Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Alkaloids.
TEMPERAMENT	:	Hot and Dry
ACTION	:	Daf-e-Bukhar, Musakkin, Mukhaddir Maqami, Mudirr-e-Baul wa Haiz, Nafa-e-Amraz-e-Saudaviya wa Balghamiya, Muhaiyyij-e-Jild.
THERAPEUTIC USES	:	Shaqiqa, Arqun Nisa, Zat-ul-Janb, Zat-ur-Riya, Bukhar, Ehtabas-e-Baul wa Haiz, Juzam, Bars, Zeeq-un-Nafas, Qurooh-e-Khabisa
DOSE	:	15-30 mg
IMPORTANT FORMULATIONS	:	Habb-e-Rahat, Habb-e-Nuqra, Dawa-e-Jiryan.

BHANGRA
(Whole plant)

The drug Bhangra consists of whole plant of *Eclipta alba* Hassk. (Fam. Asteraceae); a herbaceous annual, 30-50 cm high, erect or prostrate, much branched, strigosely hirsute, often rooting at nodes, a common weed of moist places found throughout India ascending upto1700 m.

OTHER NAMES:

Urdu	:	Bhangra
Arabic	:	Suweid
Hindi	:	Bhangara, Bhangaraiya
Bengali	:	Garujalu, Gurugada Soppu, Keshavardhana, Kodigaraju
Gujarati	:	Bhangaro, Bhangro
Kannad	:	Garajalu, Gurugada Soppu, Keshavardhana, Kodigaraju
Tamil	:	Karisalamkanni, Karisalanganni, Karisalai
Malayalam	:	Kayyonni, Knnunni
Marathi	:	Nhangra, Bhringiraja, Maka
Punjabi	:	Bhangra
Telugu	:	Guntakalagara, Guntagalagara

DESCRIPTION:

Macroscopic :

Root - Root well developed, a number of secondary branches arise form main root, upto about 7 mm in diameter, cylindrical, grayish.

Stem - Stem herbaceous, branched, occasionally rooting at nodes, cylindrical or flat, rough due to appressed white hairs, node distinct, greenish, and occasionally brownish.

Leaf - Leaf opposite, sessile to subsessile, 2.2-8.5 cm long, 1.2 – 2.3 cm wide, usually oblong, lanceolate, sub-entire, sub-acute or acute, strigose with appressed hairs on both surfaces.

Flower - Flowers in capitulum or head, solitary or in pair together on unequal axillary peduncles; involucral bracts about 8, ovate, obtuse or acute, herbaceous, strigose with appressed ***hairs***; ray floret ligulate, ligule small, spreading, scarcely as long as bracts, not tootherd, white; disc floret tubular, corolla often 4 toothed; pappus absent, except occasionally very minute teeth on the top of cypsella; stamen 5, filaments epipetalous, anthers united into a tube, filaments free with obtuse base bicarpellary, syncarpos, ovary inferior, unilocular with one basal ovule.

Fruit - Fruit Cypsella, one seeded, cuneate, with a narrow wing, covered with warty excrescences, brown.

Seed - Seed 0.2-0.25 cm long, 0.1 cm wide, dark brown, hairy and non endospermic.

Microscopic:

Root – Mature root shows poorly developed cork, consisting of 3-5 rows of thin-walled, tangentially elongated cells; secondary cortex consists of outer one or two rows of tangentially elongated or rounded cells with air cavities. Inner secondary cortex of tangentially elongated to irregular shaped parenchymatous cells with conspicuous air cavities; stone cells found scattered in seconday cortex and cork, in singles or in groups of various shape and size. Pericyclic fibres in tangentially arranged bands of many cells or in singles; secondary phloem consists of sieve elements including phloem fibres traversed by multiseriate phloem rays; phloem rays broader towards periphery, consisting of rounded cells; xylem composed of vessels, fibre tracheids, fibres and xylem parenchyma, traversed by xylem rays. Vessels numerous, found scattered throughout wood. In macerated preparation vessels small, drum-shaped, cylindrical elongated with pitted walls and perforations simple, rarely slightly oblique; fibre tracheids, pitted, with very pointed tips, xylem fibres long with pointed tapering ends and short lumen, a few fibres show peg-like outgrowths towards the tapering ends. Xylem parenchyma sparse usually squarish to rectangular having simple pits on their walls, xylem ray distinct, run straight in tangential section, generally 5-32 cells in height and 3-5 cells in width although very rarely uniseriate and biseriate rays also found, ray cells pitted.

Leaf

Petiole – Shows single layered upper and lower epidermis consisting of tubular cells, covered with striated cuticle. Trichomes of two types, non-glandular, uniseriate, 1-5 celled, warty, and with pointed apical cell; epidermis followed by wide cortex, consisting of 2-5 layered collenchyma on both, upper and lower side with distinct angular thickening; parenchyma 4-6 layered on upper side and 5-8 layered on lower side consisting of isodiametric, thin-walled cells with intercellular spaces; five vascular bundles, central one largest while four others small flanking to either side of central bundle, consists of xylem on dorsal side and phloem on ventral side; xylem vessels arranged in radial rows traversed by xylem rays.

Midrib – ***S***ection cut at basal region shows both upper and lower single layered epidermis, externally covered with cuticle, a few epidermal cells elongate outwards to form uniseriate hairs; epidermis followed by cortex, consisting of 3-5 layered collenchymatous cells on both sides; section cut at middle region shows 3-4 layered collenchymatous cells on dorsal and 1-3 layered on ventral side, while the section cut at apical region, shows 2 layered collenchymatous cells on both sides. Similarly transverse section cut at a basal, middle and apical regions shows 4-6 layered parenchymatous cells on dorsal side and 6-9 layered parenchyma on ventral side. In section cut at basal region 4-6 layered parenchyma on both the sides in the middle region with thin-walled cells and intercellular spaces, 2-3 layered parenchymatous cells on both side in the apical region; in the basal region section shows vascular bundle similar to that of petiole while in the section cut at middle and apical region section shows 4 smaller bundles shifting towards lamina.

Lamina – shows a dorsiventral structure, epidermis single layered, externally covered with cuticle, followed by single layered palisade parenchyma containing chlorophyll contents. Spongy parenchyma irregularly arranged with distict intercellular spaces and filled with chlorophyll contents. Mesophyll traversed by number of veins; anisocytic and anomocytic stomata present on both surface , more abundant on lower surfaces. Stomatal index 20.0-22.5 on upper and 23.5 – 26.0 on lower surface; palisade ratio 3.8-4.5; hairs stiff, pointed, wide at the base, about 3 celled, unisreiate, middle cells longest, uppermost generally not exceeding the basal cell in length, septa thick-walled.

Stem – mature stem shows single layered epidermis, externally covered with cuticle, a few epidermal cells elongate to form characteristic non-glandular trichomes, the cork where formed, poorly developed consisting of rectangular cells. Secondary cortex composed of large, rounded or irregular shaped parenchymatous cells having wide air spaces; endodermis single layered consists of tangentially elongated cells; pericyclic fibers distinct, arranged in tangential strands. Vascular bundles in a ring, collateral, endarch, of varying sizes traversed by medullary rays; phloem a narrow strip composed of sieve elements and phloem parenchyma; xylem consists of large number of vessels, xylem fibres and xylem parenchyma; xylem vessels appear evenly distributed throughout the xylem. In macerated preparation vessels barrel-shaped , some elongated with simple perforations, pitted with spiral thickening; xylem fibres with wide lumen, pointed tips and pitted walls, a few often bifurcate and a few large, peg-like outgrowth; xylem rays triseriate to pentaseriate, normally biseriate and uniseriate, 8-15 cells in height and 3-5 cells in width; centre occupied by a wide pith consisting of isodiametric cells of parenchyma.

Powder: Dark green; shows vessels in large groups or single broken prieces with pitted walls, numerous fibres entire or in pireces, trichomes entire or in pieces, warty, a few attached with epidermal and subsidiary cells, anomocytic and anisocytic stomata.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 11 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS **:** Alkaloids, Ecliptine and Nicotine.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Musaffi-e-Khoon,Muqawwi-e-Bah, Muqawwi-e-Basar, Kasir-e-Riyah, Mohallil, Musaffi-e-Shar.

THERAPEUTIC USES **:** Zof–e-Bah, Ezam-e-Kabid, Ezam-e-Tehal

DOSE **:** 5-7 g

IMPORTANT FORMULATION **:** Majoon Bhangra

CHANBELI
(Leaf)

The drug Chanbeli consists of dried leaves of *Jasminum officinale* Linn. (Fam. Oleaceae); a large climbing shrub with dark green twigs and pinnate leaves, found in Kashmir at an altitude of 900-2700 m and cultivated throughout the country.

OTHER NAMES :

Urdu	:	Chanbeli
Arabic	:	Yasmeen
Persian	:	Yasmeen safaid
Hindi	:	Chamelee
Bengali	:	Chamelee
Gujarati	:	Chamelee
Kannad	:	Jati Maltiga, Sanna Jati Mallige
Tamil	:	Pichi, Jatimalli
Malayalam	:	Pichi
Marathi	:	Chamelee
Punjabi	:	Chamelee

DESCRIPTION :

Macroscopic:- Leaf single or in groups of 2-7 leaflets, upto 7.5 cm long and upto 2.5 cm broad; imparipinnately compound, terminal leaflet larger;. ovate or lanceolate, acumi-nate; lateral leaflets shorter, acute, sessile or shortly petiolate; brownish-green; taste bitter.

Microscopic:

Rachis - Rachis shows more or less convex outlline with two lateral wings; epidermis sin-gle layered covered by thick cuticle; hairs mostly unicellular with pointed apex, glandular, hair rarely found only on the upper surface; collenchyma 2-5 layered; pericycle represented by slightly 1ignified small fibre groups; vascular bundles three, crescent-shaped, small accessory bundle present in each wing.

Midrib - Shows similar structure as rachis; 3 - 5 layers of collenchymatous cells towards lower surface; pericycle present in the form of non-lignified fibre groups; vascular bundle single and crescent-shaped.

Lamina - shows dorsiventral structure, epidermis single layered on either side, covered by a thick striated cuticle; hairs as in rachis. Palisade 1- 2 layered; spongy parenchyma 4-6 layers; stomata anomocytic only in lower surface.

Powder: Yellowish-green; shows palisade and spongy parenchyma, unicellular hairs, fibres and vessels with spiral thickening, polygonal epidermal cells .and anomocytic sto-mata in surface view.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 6 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 18 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 25 per cent, Appendix 2.2.7

T.L.C. -:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows under UV (366 nm) three fluorescent zones at Rf 0.44 (blue), 0.52 (light blue) and 0.91 (blue). On exposure to Iodine vapours ten spots appear at Rf 0.08, 0.18, 0.38, 0.44, 0.49, 0.53, 0.59, 0.67, 0.81 and 0.91 (all yellow). On spraying with Dragendorff reagent followed by 5% Methanolic-Sulphuric acid reagent four spots appear at Rf 0.08, 0.18 (both orange), 0.44 and 0.91 (both light orange). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110°C many spots of brown, yellow, blue and violet colour appear from the point of application to the solvent front. Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Resin, Salicylic Acid, Alkaloid (Jasminine) and Essential oil.
TEMPERAMENT	:	Hot and Dry
ACTION	**:**	Musakkin-e-Waj-e-Dandan
THERAPEUTIC USES	**:**	Qula
DOSE	:	3 -5 g

CHIRCHITA
(Root)

The drug Chirchita consists of dried root of *Achyranthes aspera* Linn. (Fam. Amaran-thaceae); a stiff erect, 0.1-0.9 m high, herb found commonly as a weed throughout the country up to 900 m.

OTHER NAMES :

Urdu	:	Chirchita
Arabic	:	Oqais
Persian	:	Kharwaz Guna
Hindi	:	Chirchita, Latjira
Bengali	:	Apang
Gujarati	:	Aghedo
Kannad	:	Uttarane, Uttaren
Tamil	:	Nayuruvi
Malayalam	:	Kadaledee
Marathi	:	Anghada
Punjabi	:	Puthakanda, Lattajeera
Telugu	:	Uttareni

DESCRIPTION:

Macroscopic: Tap root cylindrical slightly ribbed, upto 1.0 cm in thickness, gradually tapering, rough due to presence of some root scars; secondary and tertiary roots present; yel-lowish-brown; odour not distinct; taste not characteristic.

Microscopic: Mature root shows 6-10 layered, rectangular, tangentially elongated, thin-walled cork cells; secondary cortex consisting of 6-9 layers, oval to rectangular thin-walled parenchymatous cells having scattered thick-walled, irregular lignified stone cells, fol-lowed by 5-6 discontinuous rings of anomalous secondary thickening, composed of vascular tissues, small patches of sieve tubes are distinct in the phloem parenchyma demar-cating the xylem rings. Secondary xylem composed of tracheids, fibres and parenchyma; vessels with both simple and bordered pits and with scalariform thickening, measuring 135-348 µ in length and 32-64 µ in width; fibres pointed at both ends with walls moder-ately thickened, measuring 260-740 µ in length and 12-24 µ in width; tracheids have tapering ends, measuring 165-535 µ in length and 17-34 µ in width.

Powder: Yellowish-brown; shows fragments of rectangular cork cells, stone cells, ves-sels showing bordered pits and scalarifonn thickening, fibres and a few prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 2 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 10 per cent, Appendix 2.2.7

T.L.C. :

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Chloroform : Methanol (95:5) shows wider UV (366 nm) five fluorescent zones at Rf. 0.05, 0.19, 0.43, 0.50 and 0.97 (all light blue). On exposure to Iodine vapour six spots appear at Rf. 0.05, 0.12, 0.43, 0.50, 0.92 and 0.97 (all yellow). On spraying with Dragendorff's reagent fo1lowed by 5% Methanolic-Sulphuric acid reagent two spots appear at Rf. 0.12 and 0.97 (both light orange). Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Saponins
TEMPERAMENT	:	Hot and Dry
ACTION	**:**	Daf-e-Zahar-e-Aqrab, Kasir-e-Riyah, Muqawwi-e-Meda, Mudirr-e-Baul, Mohallil-e-Auram, Munaffis-e-Balgham, Musaffi-e-Dam.
THERAPEUTIC USES	**:**	Nafakh wa Dard-e-Shikam, Sual, Zeeq-un- Nafas, Sang-e-Masana, Bawaseer-Khooni.
DOSE	:	1-3 g
IMPORTANT FORMULATION	**:**	Namak Chirchita

CHIRONJI
(Seeds)

The drug Chironji consists of seeds of *Buchanania lanzan* Spreng. Syn. *B. latifolia* Roxb. (Fam. Anacardiaceae); an evergreen tree upto 15 m high, found throughout the country in dry deciduous forests.

OTHER NAMES :

Urdu	:	Chironji
Arabic	:	Habbus samna
Persian	:	Naql Khwaja
Hindi	:	Piyal, Piyar, Chiraungi
Bengali	:	Chirangi, Chowl, Satdhan
Gujarati	:	Charal, Shalichokha
Kannad	:	Piyal, Piyar, Chiraungi
Tamil	:	Muolaima, Korka, Saraparuppu
Malayalam	:	Mural, Priyalam, Mural maram
Marathi	:	Charoli
Telugu	:	Sara, Sarapappu

DESCRIPTION:

Macroscopic: Seed laterally much compressed, creamish-brown, mottled with darker brown line,0.4-0.6 cm long, 0.35-0.5 cm wide, funicle stout, micropyle superior, linear. Hilum present at the apex of round edge; slight pressure separates oily cotyledons; odour pleaseant; taste sweetish-oily.

Microscopic: Longitudinal section of seed-coat shows epidermis consisting of polygonal cells with scattered, large, pitted, thick-walled, sclerenchymatous cells, occurring mostly in groups followed by remnants of disorganized collapsed cells of integument which are of various size, thin-walled and parenchymatous cells filled with brownish content and form a pigment layer, below which a band of parenchymatous cells present, consisting of elongated or tubular cells. Cotyledons consisting of epidermis and thin-walled parenchymatous cells, epidermal cells of cotyledons barrel-shaped and the parenchymatous cells polyhedral and filled with aleurone grains of globoid type measuring 2.5-5.0 µ in diameter and oil globules; procambium bundles running longitudinally also occur among these parenchyma cells.

Powder: A creamish-brown paste; shows numerous mesophyll cells, filled with oil globules and aleurone grains of globoild type measuring 2.5-5.0 µ in diameter and sclerenchymatous cells; in surface view seed coat polyhedral in shape, thick-walled and filled with brownish contents.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 07 per cent, Appendix 2.2.7

T.L.C.:

T.L.C of alcoholic extract of the drug on silica gel 'G' plate using Benzene: Ethylacetate (3:1) shows under U.V. (254 nm) two fluorescent zones at Rf. 0.72 and 0.94 (blue). On exposure to Iodine vapour seven spots appear at Rf. 0.08, 0.27, 0.54, 0.72, 0.91, 0.94 and 0.98 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and on heating the plate for ten minutes at 105^0C eight spots appear at Rf. 0.08, 0.27, 0.54, 0.72, 0.84, 0.91, 0.94 and 0.98 (all violet.) Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Albuminoids, oils and starch.
TEMPERAMENT	**:**	Hot and Moist
ACTION	**:**	Musammin-e-Badan, Muqawwi-e-Bah, Jali, Muwallid-e-Mani
THERAPEUTIC USES	**:**	Zof-e-Bah, Zof-e-Badan, Riqqat-e-Mani
DOSE	**:**	6– 10 g
IMPORTANT FORMULATION	**:**	Luboob-e-Kabir, Laboob Saghir.

DAFLI/DAFLA
(Root)

The drug Dafli consists of dried root of *Nerium indicum* Mill. Syn. *N. odorum* Soland (Fam. Apocynaceae); a large glabrous, evergreen, woody shrub with watery latex, found throughout the year in Upper Gangetic Plains, Himalayas from Nepal to Kashmir upto 2000 m, Central and Southern India; also cultivated near the temples and gardens.

OTHER NAMES:

Urdu	:	Kaner
Arabic	:	Sammul himar
Persian	:	Kharzahra
Hindi	:	Kaner
Bengali	:	Karbbe, Karbee
Gujarati	:	Kaner
Kannad	:	Kanagilu, Kharjahar, Kanigale, Kanagile
Tamil	:	Sevvarali, Arali
Malayalam	:	Kanaveeram
Marathi	:	Kanher
Punjabi	:	Kastooripatte, Errugumeru

DESCRIPTION :

Macroscopic: Drug available in cut pieces, 0.5-2.6 cm thick, branched, cylindrical, external surface grayish with long irregular streaks caused by rupture of bark, internal surface cream coloured; fracutre short; taste bitter.

Microscopic: Root shows cork consisting of 5-12 layered, thin-walled, rectangular, com-pactly arranged parenchymatous cells with a few outer layers occasionally exfoli-ated; secondary cortex consisting of 6-10 layers of oval, tangentially elongated, thin- walled, parenchymatous cells, a few thick-walled laticiferous cells present in this re-gion; secondary phloem composed of oval to polygonal, thin-walled, parenchymatus cells; secondary xylem consisting of usual elements, having pitted vessels, fibres with pointed tips; xylem rays usually uniseriate and rarely biseriate; prismatic crystals of calcium oxalate and simple starch grains scattered in secondary cortex, secondary phloem and phloem rays; simple, oval to round, elliptical starch grains measuring 3--11 μ in diameter, found scattered in cortical cells, phloem and xylem rays.

Powder: Grayish-brown; shows thin-walled, parenchymatous cells, fragments of cork cells, pitted xylem fibres and vessels, a few prismatic crystals of calcium oxalate, simple, round to oval, elliptical starch grains measuring 3-11 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 7.5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 3.5 per cent, Appendix 2.2.4.

Alcohol-soluble extractive	:	Not less than 8 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 8 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Chloroform: Methanol (8 : 2) shows under U.V. (366 run) ten fluorescent zones at Rf. 0.11, 0.15 (both yellow) 0.19 (blue), 0.26 (yellow), 0.49 (pink), 0.60, 0.64, 0.72, 0.88 (all blue) and 0.95, (yellow). On exposure to Iodine vapour ten spots appear at Rf. 0.11, 0.22, 0.30, 0.49, 0.53, 0.64, 0.68, :0.72, 0.90 and 0.95 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate at 105°C for about ten minutes eleven spots appear at Rf. 0.05, 0.11, 0.22, 0.30, 0.49, 0.53 (all grey) 0.64 (yellow), 0.68, 0.72 (both grey),0.90 (violet) and 0.95 (brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glycoside-Cardiac Glycoside.
TEMPERAMENT	**:**	Hot and Dry
ACTION	:	Mohallil,Jali,Mujaffif,Musakkin-e-Dard,Musaffi-e-Dam, Muqawwi-e-Bah.
THERAPEUTIC USES	:	Jarb-wa-Hikka, Daad, Kalaf, Fasad-e-khoon, Zof-e-Bah
DOSE	:	1-3 g

DARHALD
(Stem)

The drug Dar Hald consists of dried stem of *Berberis aristata* DC. (Fam. Berberidaceae); an erect, spinous, deciduous shrub, usually 1.8-3.6 m in height found in the Himalayan ranges at an elevation of 1000-3000 m, and in the Nilgiri hills in South India.

OTHER NAMES:

Urdu	:	Darhald
Arabic	:	Amberbarees
Persian	:	Darchoba
Hindi	:	Daruhaldi, Darhal
English	:	Indian Berberry.
Bengali	:	Maradarishana, Maramanjnal
Gujarati	:	Daruharidra, Daruhuladur
Kannad	:	Maradarishana, Maradarishina, daruhaladi
Tamil	:	Gangeti, Varatiu manjal
Malayalam	:	Maramannal, Maramanjnal
Marathi	:	Daruhalad
Oriya	:	Daruharidra, Daruhalidi
Punjabi	:	Sumalu
Telugu	:	Manupasupu

DESCRIPTION:

Macroscopic: Drug available in pieces of variable length and thickness, bark about 0.4-0.8 cm thick, pale yellowish-brown, soft, slosely and rather deeply furrowed, rough, brittle, xylem portion yellow, more or less hard, radiate with xylem rays, pith mostly absent, when present small, yellowish-brown when dried, fracture short in bark region, splintery in xylem; taste, bitter.

Microscopic: Stem **s**hows rhytidoma with cork consisting of 3-45 rectangular and squarish, yellow coloured, thin-walled cells, arranged radially; sieve elements irregular in shape, thin-walled, a few cells containing yellowish-brown contents; phloem fibres arranged in tangential rows consisting of 1-4 cells, each fibre short thick-walled, spindle-shaped, lignified having wide lumen; half inner portion of rhytidoma traversed by secondary phloem rays; phloem rays run obliquely consisting of radially elongated parenchymatous cells, almost all phloem rays cells having single prismatic crystals of calcium oxalate, a few cells of rhytidoma also contain prismatic crystals of crystals of calcium oxalate; stone cells also found scattered in phloem ray cells in groups, rarely single, mostly elongated, a few rounded, arranged radially, some of which contain a single prism of calcium oxalate crystals; secondary phloem, a broad zone, consisting of sieve elements arranged in tangential bands and tangentially compressed cells alternating with single to five rows of phloem fibres, traversed by multisriate phloem rays; sieve elements arranged in tangential bands and tangentially compressed cells alternating with single to five rows of phloem fibers; phloem fibres short, lignified, thick-walled having pointed ends; secondary xylem broad consisting of xylem vessels, tracheids, xylem fibres and traversed by multisriate xylem rays; xylem vessels numerous, small to medium sized, distributed throughout xylem region in groups or in singles, groups of vessels usually arranged radially; isolated vessels cylindrical with rounded or

projected at one or both ends with spiral thickening; xylem fibres numerous, lignified, large, thick-walled with wide lumen and pointed tips; xylem rays quite distinct, straight , multiseiate, consisting of radially arranged rectangular cells, each ray 30-53 cells high, 8-12 cells wide, a few ray cells containing brown contents.

Powder: Yellow; shows mostly fragments of cork cells, sieve elements, yellow coloured phloem fibres entire or in pieces, stone cells in singles or in groups, numerous prismatic crystals of calcium oxalate, xylem vessels having spiral thickening, thick-walled, lignified xylem fibres and ray cells.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 14 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 8 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS **:** Alkaloids

TEMPERAMENT **:** Cold and Dry

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

THERAPEUTIC USES **:** Amraz-e-Chashm, Yarqan, Fasad-e-Dam, Ehtebas-e-Baul

DOSE **:** 3-5 g

IMPORTANT FORMULATION : Qurs-e-Zarishk, Dawa-ul-Misk Jawahar wali

DHATURA
(Seeds)

The drug Dhatura consists of dried seeds of *Datura metel* Linn.; Syn. *D. fastuosa* L. (Fam. Solanaceae); occurring wild throughout the country.

OTHER NAMES:

Urdu	:	Dhatura
Arabic	:	Jauz Masil
Persian	:	Jauz Masil
English	:	White Thorn Apple
Hindi	:	Dhatura
Bengali	:	Dhutura, Dhutra
Gujarati	:	Dhaturo
Kannad	:	Umbe
Tamil	:	Oomattai, Umattai
Malayalam	:	Ummam
Marathi	:	Dhatra
Oriya	:	Dudura
Punjabi	:	Dhatura
Telugu	:	Ummettha, Erriummetta

DESCRIPTION:

Macroscopic : Seed reniform, compressed, flattened, surface finely pitted; 0.6 cm long, 0.4 cm wide; light brown to yellowish-brown in colour; thicker towards the curved edge, which is rugose; large, pale strophiole near micropyle; odourless; taste bitter.

Microscopic: Shows in outline more or less elongated, irregular or wavy structure having bulgings at either side; testa single layered consists of thick-walled, lignified, sclerenchymatous cells forming club-shaped structure, followed by 3-5 layered more or less tangentially elongated, thin-walled parenchymatous cells; endosperm encloses more or less curved embryo composed of polygonal, thin-walled parenchymatous cells, filled with aleurone grains and abundant oil globules.

Powder: Brown and oily; shows fragments of testa of groups of thick-walled, light brown, sclerenchymatous cells; polygonal, thin-walled parenchymatous cells containing oil globules and aleurone grains.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 6 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 7 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate: Diethylamine (7:2: 1) shows under U.V. (366 nm) three fluorescent zones at Rf. 0.18, 0.33 (both light blue) and 0.93 (blue). On exposure to Iodine vapour three spots appear at Rf. 0.33, 0.47 and 0.93 (all yellow). On spraying with Dragendorff reagent two spots appear at Rf. 0.33 and 0.47 (both orange). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alkaloids - Tropane Alkaloids - Hyoscyamine etc. and Fixed oil.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	**Externally –** Musakkin wa Mukhaddir **Internally –** Moharrik-e-Dimagh, Muskir, Daf-e-Tashannuj Aurooq-e-Khasna, Daf-e-Bukhar
THERAPEUTIC USES	**:**	Waja-ul -Mafasil, Niqras, Sual wa Zeequn Nafas, Nazla, Humma
DOSE	**:**	1-4 Chawal.
IMPORTANT FORMULATION	**:**	Habb-e-Shifa, Dawa-e-Tatura**,** Roughan Chahar Barg.

DOOB
(Root)

The drug Doob consists of dried fibrous roots of *Cynodon dactylon* (Linn.) Pers. Syn. *Panicum dactylon* Linn. (Fam. Poaceae); an elegant, hard, perennial, creeping grass growing throughout the country and ascending to 2440 m.

OTHER NAMES :

Urdu	:	Doob Ghas, Doob
Arabic	:	Ushb
English	:	Creeping Cynodon, Couch Grass, Lawn Grass
Hindi	:	Doob
Bengali	:	Durva
Gujarati	:	Khadodhro, Lilidhro, Dhro
Kannad	:	Garike Hullu
Tamil	:	Aruvam Pullu
Malayalam	:	Koruka Pullu
Marathi	:	Doorva, Hariyalee, Harlee
Punjabi	:	Dubada
Telugu	:	Garika, Pacchgaddi

DESCRIPTION:

Macroscopic: Roots fibrous, cylindrical, upto 4 mm thick, minute hair-like roots arise from the main roots; cream coloured.

Microscopic: Mature root shows epiblema or piliferous layer composed of single layered, thin-walled, radially elongated to cubical cells; hypodermis composed of 1-2 layered, thin-walled, tangentially elongated to irregular shaped cells; cortex differentiated into two zones, 1 or 2 layers of smaller, thin-walled, polygonal, lignified sclerenchymatous and 4-6 layers of thin-walled, elongated parenchymatous cells being larger; endodermis quite distinct being single layered, thick-walled, tangentially elongated cells; pericycle 1-2 layers composed of thin-walled sclerenchymatous cells; vascular bundles consisting of xylem and phloem, arranged in a ring on different radii; xylem exarch, having usual elements; centre occupied by wide pith, composed of oval to rounded thick-walled parenchymatous cells containing numerous simple, round to oval or angular starch grains measuring 4-16 μ in diameter and compound starch grains having 2-4 components.

Powder: Cream coloured; fragments of xylem vessels with pitted walls, thick-walled lignified sclerenchymatous cells and numerous simple rounds to oval or angular starch grains measuring 4-16 μ in diameter and compound starch grains having 2-4 components.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 7 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 3 per cent, Appendix 2.2.4

Alcohol-soluble extractive	:	Not less than 1 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under UV (366 nm) three fluorescent zones at Rf. 0.70,0.89 (both blue) and 0.92 (pink). On exposure to Iodine vapour six spots appear at Rf. 0.22, 0.30, 0.37, 0.80, 0.89 and 0.92 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate at 105°C for ten minutes six spots appear at Rf. 0.22, 0.30, 0.37, 0.80, 0.89 and 0.92 (all grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Phenolic Phytotoxins and Flavonoids.
TEMPERAMENT	**:**	Moderate towards cold.
ACTION	**:**	Musakkin-e-Meda , Musakkin-e-Hararat, Mudirre-e-Baul.
THERAPEUTIC USES	**:**	Surkh Bada, Shara, Sozish-e-Baul, Qai.
DOSE	**:**	3-5 g

FILFIL SIYAH
(Fruit)

The drug Filfil Siyah consists of fully mature dried fruit of *Piper nigrum* Linn. (Fam. Pipera-ceae); a climber, cultivated from Konkan Southwards, especially in North Konkan, Kerala, and also in Assam; fruits ripen from December to March, depending upon climatic condi-tions; fruits harvested from December to April.

OTHER NAMES:

Urdu	:	Filfil Siyah, Kalimirch
Arabic	:	Filfil Aswad
Persian	:	Filfil Siyah
Hindi	:	Kalamirch
Bengali	:	Golmorich, Kalaorich, Morich
Gujarati	:	Kalimori
Kannad	:	Karimonaru, Menaru
Tamil	:	Milagu
Malayalam	:	Kalamiri
Marathi	:	Kalamiri
Punjabi	:	Galmirich, Kalimirch
Telugu	:	Miriyalu, Marichamu

DESCRIPTION:

Macroscopic : Fruits grayish-black to black, hard, wrinkled 0.4-0.5 cm in diameter odour aro-matic taste pungent.

Microscopic : Fruit consists of a thick pericarp for about one third of fruit and an inner mass of perisperm, enclosing a small embryo; pericarp consists of epicarp, mesocarp and endocarp; epicarp composed of single layered, slightly sinuous, tabular cells forming epidermis, below which, are present I or 2 layers of radially elongated, lignified stone cells adjacent to group of cells of parenchyma; mesocarp wide, composed of band of .tangentially elongated parenchymatous cells having a few isolated, tangentially elon-gated oil cells present in outer region and a few fibro-vascular bundles, a single row of oil cells in the inner region of mesocarp; endocarp composed of a row of beaker- shaped stone cells; testa single layered, yellow coloured, thick-walled sclerenchyma-tous cells; perisperm contains parenchymatous cells having a few oil globules and packed with abundant, oval to round, simple and compound starch grains measuring 5.5-11.0 μ in diameter; having 2-3 components and a few minute aleurone grains.

Powder: Blackish-grey; shows more or less iso-diametric or slightly elongated stone cells, interspersed with thin-walled, polygonal hypo-dermal cells; beaker-shaped stone cells from endocarp and abundant polyhedral, elongated cells from perisperm, packed tightly with masses of minute compound 2-3 and single, oval to round, starch grains measuring 5.5-11.0 μ in diameter and a few aleu-rone grains and oil globules.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (7 : 3) shows in visible light four spots at Rf. 0.05, 0.08 (both light green), 0.27 (light yel-low) and 0.52 (yellow). Under UV (366 nm) ten fluorescent zones are visible at Rf. 0.05,0.08 (both light brown), 0.20 (light blue), 0.46 (blue), 0.52 (greenish yeliow), 037 (bluish-yellow), 0.66 (light blue), 0.74 (light pink), 0.82 and 0.97 (both blue). On exposure to Iodine vapour eleven spots appear at Rf. 0.05,0.08, 0.14, 0.20, 027,0,34, 0.46; 0.57, 0.66, 0.74 and 0.97 (all yellow). On spraying with Dragendorff's reagent followed by 5% Methanolic-Sulphuric acid reagent nine spots appear at Rf. 0.05 (light orange), 0.14,0.20, 0.27 (all orange), 0.46, 0.57 (both yellowish orange), 0.66, 0.74 (both orange) and 0:91 (light orange). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110°C twelve spots appear at Rf. 0.05,0.08,0.20, 0.27, 0.46;0.52;0.57,0.66, 0.74,0.82, 0.90and 0.97 (all violet). Appendix 2.2.10

T.L.C. of Piperine

PREPARATION OF THE EXTRACT:

Extract 1 g of Pepper powder by heating under reflux for 15 minutes with 10 ml methanol filter evaporate the filtrate so as to reduce it to 2 ml and use for TLC application.

STANDARD PIPERINE: Dilute 5 gm in 5 ml methanol

ADSORBENT: Silica gel plate.

SOLVENT SYSTEM: Toluene: Ethyl acetate (7:3), (saturate the chamber for at least 30 minutes)

APPLICATION: Pepper extract:- 2.0 µ
Piperine - 10 µ band form

RUNNING DISTANCE : 10 to 12 cm

DRYING: Air drying for 15 to 20 min. and then in an oven for 5 min.

DETECTION: Cool and spray the plate thoroughly with Vanillin-Sulphuric acid reagent and heat at 110° C for 5-10 min. under observation. When piperine spots appear lemon yellow, the plate is to be taken out. Over-heating turns yellow spots to violet.

RF. OF PIPERINE: Approximately 0.5 in case of hand made plates.

CHEMICAL CONSTITUENTS	**:**	Alkaloids (Piperine, Chavicine;-Piperidine, Piperetine), Essential oil.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Externally – Jali, Jazib-e-Khoon, Musakkin. Internally – Muharrik, Muquawwi-e-Meda, Jigar wa Asab, Kasir-e-Riyah, Mudirr-e-baul wa Haiz, Muqawwi-e-Bah, Munaffis-e-Balgham, Tiryaq-e-Meda.
THERAPEUTIC USES	**:**	Nafkh-e-Shikam, Fasad-e-Hazm, Zof-e-Hazm, Kasrat-e-Riyah, Bars-o-Bahaq.
DOSE	**:**	1-2 g
IMPORTANT FORMULATION	**:**	Dawa-ul-Shifa, Jawarish Kamoni, Jawarsh Kamooni kabir, Jawarish Falafali

GHONGCHI
(Root)

The drug Ghongchi consists of dried root of *Abrus precatorius* Linn. (Fam. Papilionaceae); a climber, all along Himalayas ascending to 900 m, spreading throughout the plains; flowering in August-September, fruits ripen during winter.

OTHER NAMES:

Urdu	:	Ghongchi, Ratti
Arabic	:	Ainuddeek
Persian	:	Chashm Kharoos Surkh
Hindi	:	Ratti, Ghungchi
Bengali	:	Kunch, Shonkainh
Gujarati	:	Rati, Chanothee, Chonotee
Kannad	:	Guluganji, Gulagunja
Tamil	:	Kunrimani, Kundumani
Malayalam	:	Kunni, Cuvanna Kunni
Marathi	:	Gunja
Oriya	:	Kainch
Punjabi	:	Ratti
Telugu	:	Guriginga, Gurivinda

DESCRIPTION:

Macroscopic : Root, simple or branched, cylindrical, most often irregularly curved, light brown, surface profusely warty and somewhat rough on account of eruptive development of numerous small lenticles; bark thin, slightly corky, soft, exfoliating in small flakes, exposing internally both cream or yellowish-white; internal bark yellow with a leathery fibrous texture; wood hard light-yellowish or cream coloured; odourless; taste, feebly sweetish becoming mildly bitter.

Microscopic: Root **s**hows thin cork of 3-5 layers of narrow, tangentially elongated cells, some with brownish content; cork cambium, when distinct, composed of 1-2 cells wide, thin-walled, comparatively larger and slightly tangentially elongated cells, followed by 2-4 rows of spherical ovoid or slightly elongated stone cells with thick, pitted walls, small groups of 4-10 sclerenchymatous cells, smaller than stone cells, present at short intervals; secondary phloem consists of usual elements traversed by medullary rays diverging towards periphery; parenchyma thin-walled, mostly tangentially elongated with occasional patches of sieve elements in somewhat collapsed form; small groups of sclerenchyma, similar to those occurring in cortex are also present; cells in inner phloem region appear circular to polyhedral; in older samples phloem elements usually found in compressed condition forming obliquely and tangentially arranged irregular patches; medullary rays distinct and 1-6 cells wide, thin-walled and rectangular, tangentially elongated towards distal end of ray and radially elongated in xylem parts and bast region, mostly containing starch grains of various sizes; cambium forms a complete ring of 1-2 rows of very narrow cells outside the wood; wood composed of narrow concentric, annular bands of very thick-walled wood fibres alternating with similar but wider zone of thick-walled parenchyma; vessels of varying sized with thick, pitted walls; medullary rays usually uni or biseriate but a few broader rays, 5-10 or more rows of cells occasionally present; parenchyma cells of wood and bast filled with simple, rounded to oval starch grains measuring 5.5-13.75 μ in diameter.

Powder: Grayish-brown; shows fragments of cork, stone cells, groups of sclerenchymatous cells, numerous xylem vessels with pitted walls, rounded to oval simple starch grains measuring 5.5 – 13.75 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 2.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 4 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 10 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS **:** Glucoside (Glycyrrhizin)

TEMPERAMENT **:** Hot and Dry

ACTION **:** **M**ohallil, Jali, Akkal, Mohayyij

DOSE **:** 100 mg

THERAPEUTIC USES **:** Bahaq, Bars, Kalaf, Sabal, Bayaz-e-Chashm (as a Surma).

IMPORTANT FORMULATION **:** Raughan Ganj, Majoon-e-Malook

GUL-E-SURKH
(Fowers)

The drug Gul-e-Surkh consists of dired flowers of *Rosa centifolia* Linn. (Fam. Rosaceae); a small erect shrub, 1-1.8 m high, cultivated in gardens.

OTHER NAMES:

Urdu	:	Gulab
Arabic	:	Ward
Persian	:	Gul-e-Surkh
Hindi	:	Gulab
Bengali	:	Golap
Gujarati	:	Moshamee Gulab
Kannad	:	Rojahu
Tamil	:	Rojapoo
Malayalam	:	Rojapuvvu
Marathi	:	Gulab
Punjabi	:	Gulab
Telugu	:	Rosappoovu, Gulab

DESCRIPTION:

Macroscopic : Flower stalked, pinkish-yellow, consists of sepals, petals and stamens attached to pedicel with thalamus at the base; stalk 0.6-3.5 cm long, light green, slender, covered with numerous prickles and hairs; thalamus 1.0-1.8 cm long, light greenish -brown, covered with numerous prickles and hairs; sepals 5, free, 1.3 – 2.4 cm long, unequal, leaf-like, upper part creamish-green and light yellowish-green on lower part, having glandular hairs; petals numerous, pinkish-yellow, 1.5- 4.2 cm long, 1.3 – 2.5 cm wide, smooth obovate to sub-cordate; stamens numerous, free, unequal, dorsifixed, dark-brown; filament 0.3-0.5 cm long; carpels many free, ovary inferior; styles lateral, hairy, free; stigma terminal; taste astringent; odour aromatic.

Microscopic:

Sepal - Shows single layered epidermis on both surfaces; numerous long, unicellular hairs present on upper surface, a few glandular hairs on lower surface; both epidermises followed by a wide zone of mesophyll consisting of round to oval, thin-walled, parenchymatous cells; a number of vascular bundles found scattered in this region.

Petal - Shows lower epidermis papillose and without cuticle; upper epidermis single layered with thin striated cuticle, followed by mesophyll consisting of oval to polygonal, elliptical, thin-walled, parenchymatous cells; a number of vascular bundles found scattered in this zone.

Powder: Light-brown in colour; fragments of petal of epidermis consisting of thin-walled, sinuous cells extended to form papillae; xylem vessel with spiral thickenings long, pointed, uniseriate, unicellular hair and stalked capitate glandular hairs; abundant, smooth spherical pollen grains, measuring 27- 41 µ in diameter having clear intine and exine with three distinct germ pores.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 7.5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 24 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' using n-Butanol : Acetic acid: Water (5:1 :4) shows in visible light six spots at Rf. 0.42 (violet), 0.50 (pink), 0.66, 0.82, 0.87 and 0.92 (all yellow). Under U.V. (366 nm) five fluorescent zones visible at Rf. 0.42 (blue), 0.50 (pink), 0.82, 0.87 and 0.92 (all blue). On exposure to Iodine vapour six spots appear at Rf. 0.42 (grey), 0.50 (pinkish grey), 0.66, 0.82, 0.87 and 0.92 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for about ten minutes at 110°C eight spots appear at Rf. 0.19 (grayish black), 0.32 (grayish black), 0.42, 0.50 (both violet), 0.66, 0.82, 0.87 and 0.92 (all brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential Oil.
TEMPERAMENT	**:**	Murakkab-ul-Quwa
ACTION	**:**	Mufarreh, Muqawwi-e-Aza-e-Raisa, Muqawwi-e-Badan, Daf-e- Qabz, Mohallil-e-Auram, Musakkin.
THERAPEUTIC USES	**:**	Qabz, Aashob-e-Chasm, Warm-e-Jigar, Zof-e-Qalb,Khafaqan
DOSE	**:**	3-5 g
IMPORTANT FORMULATION	**:**	Arq-e-Gulab, Majoon Dabeed-ul-ward, Gulqand.

HABB-US-SALATEEN
(Seeds)

The drug Habb-us-Salateen consists of dried seeds of *Croton tiglium* Linn. (Fam. Euphorbiaceae); a small evergreen tree, 5-7 m high, found throughout tropical India.

OTHER NAMES:

Urdu	:	Jamalgota
Arabic	:	Habbus Salateen
Persian	:	Tukhme Bed Anjeer Khatai
Hindi	:	Jamalgota
Bengali	:	Jaipala
Gujarati	:	Nepalo, Jamalagota
Kannad	:	Nepal, Japal beej, Japala, Nervala
Tamil	:	Nervalam, Neervalam, Valam
Malayalam	:	Nervalam, Neervalam
Marathi	:	Jepal japal
Punjabi	:	Japolota
Telugu	:	Nepalamu

DESCRIPTION:

Macroscopic: Seed albuminous, ovate, oblong, slightly quadrangular, convex on dorsal and somewhat flattened on ventral surface, about 12 mm in length and resemble castor seed in shape, dull cinnamon-brown, often mottled with black due to abrasion in testa, crancle easily detatched and usually absent, hilum on ventral side less distinct than that of castor seed, raphe runs along ventral surface of seed, terminating in a dark chalaza at opposite extremity, kernel yellowish and oily, consisting of a large endosperm, enclosing papery cotyledons and a small radicle, no marked odour; kernel gives at first oily taste followed by an upleasant acridity.

Microscopic: Seed **s**hows a hard testa, consisting of an epidermal layer, covered externally with a thick cuticle and composed of oval and tangentially elongated cells, filled with brownish content; epidermis followed by a layer of raidally elongated , thin-walled cells; endosperm consists of polygonal parenchymatous cells filled with oil globules, a few cells having rosette crystals of calcium oxalate; central region of endosperm shows a dicotyledonous embryo consisting of thin-walled parenhymatous cells.

Powder: White with black fragments of testa; under microscope shows elongated cells containing reddish-brown and yellow contents, oil globules and a few rosette crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 3 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 7 per cent, Appendix 2.2.7

T.L.C.:

T.L.C of alcoholic extract of the drug on silica gel 'G' plate using n-Butanol : Acetic acid: Water (4:1:5) shows under U.V. light (366 nm) three spots at Rf. 0.34, 0.54 and 0.84 (all violet). On exposure to Iodine vapour six spots appear at Rf. 0.10, 0.29,0.39, 0.49, 0.63 and 0.90(all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate at 105^0C for ten minutes three spots appear at Rf. 0.34 (grey), 0.54 (yellow) and 0.84 (brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil, Resins & Phorbol esters.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mushil-e-qavi, Munaffit .
THERAPEUTIC USES	**:**	Amraz-e-Balghami wa Sawdavi, Daad, Ganj, Bars, Waja-ul-Mafasil, Qoolanj.
DOSE	**:**	50 mg -100 mg.
IMPORTANT FORMULATION	**:**	Habb-e-Mushil; Habb-e-Mulaiyin, Dawa-e-Siyah Mushil.

HANZAL
(Root)

The drug Hanzal consists of dried root of *Citrullus colocynthis* Schrad. (Fam. Cucurbitaceae); an annual or perennial, wild herb with prostrate or climbing stem, occurring throughout in drier part of the country.

OTHER NAMES:

Urdu	:	Hanzal, Indrayan
Arabic	:	Hanzal
Persian	:	Kharpaza-e-Talkh, Hindwana-e-Talkh
English	:	Colocynth, Bitter Apple
Hindi	:	Indrayan
Bengali	:	Rakhal Sasa Mul
Gujarati	:	Indravaran, Indrayan, Indramanoa, Indarvaranova
Kannad	:	Havumekke, Havumakke, Indravaruni, Tuntikai, Kadukavadi
Tamil	:	Paikamatti, Paythumatti, Varithummati, Aruthummatti
Malayalam	:	Valiyakattuvell, Valiya Pekkumatti, Cheeiyakattuvellari
Marathi	:	Endrayana, Indravarana
Oriya	:	Gothakakucti, Indrayanalata, Garukhiya
Punjabi	:	Kaudatumma, Tumbi
Telugu	:	Chedu Puchcha

DESCRIPTION:

Macroscopic : Root available in cut pieces of 2-7 cm long, 0.2-2.5 cm thick, cylindrical, slightly twisted; dull yellow; longitudinal fissures present; fracture short; taste extremely bitter.

Microscopic: Root - Mature root shows wavy outline consisting of 6-10 layers of rectangular, thick-walled, tangentially elongated cork cells, a few filled with dark brown contents; secondary cortex consists of 10-15 layers of elliptical, tangentially elongated, thin -walled, parenchymatous cells; secondary phloem a narrow-zone, composed of sieve elements, parenchyma and medullary rays; xylem forms bulk of root, consisting of vessels, fibres, parenchyma and medullary rays; vessels mostly solitary or in groups of two to four having reticulate and spiral thickenings; fibres aseptate, thick-walled, pitted, elongated with pointed ends, lying around vessels; medullary rays poorly developed and uniseriate; starch grains oval to round in shape 2,5-7.5 μ in diameter mostly simple or rarely compound having 2-3 components, found scattered throughout but more abundantly in phloem parenchyma.

Powder: Dirty yellow; shows aseptate fibres, reticulate and spiral vessels, starch grains simple or occasionally compound measuring 2.5 - 7.5 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 8 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 2 per cent, Appendix 2.2.4

Alcohol-soluble extractive	:	Not less than 6.5 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform: Methanol (85:15) shows under UV (366 nm) two fluorescent spots at Rf. 0.16 and 0.30 (both blue). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for about ten minutes at 105^0 C two spots appear at Rf. 0.16 and 0.30 (both grayish blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Saponin and traces of Alkaloid
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mudirr-e-Baul wa Haiz, Muhallil, Daf-e-Samoom, Muraqqiq-e-Dam.
THERAPEUTIC USES	**:**	Daul feel, Istisqa, Ghilzat-e-Dam, Usr-e-Tams, Sammiat-e-Aqrab.
DOSE	**:**	1-2 g
IMPORTANT FORMULATION	**:**	Itrifal Deedan, Arq Matbookh Haft Roza

HEEL KALAN

(Seeds)

The drug Heel Kalan consists of dried seed of *Amomum subulatum* Roxb. (Fam Zingiberaceae); a herb with leafy stem and perenninal root stock; cultivated in swampy places along the sides of mountain streams in Bengal, Assam, Kernataka & Kerala.

OTHER NAMES:

Urdu	:	Badi Elaichi
Arabic	:	Qaqila Kibar
Persian	:	Heel Kalan
English	:	Greater or Nepal cardamom
Hindi	:	Bari elachi
Bengali	:	Baara aliach
Gujarati	:	Elaicho, Mothi Elichi.
Kan.	:	Dodda Yalakki, Nepdi Elakki
Tamil	:	Periya elam, Baraelam, Kattu elam
Malayalam	:	Valiya Elam, Perelam
Marathi	:	Mothi elayachi
Ori.	:	Bada aleicha, Aleicha
Punj.	:	Budi elechi
Telugu	:	Pedda Elakulu

DESCRIPTION :

Macroscopic: Seed 0.4 cm long, 0.3 cm wide, irregularly ovoid with 3 flattened face covered externally with a colourless, membraneous aril; brown to dark brown; odour, aromatic; taste, spicy pungent.

Microscopic:

Seed – Shows a very thin membraneous aril composed of several layers of collapsed cells containing oil globules and prismatic crystasls of calcium oxatalte; testa consist of single layered epidermis of rectangular cells followed by 1-2 layers of collapsed , thin-walled parenchymatous cells, beneath this a single layered large rectangular cells containing oil globules present which is internally surrounded by several layers of flattened, thin-walled, parenchymatous cells; perisperm consists of polygonal, thin-walled, parenchymatous cells containg round to oval starch grains measuring 2-5 μ in diameter, and cluster of calcium oxalate crystals perisperm surrounded externally by thin-walled, sclerenchymatous, radially elongated dark brown beaker like cells; perisperm encloses the endosperm and embryo, both composed of polygonal, thin-walled, parenchymatous cells, rich in protein.

Powder – Light brown; shows fragments of testa, polygonal, thin-walled, perisperm cells, globules, rarely cluster of calcium oxalate crystals, rounded to oval, simple, starch grains measuring 2-5 μ in diameter meter.

IDENTITY, PURITY AND STRENGTH:-

Foreign matter	:	Not more than 1 per cent, Appendix 2.2.2.
Total ash	:	Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 14 per cent, Appendix 2.2.7.
Volatile Oil	:	Not less than 1 per cent, v/w appendix 2.2.10

CHEMICAL CONSTITUENTS : Volatile oil (rich in Cineole)

TEMPERAMENT : Hot and Dry

ACTION : Muqqawwi-e- Meda,Hazim,Kasir-e-Riyah, Mutayyeb-e-Dahan

THERAPEUTIC USES : Zof-e-Meda, Zof-e-Hazm, Nafakh-e-Shikam, Bu-e-Dahan.

DOSE : 500 mg – 1 g

IMPORTANT FORMULATIONS : Jawarish Anarain, Jawarish Bisbasa, Zaroor Katha, Safoof-e-Kath.

HULBA
(Seeds)

The drug Hulba consists of *Trigonella foenum-graecum* Linn. (Fam. Papilionaceae); an aromatic, 30-60 cm tall, annual herb, cultivated throughout the country.

OTHER NAMES:

Urdu	:	Methi
Arabic	:	Hulba
Persian	:	Shamleet
English	:	Fenugreek
Hindi	:	Methi
Gujarati	:	Methi
Kan.	:	Menthe, Mente
Tamil	:	Mendium, Ventaiyam
Malayalam	:	Uluva
Marathi	:	Methi
Punjabi	:	Methi
Telugu	:	Mentulu

DESCRIPTION:

Macroscopic : Seed oblong, rhomboidal with deep furrow running obliquely from one side, dividing seed into a larger and smaller part, 0.2-0.5 cm long, 0.15-0.35 cm broad, smooth, very hard; dull yellow; seed becomes mucilaginous when soaked in water; odour, pleasant; taste bitter.

Microscopic : Seed shows a layer of thick-walled, columnar palisade, covered externally with thick cuticle; cells flat at base, mostly pointed but a few flattened at apex, supported internally by a tangentially wide bearer cells having radiameter l rib-like thickenings; followed by 4-5 layers of tangentially elongated, thin-walled, parenchymatous cells; endosperm consists of a layer of thick-walled cells containing aleurone grains, several layers of thin-walled, mucilaginous cells, varying in size, long axis radially elongated in outer region and tangentially elongated in inner region; cotyledons consists of 3-4 layers of palisade cells varying in size with long axis and a few layers of rudimentary6 spongy tissue; rudimentary vascular tissue situated in spongy mensophyll; cells of cotyledon contain aleurone grains and oil globules.

Powder: Yellow; shows groups of palisade parenchymatous cells, aleurone grains, oil globules, endosperm and epidermal cells of testa.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.6.

CHEMICAL CONSTITUENTS	:	Alkaloid, Sapogenins and Mucilage.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	**J**aali, Mohallil, Munzij-e-Auram, Muqawwi-e-Aasab, Muqawwi-e-Bah, Munaffis-e-Balgham, Mudirr-e-Haiz, Kasir-e-Riyah, Mulaiyyin.
THERAPEUTIC USES	**:**	Aashob-e-Chashm, Sual, Zeeq-un-Nafas, Ehtabas-e-Haiz, Zof-e-Bah, Zof-e-Aasab, Waja-ul-Mafasil.
DOSE	**:**	3-5 g
IMPORTANT FORMULATIONS	**:**	Qairooti Aarad Karsana, Marham Dakhilyoon, Dawa-ul-Misk.

JAL BRAHMI
(Whole plant)

The drug Jal brhami consists of dried whole plant of B*acopa monnieri* (Linn.) Pennel. Syn. *Lysimache monnieri* Linn. (Fam. Scrophulariaceae); a glabrous, succulent, small, prostrate or creeping annual herb, found throughout in diameter in wet and damp places.

OTHER NAMES :

Urdu	:	Jal Brahmi
Hindi	:	Brahmi
Gujarati	:	Neerbrahmi, Bamanevari
Kannad	:	Nirubrahmi, Valabrahmi, Ondelaga, Mandukaparni
Tamil	:	Nirabrahmi, Brahmi vazhukkai
Malayalam	:	Bhahmi
Marathi	:	Jalnam, Brahmi, Birami
Oriya	:	Brahmi
Punjabi	:	Brahmibuti
Telugu	:	Sambarenu, Sambarani

DESCRIPTION:

Macroscopic :

Root: Thin, wiry, small, branched creamish-yellow.

Stem: Thin, green or purplish green, about 1-2 mm thick, soft, nodes and internodes prominent, glabrous; taste, slightly bitter.

Leaf : Simple, opposite, decussate, green, sessile, 1-2 cm long, obovate-oblong; taste, slightly bitter.

Flower: Small, solitary axillary, pedicels 6-30 mm long, bracteoles shorter than pedicels.

Fruit : Capsules upto 5 mm long, ovoid and glabrous.

Microscopic:

Root shows a single layer of epidermis, cortex having large air cavities; endodermis single layered; pericycle not distinct; stele consists of a thin layer of phloem with a few sieve elements and isolated material from xylem shows vessels with reticulate thickenings.

Stem shows single layer of epidermis followed by a wide cortex of thin-walled cells with very large intercellular spaces; endodermis single layered; pericycle 3 consisting of 1-2 layers; vascular ring continuous, composed of a narrow zone of phloem towards periphery and a wide ring of xylem towards centre; centre occupied by a small pith with distinct intercellular spaces; starch grains simple, round to oval, present in a few cells of cortex and endodermis, measuring 4-14 μ in diameter, and 8.0-14.0 x 2.5 – 9.0 μ in diameter respectively.

Leaf shows a single layer of upper and lower epidermis covered with thin cuticle; glandular hairs sessile, subsidiary cells present on both surfaces; a few prismatic crystals of Calcium oxalate occasionally found distributed in mesophyll cells; mesophyll traversed by small veins surrounded by bundle sheath; no distinct midrib present.

Powder: Yellowish – brown; shows xylem vessels with reticulate thickening, glandular hairs, simple, round and oval starch grains, measuring 4-14 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 18 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 6 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS **:** Alkaloids.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Muqawwi-e-Dimagh Wa Hafiza, Musakkin, Musaffi-e-Dam, Mudir-e-Baul,Waja-ul-Asab, Musakkin, Hirkat-ul-b

THERAPEUTIC USES **:** Zof-e-Dimagh wa Hafza, Sozish-e-Baul

DOSE **:** 5 g

JAMUN
(Stem Bark)

The drug Jamun consists of dried stem bark of *Syzygium cuminii* (Linn.) Skeels (Fam. Myrtaceae); a large evergreen tree, attaining a height of 30 m and a girth of 3.6 m with a bole up to 15 m, found throughout India upto an altitude of 1,800 m.

OTHER NAMES:

Urdu	:	Jamun
Hindi	:	Jomuna, Raja Jambuda
Bengali	:	Jaam
Gujarati	:	Jambu, Jambuda
Kannad	:	Merale, Jamneralae, Jambu, Neralamara
Tamil	:	Naaval, Navval Sambu, Mahamaram, Nagal
Malayalam	:	Njaval, Naval
Marathi	:	Jambhool
Oriya	:	Jamukoli, Jamu, Jam
Punjabi	:	Jammu
Telugu	:	Nesedu

DESCRIPTION:

Macroscopic : Drug occurs in slightly curved or flat pieces, 0.5-2.5 cm thick, younger bark mostly channelled, external surface more or less rough and rugged due to exfoliation and vertical cracks, light grey to ash coloured, internal surface fibrous, rough, and reddish-brown, and fracture short and splintery; taste astringent.

Microscopic: Mature stem bark shows a wide zone of cork differentiated into upper and lower cork zones, forming a rhytidoma; cork consisting of tangentially elongated rectangular cells, upper few layers thick, stratified and reddish-brown, having groups of 2-4 stone cells and crushed elements of phloem; lower cork thin and colourless; cork cambium not distinct; secondary phloem composed of sieve elements, and phloem rays; phloem parenchyma thin-walled and polyhedral in shape; stone cells, oval to angular, elongated; fibres aseptate; both stone cells and fibres single or in groups present throughout this region; phloem rays 1-4 cells wide; reddish-brown content, rosette crystals of calcium oxalate and simple, round to oval starch grains, measuring 5-11 μ in diameter.

Powder: Light brown; shows fragments of thin-walled cork cells, aseptate fibres; single or in groups, oval to angular, elongated, stone cells; rosette and prismatic crystals of calcium oxalate and simple, round to oval starch grains, measuring 5-11 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 11 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 9 per cent, Appendix 2.2.6

Water-soluble extractive	:	Not less than 11 per cent, Appendix 2.2.7
CHEMICAL CONSTITUENTS	**:**	Tannins.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Habis-e-Ishal, Muqawwi-e-Meda; Muqawwi-e-lissa
THERAPEUTIC USES	**:**	Ishal, Zof-e-Meda, Zof-e-lissa
DOSE	**:**	2-5 g

JAMUN
(Seeds)

The drug Jamun consists of dried seeds of *Syzygium cuminii* (Linn.) Skeels (Fam. Myrtaceae); a large evergreen tree, attaining a height of 30 m and a girth of 3.6 m with a bole up to 15 m, found throughout India upto an altitude of 1,800 m.

OTHER NAMES :

Urdu	:	Jamun
Hindi	:	Jamuna
Bengali	:	Badjam, Kalajam
Gujarati	:	Gambu, Jamun
Kannad	:	Nerale Beeja, Jambu Nerale
Tamil	:	Naval
Malayalam	:	Njaval
Marathi	:	Jambul
Oriya	:	Jam Kol, Jamu Kol
Punjabi	:	Jaamun
Telugu	:	Alla Nereduchettu, Neredu Chettu

DESCRIPTION:

Macroscopic : 2-5 seeds, compressed together into a mass resembling a single seed, the whole seed enclosed in a cream coloured, coriaceous covering, smooth, oval or round, 1 cm long, 1 cm wide, brownish-black; taste, astringent.

Microscopic:

Seed shows cotyledons consisting of single layered epidermis, mesophyll composed of isodiametric, thin-walled, parenchymatous cells fully packed with simple starch grains, oval rounded measuring 7-28μ in diameter, a few schizogenous cavities are also found.

Powder: Brown coloured; shows a few parenchymatous cells and numerous oval, rounded starch grains, measuring 7-28 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.7

T.L.C.:

T.L.C of alcoholic extract of the drug on silica gel 'G' plate using Toluene : Ethyl acetate

(90:10) shows under U.V. light (366 nm) one flurorescent zone at Rf. 0.30 (blue). On exposure to Iodine vapour four spots appear at Rf. 0.12,0.20,0.30 and 0.95 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 105^0C, three spots appear at Rf. 0.20, 0.30 and 0.95 (all violet) Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glycoside (Jamboline), Tannin, Ellagic acid and Gallic acid.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Muqawwi-e-Meda wa Jigar, Moharrik-e-Ishtaha Qabiz, Musakkin-e-hararat,
THERAPEUTIC USES	**:**	Zof-e-Meda wa Jigar, Zof-e-Ishtahala, Muskkin-e-Sozish, Ishal-e-Damvi wa Safravi, Ziyabetus.
DOSE	**:**	3-5 g
IMPORTANT FORMULATION	**:**	Safoof Ziyabetus, Qurs Ziyabetus, Safoof Khasta.

KAIPHAL
(Stem Bark)

The drug Kaiphal consists of dried stem bark of *Myrica esculenta* Buch.- Ham. ex D. Don. Syn. *M. nagi* Hook.f. (Fam. Myricaceae); a dioecious evergreen, small or moderate sized tree, 3-15 m high, found in subtropical Himalayas from Ravi eastward to Assam, Khasi, Jaintia, Naga and Lushai hills upto an elevation of 900-2100 m.

OTHER NAMES:

Urdu	:	Kaiphal
Arabic	:	Ood-ul-Barq
Persian	:	Dar-e-Sheeshan
Hindi	:	Kayphal
Bengali	:	Kaychhal, Katphal, Kayphal
Gujarati	:	Kayphal
Kannad	:	Kadujai Kai, Katphala, Kirisivari, Kirishivane
Tamil	:	Marudam, Marudampatai
Malayalam	:	Marut
Marathi	:	Kaayphal
Punjabi	:	Kanphal, Kayphal
Telugu	:	Kaidaryamu

DESCRIPTION:

Macroscopic : Drug occurs in pieces of variable length, 1-2.5 cm thick, slightly quilled, fissured longitudinally and transversely, outer surface rough, grey to brownish-grey, inner surgace dark brown and smooth; fracture, hard; taste, bitter.

Microscopic: Mature stem bark shows multilayered cork, composed of rectangular, tangentially elongated, thin-walled cells, some filled with red contents; secondary cortex a wide zone, composed of thin-walled, rectangular to polygonal, parenchymatous cells, a number of cells filled with red colouring matter and simple, round to oval starch grains measuring 6-11 μ diameter a number of stonecells, in singles or in groups, circular polygonal or oval, thick walled, lignified with simple pits and radiating canals, found scattered throughout secondary cortex; secondary phloem consists of sieve elements, phloem fibres, crystal fibres, stone cells and phloem parenchyma traversed by phloem rays. Numerous prismatic crystals of calcium oxalate present in secondary phloem; phloem fibres with blunt or pointed end and highly thick walled, with very narrow lumen present in groups; stone cells similar to those found in secondary cortex, mostly in singles or in groups of 2-3 sometimes associated with fibre groups in phloem parenchyma. In isolated preparation and tangential sections crystal fibres show more than twenty chambers having single prismatic crystals of calcium oxalate in each chamber; a number of phloem parenchyma cells containing red colouring matter; phloem rays 1-4 seriate, containing red colouring matter.

Powder: Rusty red; shows a number of stone cells, phloem fibres, crystal fibres and prismatic crystals of calcium oxalate and simple, round to oval, starch grains measuring 6-11 μ in diameter.

IDENTITY, PURITY AND STRENGTH

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 13 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 12 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid: Water (4:1:5) shows in visible light five spots at Rf. 0.25, 0.43, 57, 0.75 (all grey) and 0.88 (yellowish green). Under U.V. (366 nm) seven fluorescent zone are visible at Rf. 0.09, 0.18 and 0.30 (all light blue), 0.43 (green), 0.49 (blue), 0.65 blue) and 0.71 (pink). On exposure to Iodine vapour eleven spots appear at Rf. 0.07, 09, 0.12, 0.25, 0.30, 0.35, 0.43, 0.52, 0.57, 0.75 and 0.88 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C six spots appear at Rf. 0.09 (black), 0.30 (black), 0.57 (light brown), 0.71 (light pink), 0.82 light pink) and 0.88 (yellowish green). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Waxy Material
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mohallil, Qabiz, Kasir-e-Riyah, Muqawwi-e-Asab, Daf-e-Taaffun, Muattis, Jazib-e-Ratubat
THERAPEUTIC USES	**:**	Falij, Laqwa, Rasha, Qurooh-e-Khabisa, Dard-e-Dandan, Nazla, Zukam, Sual.
DOSE	**:**	3-5 g.
IMPORTANT FORMULATION	**:**	Safoof Istihaza, Raughan Surkh

KAIPHAL
(Fruit)

The drug Kaiphal consists of dried fruit of *Myrica esculenta* Buch.- Ham. ex D. Don. Syn. *M.nagi* Hook.f. (Fam. Myricaceae); a deciduous, evergreen, small or moderate sized tree, 3-15 m high, found in sub-tropical Himalayas from Ravi eastwards to Assam, and in Khasi, Jaintia, Naga and Lushai hills at the elevation of 900-2100 m.

OTHER NAMES :

Urdu	:	Kaiphal
Arabic	:	Ood-ul-Barq
Persian	:	Dar-e-Sheeshan
Hindi	:	Kayphal
Bengali	:	Kaychhal, Katphal, Kayphal
Gujarati	:	Kayphal
Kannad	:	Kadujai Kai, Katphala, Kirisivari, Kirishivane
Tamil	:	Marudam, Marudampatai
Malayalam	:	Marut
Marathi	:	Kaayphal
Punjabi	:	Kanphal, Kayphal
Telugu	:	Kaidaryamu

DESCRIPTION:

Macroscopic :

Fruit : A drupe, ellipsoid or ovoid, 0.7-1.0 cm long, 0.5-0.7 cm wide, dark brown, surface tubercled, very hard; taste, sourish sweet.

Seed : Ovoid, 0.6 cm long, 0.3 cm wide, surface very smooth, light brown; taste, oily.

Microscopic:

Fruit: Shows epicarp cells isodiametric in surface view, mass of reddish-brown, thin-walled, parenchymatous cells, a few elongated tubercled cells with smooth walls, endocarp hard and stony consisting of sclerenchymatous cells.

Seed: Seed coat shows single layered, thick, brown coloured cells; cotyledons composed of sinlge layered, thin-walled, isodiametric, fully packed with oil globules and aleurone grains.

Powder: Yellowish – brown; shows rectangular to hexagonal, thin-walled seed coat and polyugonal epidermal cells in surface view; tubereled parenchymatous cells, oil globules and aleurone grains

IDENTITY, PURITY AND STRENGTH:

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

Total ash	:	Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 2.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 17 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the a1coholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows in visible light five spots at Rf. 0.25, 0.43, 0.57, 0.75 (all grey) and 0.88 (yellowish green). Under U.V. (366 nm) seven fluorescent zones are visible at Rf. 0.09, 0.18 and 0.30 (all light blue), 0.43 (green), 0.49 (blue), 0.65 (blue) and 0.71 (pink). On exposure to Iodine vapour eleven spots appear at Rf. 0.07, 0.81, 0.12, 0.25, 0.30, 0.35, 0.43, 0.52, 0.57, 0.75 and 0.88 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C six spots appear at Rf. 0.09 (black), 0.30 (black), 0.57 (light brown), 0.71 (light pink), 0.82(light pink) and 0.88 (yellowish green). Appendix 2.2.10

TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mohallil, Qabiz, Kasir-e-Riyah, Muqawwi-e-Asab, Daf-e-Taaffun, Muattis, Jazib-e-Ratubat.
THERAPEUTIC USES	**:**	Falij, Laqwa, Rasha, Qurooh-e-Khabisa, Dard-e-Dandan, Nazla, Zukam, Sual.
DOSE	**:**	3-5 g
IMPORTANT FORMULATION	**:**	Safoof Istihaza, Raughan Surkh.

KAKRI

(Seeds)

The drug Kakri consists of seeds of *Cucumis melo* var. *utilissimus* Duthie & Fuller syn. *C. utilissimus* Roxb. (Fam.Cucurbitaceae), an annual creeping herb, cultivated in many parts of the country, especially in North India and particularly in Uttar Pradesh and Punjab.

OTHER NAMES :

Urdu	:	Kakari
Arabic	:	Bazrul Qissa
Persian	:	Tukhme Khayare Daraz, Tukhme Khayer za, Tukhme Khayar
Hindi	:	Kakri, Kakadi
Bengali	:	Kakur, Karikuda
Gujarati	:	Kakadi
Kannad	:	Saute
Tamil	:	Kakkarikkay, Vellarikkai
Malayalam	:	Kamkadi, Vellarika
Marathi	:	Kakdi, Valnka
Punjabi	:	Kakri
Telugu	:	Dosakaya

DESCRIPTION:

Macroscopic: Seed compressed, more or less ellipsoid, 0.7-1.0 cm long, 0.3-0.4 cm wide, surface smooth, glossy, creamish-yellow taste sweetish oily.

Microscopic: Seed **s**hows seed coat consisting of a layer of round to oval stone cells, lignified with distinct lumen and striations, followed by a narrow zone of endosperm consisting of cellulosic, thin-walled, rounded and tangentially elongated, parenchymatous cells, containing a few oil globules and aleurone grains. Cotyledons two, straight, consisting of single layered epidermal cells, covered with thick cuticle, mesophyll cells thin-walled, radially elongated to squarish, parenchymatous, containing numerous oil globules and aleurone grains.

Powder: Creamish-yellow and oily; shows stone cells, mesophyll cells and numerous oil globules and aleurone grains.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS	**:**	Oil & Sugars
TEMPERAMENT	**:**	Cold and Moist
ACTION	**:**	Mudirr-e-Baul, Musakkin-e-Safra, Musakkin-e-Dam, Musakkin Atash.
THERAPEUTIC USES	**:**	Suzak, Hurqat-ul-Baul, Hararat-e-Jigar wa Meda, Sange gurda wa Masana
DOSE	**:**	5-7 g

KARANJ
(Root Bark)

The drug Karanj consists of dried root bark of *Pongamia pinnata* (Linn.) Pierre. Syn. *P.glabra* Vent, *Cytisus pinnatus* Linn.(Fam. Papilionaceae), a glabrous tree, upto 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

OTHER NAMES :

Urdu	:	Karanj
Hindi	:	Karanj
Bengali	:	Natakaranja, Dahara Karanja
Gujarati	:	Kanaji
Kan.	:	Honge Beru
Tamil	:	Pungai
Malayalam	:	Pongu, Ungu
Marathi	:	Karanja
Oriya	:	Karanja
Punjabi	:	Karanj
Telugu	:	Ganuga, Kanuga

DESCRIPTION :

Macroscopic: Drug occurs in pieces of variable sizes; reddish-brown externally and yellowish-white, internally; external surface rough, due to peeling off of outer thin skin and presence of numerous irregularly scattered and transversely arranged rows of lenticels; fracture fibrous; taste very bitter.

Microscopic: Root bark shows cork consisting or 5-15 or more rows of rectangular, tangentially elongated, thin-walled, cells; secondary cortex wide composed of polygonal, tangentially elongated cells, most of the cells containing both simple and compound starch grains having 2-5 components round to oval in shape, 3-11 μ in diameter, a few cells contain yellowish-brown contents and prismatic crystals of calcium oxalate; stone cells found scattered in this region in singles and groups, single cells of varying shape and size; secondary phloem very wide, composed of tangentially arranged fibres alternating with sieve tubes and phloem parenchyma, traversed by phloem rays; most of phloem parenchyma cells contain starch grains and crystals, similar to those present in secondary cortex. Phloem rays many, mostly straight, 1-2 seriate, consisting of thin-walled, radially elongated cells towards inner region and tangentially elongated towards periphery; most of ray cells contain starch grain, similar to those present in secondary cortex.

Powder: Creamish-yellow; shows thin-walled, parenchymatous cells, cork cells, phloem fibres, stone cells and simple and compound starch grains measuring 3 –11 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 2 per cent, Appendix 2.2.4.

Alcohol-soluble extractive	:	Not less than 3.5 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 17 per cent, Appendix 2.2.7.

T.L.C. :

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene : Ethylacetate (9 : 1) shows under U.V. light (366 nm) eleven fluorescent zones at Rf. 0.04 (blue), 0.08 (greenish blue), 0.13 (Sky blue), 0.18 (blue), 0.25 (Sky blue), 0.31 (Sky blue), 0.37 (greenish yellow), 0.42 (Sky blue), 0.47 (greenish yellow), 0.51 (light blue), 0.80 (light blue). On exposure to Iodine vapour nine spots appear at Rf. 0.09, 0.18, 0.31, 0.37, 0.47, 0.47, 0.51, 0.80 and 0.98 (all yellow). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Flavones Kanugin, Demethoxy-kanugin, Pongachromene & Tetra-o-Methylfisetin.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Daf-e-Bhagandar.
THERAPEUTIC USES	**:**	Bhagandar.
DOSE	**:**	3- 5 g

KARANJ
(Leaf)

The drug Karanj cosists dried leaf of *Pongamia pinnata* (Linn.) Pierre. Syn. *P.glabra* Vent, *Cytisus pinnatus* Linn.(Fam. Papilionaceae), a glabrous tree, upto 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

OTHER NAMES :

Urdu	:	Karanj
Hindi	:	Natakaranja, Dahara Karanja
Gujarati	:	Kanaji
Kannad	:	Karanj
Bengali	:	Honge Beru
Tamil	:	Pungai
Malayalam	:	Pongu, Ungu
Marathi	:	Karanja
Oriya	:	Karanja
Punjabi	:	Karanj
Telugu	:	Ganuga, Kanuga

DESCRIPTION :

Macroscopic: Leaves imparipinnate, leaflets 2-3 pairs, ovate or elliptic with smooth margins, 6.2-11.5 cm long and 3.9-8.3 cm wide, dark green, petiolule short, 0.5-0.8 cm.

Microscopic:

Leaf :

Petiolule – circular in outline, covered with cuticle, epidermis single layered, consisting of tabular cells; cortex consisting of angular, isodiametric, collenchymatous cells without intercellular spaces, a few cells containing prismatic crystals of calcium oxalate; pericycle present in the form of sclerenchymatous sheath; vascular bundle single, arc-shaped, consisting of xylem and phloem; xylem vessels arranged radially, traversed by xylem rays; a few schizogenous cavities found scattered in cortex.

Midrib – shows single layered epidermis, consisting of tabular cells, covered with thick cuticle, followed by 3-4 layered collenchymatous hypodermis; cotrtex consists of round to oval, thin-walled parenchymatous cells; pericycle present in the form of sclerenchymatous sheath; vascular bundle, collateral, conjoint and arranged in discontinuous ring; central portion occupied by oval to polygonal thin-walled parenchymatous pith, prismatic crystals of calcium oxalate present in cortex, phloem and pith.

Lamina – shows single layered epidermis covered with thick cuticle, palisade two layered; spongy parenchyma 3-5 layered, a few containing prismatic crystals similar to midrib, occasionally a few spongy parenchyma cells get elongated and look like palisade cells, palisade ratio 3.5.5.0; vein islet number 18-25 per mm square, stomata anisocytic, present in lower surface, stomatal index 12.5-20.

Powder: Green shows spiral xylem vessels, mesophyll cells, epidermal cells and a few prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 3.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 16 per cent, Appendix 2.2.7.

CHEMICAL CONSTITUENTS : A new Furanoflavone – 3' –methoxy pongapin in addition to Karanjin, Kanjone and its two isomers 7-Methoxyfurano-(4",5",-6-5) – flavone and 8-Methoxyfurano-(4",5",-6,5)-flavone and 8-methoxyfurano-(4",5"-6-7)-flavone.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Daf-e-Bawaseer, Daf-e-Taaffun, Mumsik, Musaffi, Qatil-e-Hashrat.

THERAPEUTIC USES **:** Bawaseer, Suzak, Sara, Zakhm Mutaafiin, Surat-e-inzal.

DOSE **:** 3-5 g

KARANJ
(Stem Bark)

The drug Karanj consists of dried stem bark of *Pongamia pinnata* (Linn.) Pierre. Syn. *P.glabra* Vent, *Cytisus pinnatus* Linn. (Fam. Papilionaceae), a glabrous tree, upto 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

OTHER NAMES:

Urdu	:	Karanj
Hindi	:	Karanj
Bengali	:	Natakaranja, Dahara Karanja
Kannad	:	Honge Beru
Tamil	:	Pungai
Malayalam	:	Pongu, Ungu
Marathi	:	Karanja
Oriya	:	Karanja
Punjabi	:	Karanj
Telugu	:	Ganuga, Kanuga

DESCRIPTION:

Macroscopic : Bark available in channelled, recurved, slightly quilled, usually 0.2-1 cm thick, lenticellate pieces, more or less smooth; outer surface ash-gray to grayish-brown and internal surface yellowish-white to cream coloured; fracture short and fibrous, odour unpleasant; taste bitter.

Microscopic: Bark shows 5-20 or more layers of cork, composed of rectangular, thick-walled cells, filled with reddish brown content, at some places lenticels also appear; secondary cortex 10-15 layered having oval to polygonal, tangentially elongated, thin~walled, parenchymatous cells; beneath secondary cortex a large group of oval to elongated stone cells, arranged in a tangential manner, forming a continuous or discontinuous band; secondary phloem composed of sieve elements, phloem parenchyma, phloem fibre and stone cells, traversed by medullary rays; sieve elements and parenchyma composed of rectangular to polygonal thin-walled cells, alternating with stone cells; fibre small, polygonal, thin-walled and aseptate, a few associated with stone cells and arranged radially; medullary rays wavy, usually 2-4 cells wide, radially elongated and rounded to oval in shape, a few stone cells scattered in secondary cortex as in secondary phloem; rhomboidal crystals of calcium oxalate found in secondary cortex; starch grains simple, rounded to oval and compound having 2-4 components, present in secondary cortex, phloem parenchyma and rays cells; oil globules found in secondary phloem only.

Powder: Yellowish-cream; shows groups of rectangular to polygonal, elongated, thin -walled parenchymatous sieve tube; aseptate fibre and stone cells; rhomboidal crystals of calcium oxalate; rounded to oval, simple and compound starch grains, measuring 3-14 μ in diameter and rarely oil globules.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 13 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 3 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 18 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS **:** Flavones and Furanoflavones like Karanjin, Pongapin, Demeth-oxy-kanugin, Kanugin, Pinnatin, Tetra-o-Methylfisetin, Gamatin, 5-Methoxyfurano (2",3",7 : 8), flavone and 5-Methoxy-3'4' Methylene dioxyfurano (2",3",7 : 8) flavone & two new Furano compoWlds Glabra-I and Glabra-H. It also contains alkaloids and Triterpenoid saponin.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Daf-e-Suzak, Daf-e-Bawaseer wa Bhagandar

THERAPEUTIC USES **:** Suzak, Bawaseer wa Bhagandar

DOSE **:** 3-5 g

KARANJ
(Root)

The drug Karanj consists of dried root of *Pongamia pinnata* (Linn.) Pierre. Syn. *P.glabra* Vent, *Cytisus pinnatus* Linn.(Fam. Papilionaceae), a glabrous tree, up to 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

OTHER NAMES :

Urdu	:	Karanj
Hindi	:	Karanj
Bengali	:	Natakaranja, Dahara Karanja
Gujarati	:	Kanaji
Kannad	:	Honge Beru
Tamil	:	Pungai
Malayalam	:	Pongu, Ungu
Marathi	:	Karanja
Oriya	:	Karanja
Punjabi	:	Karanj
Telugu	:	Ganuga, Kanuga

DESCRIPTION:

Macroscopic : Drug occurs in pieces of varying sizes, bark, reddish-brown or dull brown, rough due to the presence of numerous, irregularly distributed, and also transversely arranged rows of lenticels, bark does not easily separate from xylem, internally light yellow, light in weight, fracture, fibrous in bark portion and hard to break in xylem portion when the root is thick when in pieces splits longitudinally; taste bitter.

Microscopic: Root shows cork consisting of 5-15 or more rows of rectangular, tangentially elongated, thin-walled, cells; secondary cortex wide composed of polygonal, tangentially elongated cells, most of the cells containing both simple and compound starch grains consisting of 2-3 components, rounded to oval in shape, 3-11 μ in diameter. Some cells containing yellowish-brown contents and prismatic crystals of calcium oxalate; stone cells found in single as well as in groups of varying shapes and size; secondary phloem a very wide zone, consisting of tangentially arranged fibres, alternating with sieve elements and phloem parenchyma traversed by phloem rays mostly straight, 1-2 seriate, consisting of radially elongated, thin-walled cells towards inner region, tangentially elongated towards outer region; starch grains, and crystals similar to those of cortical cells, also present in phloem parenchyma and phloem rays; secondary xylem consisting of vessels, tracheids, fibres and parenchyma; vessels found scattered throughout secondary xylem region in singles or groups of 2-4 or rarely, more; fibres thick-walled. arranged in tangential bands traversed by xylem rays; xylem parenchyma cells thin-walled, rounded to oval in shape; xylem rays uni to triseriate consisting of radially elongated cells; starch grains and calcium oxalate crystals are similar to those present in cortical cells and also found scattered in xylem parenchyma and xylem ray cells.

Powder: Light yellow; shows fibres in singles or groups; xylem vessels entire or in pieces with reticulate thickenings; starch grains in abundance both simple and compound, consisting of 2-3 components, measuring 3-11 μ in diameter, stone cells and a few prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

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

CHEMICAL CONSTITUENTS : Karanjin, Kanugin, Demethoxy-kanugin, Pongachromene & Tetra-O- Methylfisetin.

TEMPERAMENT : Hot and Dry

ACTION : Daf-e-Suzak, Daf-e-Bawaseer wa Bhagandar.

THERAPEUTIC USES : Suzak, Bawaseer wa Bhagandar.

DOSE : 3-5 gms

KARELA

(Fresh fruit)

The drug Karela consists of fresh fruit of *Momordica charantia* Linn. (Fam. Cucur-bitaceae); a monoecious climber found throughout the country often under cultivation, upto an altitude of 1500 m.

OTHER NAMES :

Urdu	:	Karela
Arabic	:	Fisa-ul-Himar
Persian	:	Sima Hang
English	:	Bitter gourd
Hindi	:	Karela
Bengali	:	Karolla
Gujarati	:	Karela
Kannad	:	Hagalakai
Tamil	:	Paharkai
Malayalam	:	Kaippa, Pavackkai
Marathi	:	Karla
Oriya	:	Kalara, Salara
Punjabi	:	Karela
Telugu	:	Kaakara Kaaya

DESCRIPTION:

Macroscopic : Fruit 2.5 - 25 cm long, oblong, pendulous, fusiform, usually pointed or beaked, ribbed and bearing numerous triangular tubercles, 3 valved at the apex when mature, sur-face rough; light green to green in colour containing numerous seeds; taste, extremely bitter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 8.5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.6 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 28 per cent, Appendix 2.2.7

T.L.C. :

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform : Methanol (90 :10) shows under U.V. (366 nm) four fluorescent zones at Rf. 0.23 (red), 0.61 (light sky blue), 0.96 (sky blue), 0.98 (red & sky blue). On exposure to Iodine vapour four spots appear at Rf. 0.17, 0.46, 0.67 and 0.98 (all yellow). On spraying with 5% Methanolic Phosphomolybdic acid reagent nine spots appear at Rf. 0.03, 0.16, 0.34, 0.43, 0.50,0.60,0.75,0.81 and 0.98 (all blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alkaloid (Momoridicine) and Glycosides.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Meda, Mulaiyin-e-Taba, Qat-e-Balgham, Qatil-e-Kirm-e-Shikam, Mohallil -e-Auram.
THERAPEUTIC USES	**:**	Waja-ul-Mafasil, Niqras, Istisqa, Deedan-e-Shikam, Sual, Dama.
DOSE	**:**	10 -20 g
IMPORTANT FORMULATION	**:**	Sufoof Ziabetus

KATH GULAR
(Root)

The drug Kath Gular consists of dried root of *Ficus hispida* Linn. (Fam. Moraceae); a moderate sized tree or shrub, distributed throughout the outer Himalayan range from Chenab eastwards to Bengal, Central and South India and Andaman Islands.

OTHER NAMES :

Urdu	:	Kath Gulnar, Kalanngri, Kath
Arabic	:	Jamaiz, Tinul-Ahmaq
Persian	:	Anjeer Dashti
Eng	:	Wild fig.
Hindi	:	Konea-dumbar, Kathumar
Bengali	:	Kakdumur, Kathdumur, Kakadumbar
Gujarati	:	Tedumbaro, Dhedadambaro, Dhedhumbro, Dhedhumro
Kannad	:	Kadaatti, Arjeeru, Hamu, Anjeeru, Onagida, Hanna, Adane
Tamil	:	Peyatti
Malayalam	:	Peyatti, Kattatti, Erumanakku, Parakasimi
Marathi	:	Rambal, Kalodumbar, Bhuiumbar
Oriya	:	Dimri, Ani Dambura
Punjabi	:	Rumbal
Telugu	:	Brahma medi, Kakimedi

DESCRIPTION:

Macroscopic : Roots 4 -17 cm long, 1.0-2.5 cm thick, almost cylindrical, occasionally somewhat compressed at places, external surface brown to dark brown with deep, elliptical cracks and tangentially arranged rows of lenticels; fracture splintery.

Microscopic: Root shows 5-10 layers of cork, consisting of thin-walled, compressed cells, outer layers exfoliating; secondary cortex a wide zone consisting of irregularly arranged, tangentially elongated, thin-walled parenchymatous cells, some of which contain rosette - crystals of calcium oxalate and dark red coloured contents; secondary phloem consisting of' usual elements, comprising of thin-walled cells; cellulosic phloem fibres found scattered throughout secondary phloem in singles and in groups of 2-3;. a few phloem parenchyma and phloem ray cells contain rosette crystals of calcium oxalate; secondary xylem situated centrally, consisting of usual elements, all being lignified; xylem vessels numerous, equally distributed throughout secondary xylem region, in singles as well as in groups of 2-6, xylem rays numerous, straight and 1-5 cells wide.

Powder: Yellowish-brown; shows cellulosic phloem fibres, xylem vessels in broken pieces with pitted thickenings and rosette crystals of calcium oxalate.

T.L.C. :

T.LC. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) on exposure to Iodine vapour shows six spots at Rf. 0.05, 0.15, 0.30, 0.34, 0.92 and 0.98 (all yellow). On

spraying with Dragendorff, reagent followed by 5% aqueous Sodium Nitrite solution four spots appear at Rf. 0.30, 0.34,0.92 and 0.98 (all light brown). Appendix 2.2.10

IDENTITY, PURITY AND STRENGTH-

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 7 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.7

CHEMICAL CONSTITUENTS **:** Alkaloids

TEMPERAMENT **:** Hot and Dry

ACTION **:** Mukharrish, Muhammir, Daf-e-Bars

THERAPEUTIC USES : Bars-wa-Bahaq

DOSE **:** 3-5 g

MOUZ
(Rhizome)

The drug Mouz (Kela) consists of fresh rhizome of *Musa paradisiaca* Linn. (Fam. Musaceae); plant found cultivated throughout India upto 1200 m.

OTHER NAMES :

Urdu	:	Kela
Arabic	:	Mouz
Persian	:	Mouz
English	:	Banana
Hindi	:	Kela
Bengali	:	Kela, Kala. Kanch Kala, Kodali
Gujarati	:	Kela
Kannad	:	Bale Gadde
Tamil	:	Vazhai
Malayalam	:	Vazha
Marathi	:	Kela
Oriya	:	Kadali, Kadila
Punjabi	:	Kela
Telugu	:	Arati Gadda

DESCRIPTION:

Macroscopic : Drug available in 0.1-4 cm thick, transversely cut pieces, pinkish-brown to grayish-brown, occasionally attached with a few roots.

T.L.C. :

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) shows under U.V. (366 nm) two fluorescent zones at Rf 0.25 (orange) and 0.33 (green). On exposure to Iodine vapour three spots appear at Rf. 0.11, 0.25 and 0.73 (all yellow). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil and 4 -Methyl sterol ketone
TEMPERAMENT	**:**	Motadil and Moist
ACTION	**:**	Mughazzi Musammin-e-Badan, Muqawwi-e-Bah, Mulayyin, Munaffis Balgham, Jali
THERAPEUTIC USES	**:**	Laghri, Sual Yabis, Khushoonat-e-Halaq, Is-hal.
DOSE	**:**	2-5 g

KHAS
(Root)

The drug Khas consists of dried fragrant fibrous roots of *Vetiveria zizanioides* (Linn.) Syn. *Phlaris zizanaides* Linn. Nash (Fam. Poaceae); a densely tufted grass, found throughout the plains and lower hills of the country, especially on the banks of rivers and rich marshy soil, ascending to an altitude of 1200 m.

OTHER NAMES :

Urdu	:	Khas
Arabic	:	Khas
Persian	:	Khas
English	:	Cuscus Grass
Hindi	:	Khasa, Gandar, Bena, Khas
Bengali	:	Venarramula, Khaskhas
Gujarati	:	Sugandhi Valo, Valo
Kannad	:	Mudivala, Baladaberu, Lamanch, Bala Daberu
Tamil	:	Vetiver, Vilamichaver
Malayalam	:	Ramaceam, Vetiver, Lamajja, Ramacham
Marathi	:	Bala, Vala
Oriya	:	Ushira, Benachera
Punjabi	:	Panni, Khas
Telugu	:	Vetivelu, Vettiveru

DESCRIPTION:

Macroscopic : Clusters of wiry roots upto 2 mm in diameter, minute, longitudinally grooved; colour varies from cream, grey or light yellow to brown; fracture short and splintery; odour strong aromatic; taste slightly bitter.

Microscopic: Root shows an epidermis consisting of tangentially elongated cells having brownish content, followed by a layer of hypodermis, consisting of thin-walled cells, similar to epidermis; cortex consisting of 2-3 layers of thick-walled, lignified sclerenchymatous cells towards periphery and aerenchymatous cells towards centre; endodermis, single layered of barrel-shaped cells with highly thickened inner walls; pericycle many layered with thick-walled, sclerenchymatous cells enclosing radial vascular bundles arranged in a ring; simple, round to oval starch grains measuring 8--12 µ in diameter present in aerenchyma, pericycle and pith cells.

Powder : Ash-coloured; odour, strongly aromatic and bitter in taste, shows fibres in groups, isolated xylem vessels, simple, round to oval, starch grains measuring 8-12 µ in diameter .

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2per cent, Appendix 2.2.2
Total ash	:	Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 6 per cent, Appendix 2.2.4

Alcohol-soluble extractive	:	Not less than 4 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.7
Volatile oil	:	Not less than 1 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under U.V. (366 nm) two fluorescent zones at Rf. 0.49 and 0.72 (both blue). On exposure to Iodine vapour three spots appear at Rf. 0.28, 0.75 and 0.94 (all yellow). On spraying with 5% Methanolic Sulphuric acid reagent and heating the plate at 105°C for ten minutes four spots appear at Rf. 0.19, 0.33, 0.73 and 0.94 (all grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential oil.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Mufarreh Qalb, Muqawwi-e-Qalb**,** Muqawwi-e-Dimagh, Daf-e-Safra, Ghasayan, Muqawwi-e-Meda, Musakkin-e-Atsh.
THERAPEUTIC USES	**:**	Khafaqan, Zof-e-Qalb, Zof-e-Meda.
DOSE	**:**	5-7 g
IMPORTANT FORMULATION	**:**	Sharbat-e-Khas, Itr-e-Khas

KHURFA
(Whole plant)

The drug Khurfa consists of dried whole plant of *Portulaca oleracea* Linn. (Fam. Portulacaceae); an annual succulent, prostrate herb, 50 cm long, found throughout the country, ascending upto an altitude of 1500 m in the Himalayas.

OTHER NAMES :

Urdu	:	Khurfa
Arabic	:	Baqlat-ul-Humqa
Persian	:	Khurfa
English	:	Garden Purslane, Common Indian Purslane
Hindi	:	Khursa, Kulfa, Badi Lona
Bengali	:	Baraloniya, Badanjuni, Baranunia
Gujarati	:	Lui, Loni, Moti Luni
Kannad	:	Dudagorai, Doddagoni Soppu, Lonika, Loni
Tamil	:	Pasalai, Pulikkirai, Paruppukkeerai, Kozhuppu
Malayalam	:	Koricchira, Kozhuppa, Kozuppa, Kozuppaccira
Marathi	:	Kurfah, Ghola
Punjabi	:	Lonak, Chhotalunia, Khurfa, Kwfa
Telugu	:	Pappukura, Peddapavila Kura, Payilidura, Pavilikura

DESCRIPTION :

Macroscopic:

Root – Cylindrical, small, oblique, surface smooth, brownish-grey; secondary roots less in number, root hairs abundant in upper region, fracture short.

Stem – Almost cylindrical, swollen at the nodes, ribed, branched, 0.1 to 0.2 cm in diameter, fracture, short; odour, characteristic.

Leaf – Simple, sub-sessile, cuneiform, rounded and truncate at the apex; 0.3 to 2.5 cm long and 0.1 to 0.6 cm wide, oblong, spathulate, smooth and greenish-brown.

Flower – A few, bright yellow at terminal heads, sometimes in axillary clusters of 2-6, subtended by an involucre of 3-4 leaves; sepal 0.25-.04 cm long; petals obovate, 0.5 cm long, very delicate and soon falling off; stamens 8-12; style 5-6 fid, 0.35-0.4 cm long.

Fruit – An ovoid capsule, 0.3 cm long, dehiscing above the base.

Seed – Numerous, reniform, black, minute, 0.06-0.07 cm across, dark brown.

Microscopic:

Root – Shows 5-15 layers of cork, inner half filled with reddish-brown contents; secondary cortex

composed of thin-walled, oval cells, having intercellular spaces; pericycle fibre present in patches; secondary phloem consists of sieve tubes and parenchymatous cells; secondary xylem composed of vessels, tracheids and parenchyma; vessels, solitary or in groups of 2-5 arranged in radial rows, having simple pits and spiral thickening; trachieds, thick-walled with wide lumen; parenchyma abundant; simple as well as compound starch grains measuring 6-14 μ in diameter, having 2-3 components present in secondary cortex, phloem xylem parenchyma and ray cells.

Stem – Wavy in outline, shows 5-10 layers of thin walled cork, with reddish-brown content in a few cells; secondary cortex consists of 2-3 layers of collenchymatous and 3-4 layers of parenchymatous cells with intercellular spaces; pericycle present as patches of pericyclic fibres; secondary phloem mostly composed of sieve tubes and parenchyma cells; secondary xylem consists of vessels, tracheids and parenchyma; vessels having simple pits and spiral thickening; trachieds thick-walled with wide lumen; parenchyma abundant and thick-walled; rosette crystals of calcium oxalate and starch grains present in secondary cortex, phloem and xylem parenchyma, ray cells and pith.

Leaf -

Midrib – shows a collateral vascular bundle surrounded by a sheath of palisade cells; rest of the tissues between vascular bundle and epidermal cells composed of thin walled, oval, parenchymatous cells; stomata paracytic type; rosette crystals of calcium oxalate and starch grains simple, as well as compound, measuring 6-14 μ , present in mesophyll cells.

Lamina – shows a single layered upper and lower epidermis, covered externally with a thick cuticle; paracytic stomata present on both surfaces; palisade single layered; spongy parenchyma cells more or less isodiametric and loosely arranged.

Powder: Grayish-brown; shows groups of oval to polygonal, thin-walled, parenchymatous cells, pitted and spiral vessels, fragments of cork cells rosette crystals of calcium oxalate and starch grains, simple as well as compound, measuring 6-14 μ in diameter having 2-3 components.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 30 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not more than 19 per cent, Appendix 2.2.7.

T.L.C. :

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) shows six spots at Rf. 0.08, 0.10 (both green) 0.41 0.52 (both faint green), 0.68 (yellow) and 0.76 (green) in visible light. Under UV (366 nm) six fluorescent zones are visible at Rf. 0.08, 0.10, 0.41, 0.52, 0.68, 0.76 (all pinkish red). On exposure to Iodine vapour six spots appear Rf. 0.10, 0.50, 0.61, 0.68, 0.76 and 0.98 (all yellow). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Protein, Carbohydrates, Vitamin C and Mucilage.
TEMPERAMENT	**:**	Cold and Moist.
ACTION	**:**	Mubarrid, Musakkin-e-Safra wa Dam, Mudirr-e-Baul.
THERAPEUTIC USES	**:**	Shiddat-e-Atash, Ghalayan-e-Dam, Ziyadati-e-Safra, Sozish-e-Meda, Ama wa Baul.
DOSE	**:**	3-7 g
IMPORTANT FORMULATIONS	**:**	Mufarreh Barid, Banadiq-ul- Buzoor

KONCH
(Seeds)

The drug Kohnch consists of dried mature seeds of *Mucuna prurita* Hook., Syn. *M. pruriens* Baker. (Fam. Papilionaceae); a slender extensive climbing plant found almost all over the country.

OTHER NAMES:

Urdu	:	Kanwach, Konch
English	:	Cowhage
Hindi	:	Kewanch, Kaunch
Gujarati	:	Kavach, Kaucha
Kannad	:	Nasugunne, Nasugunnee
Tamil	:	Poonaikkali
Malayalam	:	Naikuruna
Marathi	:	Khajkuhilee, Kavach
Oriya	:	Baikhujnee
Punjabi	:	Tatgajuli, Kawach
Telugu	:	Doolagondi, Duradagondi

DESCRIPTION:

Macroscopic : Seed ovoid, slightly laterally compressed, with a persistent oblong, funicular hilum, dark brown with spots; usually 1.2-1.8 cm long, 0.8-1.2 cm wide, hard, smooth to touch, not easily breakable; odour not distinct; taste sweetish-bitter

Microscopic: Mature seed shows a thin seed-coat and two hard cotyledons; outer testa consists of single layered palisade-like cells; inner testa composed of 2 or 3 layers, outer layer of tangentially elongated, ovoid, thin-walled cells, inner 1 or 2 layers of dumb-bell or beaker-shaped, thick-walled cells; tegmen composed of a wide zone of oval to elliptical, somewhat compressed, thin-walled, parenchymatous cells; some cells contain starch grains; cotyledons composed of polygonal, angular, thin-walled, compactly arranged, parenchymatous cells, containing aleurone and starch grains. Starch grains small, simple, rounded to oval measuring 6-41 μ in diameter, but not over 45 μ in diameter; a few vascular bundles with vessels showing reticulate thickening or pitted present,

Powder: Pale cream coloured; shows fragments of testa with palisade-like cells thin-walled parenchyma, reticulate and pitted vessels, aleurone and starch grains small, simple, rounded to oval measuring 6-41μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 3 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 23 per cent, Appendix 2.2.7
Fixed Oil	:	Not less than 3 per cent, Appendix 2.2.8

T.L.C.:

T.L.C. of alcoholic extract on Silica gel 'G' plate, using n-Butanol : Acetic acid: Water (4:1:5), shows in visible light four spots at Rf. 0.51, 0.59, 0.69 (all grey) and 0.92 (light yellow). Under UV (366 nm) six fluorescent zones are visible at Rf. 0.45 (blue), 0.51, 0.59, 0.69 (all grey), 0.79 (light blue) and 0.92 (blue). On spraying with Ninhydrin reagent and heating the plate for ten minutes at 110°C seven spots appear at Rf. 0.17, 0.28,0.34 (all pink) 0.51 (orange), 0.59 (pink), 0.69 (grey) and 0.92 (pink). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed oil, Alkaloid and 3,4-Dihydroxyphenylalanine.
TEMPERAMENT	**:**	Moderate towards Cold.
ACTION	**:**	Mughalliz, Muqawwi-e-Bah.
THERAPEUTIC USES	**:**	Jarayan, Zof-e-Bah, Surat-e-Inzal, Riqqat-e-Mani
DOSE	**:**	3-5 g
IMPORTANT FORMULATION	**:**	Luboob-e-Kabir, Luboob-e-Sagheer

KUTKI
(Rhizome)

The drug Kutki consists of the dried rhizome with root of *Picrorhiza kurroa* Royle ex Benth. (Fam. Scrophulariaceae); a perennial, more or less hairy herb common on the north-western Himalayas from Kashmir to Sikkim. Rhizome is cut into small pieces.

OTHER NAMES :

Urdu	:	Kutki
Arabic	:	Kharbaq Hindi
Persian	:	Kharbaq Hindi
English	:	Hellebore
Hindi	:	Kutki
Gujarati	:	Kadu, Katu
Kannad	:	Katuka rohini
Tamil	:	Katuka rohini, Katuku rohini, Kadugu rohini
Malayalam	:	Kaduk rohini, Katuka rohini
Marathi	:	Kutki, Kalikutki
Oriya	:	Katuki
Punjabi	:	Karru, Kaur
Telugu	:	Katukarohini

DESCRIPTION :

Macroscopic:

Rhizome – 2.5-8 cm long and 4-8 mm thick, sub-cylindrical, straight or slightly curved, externally grayish-brown, surface rough due to longitudinal wrinkles, circular scars of roots and bud scales and sometimes roots attached, tip ends in a growing bud surrounded by tufted crown of leaves, at places cork exfoliates exposing dark cortex; fracture, short; odour pleasant; taste bitter.

Root – Thin, cylindrical, 5-10 cm long, 0.05-0.1 cm in diameter, straight or slightly curved with a few longitudinal wrinkles and dotted scars, mostly attached with rhizomes, dusty grey, fracture short, inner surface black with whitish xylem; odour pleasant; taste bitter.

Microscopic:

Rhizome – Shows 20-25 layers of cork consisting of tangentially elongated, suberised cells; cork cambium 1-2 layered; cortex single layered or absent, primary cortex persists in some cases, one or two small vascular bundles present in cortex; vascular bundles surrounded by single layered endodermis of thick-walled cells; secondary phloem composed of phloem parenchyma and a few scattered fibres; cambium 2-4 layered; secondary xylem consists of vessels, tracheids, xylem fibres and xylem parenchyma, vessels vary in shape and size having transverse oblique articulation. Tracheids long, thick-walled, lignified, more or less cylindrical with blunt tapering ends; xylem parenchyma thin-walled and polygonal in shape; center occupied by a small pith consisting of thin-walled cells; simple round to oval starch grains, measuring 25-104 μ in diameter, abundantly found in all cells.

Root – Young root shows single layered epidermis, some epidermal cells elongate forming unicellular hairs; hypodermis single layered; cortex 8-14 layered; consisting of oval to polygonal, thick-walled, parenchymatous cells; primary stele tetrach to hexarch, enclosed by single layered pericycle and single layered, thick-walled cells of endodermis; mature root shows 4-15 layers of cork, 1-2 layers of cork cambium; secondary phloem poorly developed; secondary xylem consisting of vessels, tracheids, parenchyma and fibres; vessels have varying shape and size, some cylindrical with tail-like, tapering ends, some drum shaped with perforation on end walls or lateral walls; trachids cylindrical with tapering pointed ends; fibres aseptate, thick-walled, lignified with tapering blunt chisel-like pointed ends.

Powder: Dusty grey; shows groups of fragments of cork cells, thick-walled, parenchyma, pitted vessels and aseptate fibres, simple round to oval, starch grains, measuring 25-104 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 7 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.7.

T.L.C.:

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform: Methanol (95 : 5) shows under U.V. light (366 nm) three fluorescent zones at Rf. 0.05 (blue), 0.30 (blue) and 0.35 (green). On spraying with nine spots appear at 5% methanolic sulphuric acid reagent and heating the plate for about ten minutes at 105^0 C seven spots appear at Rf. 0.05, 0.10, 0.17, 0.21, 0.30, 0.41 and 0.84 (all brownish grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glucoside (Picrorhizin).
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Meda, Kasir-e-Riyah, Mulaiyan-e-Taba, Daf-e-Humma, Mukhrij-e-Deedan-e-Ama.
THERAPEUTIC USES	**:**	Zof-e-Meda, Zof-e-Hazm, Nafakh-e-Shikam, Humma-e-Safravi, Istisqa
DOSE	**:**	500 mg -1 g

MADAR
(Stem bark)

The drug Madar consists of dried stem bark of *Calotropis procera* (Ait.) R. Br. (Fam. Asclepiadaceae); an erect shrub exuding milky white latex from cut parts, found wild more or less throughout India.

OTHER NAMES:

Urdu	:	Madar
Arabic	:	Ushar
Persian	:	Aak, Madar
English	:	Maddar
Hindi	:	Aak, Madar, Akavana
Bengali	:	Akanda, Akone
Gujarati	:	Aakado
Kannad	:	Ekka, Ekkagida
Tamil	:	Vellerukku, Erukku
Malayalam	:	Errikku
Marathi	:	Rui
Oriya	:	Arakka
Punjabi	:	Akk
Telugu	:	Jilledu

DESCRIPTION:

Macroscopic : Drug occurs in channelled, quilled and fibrous pieces, upto 0.1 - 0.5 cm thick, external surface yellowish brown having longitudinal cracks, internal surface greenish, smooth, with an occasional wood tissue attached; fracture fibrous; odour and taste not distinct.

Microscopic: Stem bark shows exfoliated cork, consisting of 6-8 layers of tangentially elongated, thick-walled cells; where cork has not developed, epidermis present consisting of a single layered rectangular cells covered externally with striated cuticle; secondary cortex composed of tangentially elongated, oval, rounded or rectangular thin-walled parenchymatous cells having intercellular spaces, some cells contain rosette crystals of calcium oxalate, a number of rounded, oval to elongated, single or groups of stone cells and latex cells also found scattered in this region; pericyclic fibres numerous, lignified; secondary phloem composed of sieve elements, phloem parenchyma, phloem fibres and phloem rays; phloem parenchyma rectangular to polygonal in shape having rosette crystals of calcium oxalate, latex cells and stone cells similar to those found in secondary cortex; phloem fibres aseptate with bordered pits; phloem rays mostly uniseriate and straight.

Powder: Light yellowish-green; shows fibres, stone cells, rosette crystals of calcium oxalate and latex cells.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 12 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 7 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Chloroform : Methanol (1:1) shows under UV (366 nm) four fluorescent zones at Rf. 0.63, 0.71, 0.81 and 0.87 (all blue). On spraying with Dragendorff reagent followed by 5% Methanolic- Sulphuric acid reagent one spot appears at Rf. 0.08 (orange). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	α - and β - Calotropeols, β-Amyrin, Giganteol, a Colourless wax, small amount of Tetra cyclic Terpenes and Traces of Sterols.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muhallil, Musakkin, Munnaffis, Hazim, Mukhrij-e-Balgham, Daf-e-Zaheer
THERAPEUTIC USES	**:**	Aatshak, Juzam, Haiza, Tap-e-Larza, Zeeq-un-Nafas, Sual, Zof-e-Hazm, Zaheer.
DOSE	**:**	250-500 mg.
IMPORTANT FORMULATION	**:**	Habb-e-Gul-e-Aak

MAJEETH
(Stem)

The drug Majeeth consists of dired stem of *Rubia cordifolia* Linn. (Fam. Rubiaceae); a perennial herbaceous prickly creeper or climber upto 10 m long, found throughout the country acending to 3750 m.

OTHER NAMES :

Urdu	:	Majeeth
Arabic	:	Foh-us-Sabagh
Persian	:	Romnas
Hindi	:	Manjitha, Manjit
Bengali	:	manjistha, Manjith
Gujarati	:	Manjitha
Kannad	:	Manjustha
Tamil	:	Manjatte
Malayalam	:	Manjatti
Marathi	:	Manjihtha
Punjabi	:	Manistha, Manjit
Telugu	:	Manjishtha

DESCRIPTION :

Macroscopic : Stem slender, more or less cylindrical, slightly flattened, wiry, about 0.5 cm thick, brown to purple coloured; surface scabrous, stiff and grooved with longitudinal cracks; prickles present in the immature stem; nodes distinct having two leaf scars, on either side; fracture short.

Microscopic: Mature stem shows exfoliating cork, ruptured at places, forming dome-shaped structure, consisintg of 3-12 or more layered radially arranged, squarish and tangentially elongated, thin-walled cells, appearing polygonal in surface view; secondary cortex 3-5 layered consisting of tangentially elongated, thin-walled cells, some of which contain acicular crystals of calcium oxalate as isolated or in bundles; a few cells contain sandy crystals as black granular masses; secondary phloem, a wide zone of reddish colour, composed of sieve elements and phloem parenchyma, fibres absent; phloem parenchyma smaller towards inner side gradually becoming larger and tangentially elongated towards.

Powder: Pink; shows numerous fragments of cork, lignified xylem vessels, tracheids, and fibres with pitted and reticulate xylem parenchyma having red coloured contents; acicular and sandy crystals as black granular masses.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 12 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 3 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 17 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid : Water (4:1:5) shows in visible light two spots at Rf. 0.92 (grey) and 0.98 (green). Under UV (366 nm) six fluorescent zones are visible at Rf. 0.28, 0.37, 0.53, 0.72, 0.92 and 0.98 (all yellow). On spraying with 5% Methanolic- Sulphuric acid reagent and heating the plate for ten minutes at 110^0 C six spots appear at Rf. 0.28, 0.37 (both grey), 0.53 (bluish grey), 0.72 (grey), 0.92 (grey) and 0.98 (violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glycosides
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mudirr-e-Baul wa Haiz, Munaqqi-e-Jigar wa Tihal, Mufatteh sudad, Musakkhin, Jali.
THERAPEUTIC USES	**:**	Ehtabas-e-Baul wa Haiz, Amraz-e-Barida Asabia, Daad, Bahaq, Bars, Aasar-e-Jild
DOSE	**:**	3-5 g
IMPORTANT FORMULATION	**:**	Majoon Dabeed-ul-ward, Raughan Surkh, Dawa-ul-Kurkum**.**

MAKO
(Whole plant)

The drug Mako consists of the dried whole plant of *Solanum nigrum* Linn. (Fam. Solanaceae); a herbaceous annual weed, 30-45 cm high, found throughout the country in dry parts, quite common in cultivated lands, road sides and gardens.

OTHER NAMES :

Urdu	:	Mako
Arabic	:	Anab-us-Salab
Persian	:	Robah Tareek
Hindi	:	Makoya
Bengali	:	Gudakamai
Gujarati	:	Piludi
Kannad	:	Ganikayeagida, Ganikegida, ganike, ganikesopu, Kage hanninagids
Tamil	:	Manarthakkali, Manaththakkali, Manitakkali, Manithathakkali
Malayalam	:	Karinthakkali, Manatakkali, Manathakkali
Marathi	:	Kamoni
Oriya	:	Lunlunia, Lunilunika
Punjabi	:	Mako
Telugu	:	Kamanchi

DESCRIPTION:

Macroscopic :

Root – Tap root with a few branches and numerous small lateral roots, externally smooth, pale brown; bark thin, easily peeled off exposing pale yellow wood.

Stem – Erect glabrous or pubescent, green, rounded at the basal region and angular at the apical region, slightly woody and branched.

Leaf- Simple, 2.5-8.5 cm long and 25 cm wide, ovate or oblong sinuate, toothed or, lobed, narrowed at both ends; petiolate, thin.

Flower - Small, extra-axillary, sub-umbellate, 3-8 flowered cymes, peduncles 6-20 mm long, slender; pedicels 6-10 mm long, very slender; calyx 2-3 mm long, glabrous, five lobed, oblong, obtuse, 1.25 mm long; corolla 4.8 mm long, divided more than half way down into 5 oblong sub-acute lobes, white or pale violet; filaments short, flattened, hairy at base; anther 1.2-2.5 mm long, yellowish, oblong, obtuse notched at apex; ovary globose, glabrous; style cylindric, hairy in lower part.

Fruit - A berry, 6 mm in diameter, obtuse, usually purplish-black but sometimes red, yellow or black; smooth shining.

Seed - Discoid, 1.5 mm in diameter, smooth, minutely pitted, yellow

Microscopic:

Root - Shows cork consisting of 2-4 rows of tangentially elongated cells; cortex of large, slightly elongated,thin-walled cells having patches of lignified sclerenchyma fibres, most of the cortical cells contain oval to round starch grains, measuring 2.5-11 μ in diameter, single or with two or rarely 3 components; a few parenchyma cells contain microsphenoidal crystals of calcium oxalate; phloem consists of thin-walled, polygonal cells, phloem rays uniseriate, filled with starch grains; xylem composed of vessels and parenchyma; vessels arranged in groups of 2-4 in radial rows; parenchyma thick-walled containing microsphenoidal crystals of calcium oxalate; rays composed of thin-walled, radially elongated cells.

Stem - Shows single layered, epidermis of cubical to barrel-shaped cells, covered with thick, slightly striated cuticle, trichomes multicellular, uniseriate; secondary cortex composed of 2-4 layered collenchyma but 4-10 layered in angular parts; tangentially elongated, oval parenchymatous cells, some containing numerous microsphenoidal crystals of calcium oxalate and simple, oval to round starch grains measuring 2.5-8.25 in diameter, endodermis single layered; pericycle consists of intermittent ring of patches of fibres either isolated or in groups of 2-4; vascular bundles-collateral, conjoint and open; cambium 2-4 layered; xylem vessels arranged radially smaller being towards centre, showing spiral thickening and simple perforations; tracheids pointed tipped and with pitted walls; xylem rays homogenous, uniseriate; internal phloem; in small or large patch-es, usually accompanied by fibres, embedded in perimedullary zones; pith large, composed of thin-walled, parenchymatous cells with small intercellular spaces, a few cells containing microspenoidal crystals of calcium oxalate.

Leaf -

Petiole - shows single layered epidermis of oval or tangentially elongated cells, covered with striated cuticle; covering trichomes uniseriate, 3-5 celled having pointed tips and warty walls; glandular hairs with 1-2 celled stalk and 2-7 celled head; epidermis single layered; chlorenchyma 2-3 layered, compactly arranged; 5-8 layered parenchyma consisting of round, thin-walled cells with smaller intercellular spaces, a few ,containing microsphenoidal crystals of calcium oxalate; central vascular bundle shallow, arc-shaped, bicollateral; two smaller bundles present laterally on either side of main vascular bundles one in each lateral wing of the petiole.

Midrib - shows upper and lower epidermis of round to oval cells, covered with striated cuticle, trichomes similar to those found on petiole; collenchyma 2-3 layered on both surfaces; parenchyma 6 layered, thin-walled with small intercellular spaces; arc-shaped bicollateral vascular bundle placed centrally.

Lamina - dorsiventral, both upper and lower epidermis single layered, composed of oval to tangentially elongated cells covered with thick cuticle; palisade single layered; spongy parenchyma 4-6 layered containing chloroplasts with intercellular spaces; a few vessels with spiral thickenings, present beneath palisade parenchyma; in surface preparation a large number of multicellular, warty hairs with pointed tips and glandular hairs are present; epidermis with irregular outline, stomata anisocytic, scattered on both surfaces but more abundant in lower surface; palisade ratio 2-4; vein islet number 7-10; stomatal index 15-17 on upper epidermis and 22-23 on lower epidermis.

Fruit - Shows thin, papery epicarp, pulpy mesocarp and axile placentation; seeds at first remain attached to the placenta but afterwards separate from it and lie free in pulp of fruit.

Powder: Creamish-green; shows fragments of vessels with spiral thickening; a few broken pieces of pointed, unicellular hairs; single, oval to round and compound with three components of starch grains, measuring 2.5 - 11 μ in diameter.

IDENTITY, PURITY AND STRENGTH-

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 16 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 7 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 4 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.7

T.L.C.:

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (90 : 10) shows two spots at Rf 0.06 & 0.34 (both brown) in visible light. Under U.V. light (366 nm) two fluorescent zones are visible at Rf. 0.06 & 0.34 (both pink). On exposure to Iodine vapour three spots appear at Rf 0.06, 0.34 and 0.97 (all yellow). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	**A**lkaloids and Saponins.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Qabiz, Rade, Mujaffif, Mulattif, Musakkin-e-Hararat, Mohallil-e-Auram.
THERAPEUTIC USES	**:**	Warm-e-Jigar wa Meda, Dard-e-Gosh.
DOSE	**:**	5-7 g
IMPORTANT FORMULATION	**:**	Qairooti Mako wali, Arq-e-Mako, Zimad-e-Kabid, Zimad-e Mohallil

MALKANGNI
(Seeds)

The drug Malkangni consists of dried, mature, seeds of *Celastrus paniculatus* Willd. (Fam. Celastraceae); a large climbing shrub, mostly found all over the hilly parts of the country upto an altitude of 1200 m.

OTHER NAMES :

Urdu	:	Malkangani
English	:	Staff tree
Hindi	:	Malkangani
Gujarati	:	Malkangani
Kannad	:	Malkangni
Tamil	:	Valuluvai
Malayalam	:	Ceruppunnari, Uzhinja
Marathi	:	Malkangoni
Oriya	:	Malangoni, jyotishmati
Punjabi	:	Malkangoni
Telugu	:	Malkangani, Peddamaveru

DESCRIPTION :

Macroscopic: Dried mature seeds more or less covered by orange-red crustly aril, seeds without aril also present, measuring 5-6 mm in length and 2.5-3.35 mm in breadth, a few roughly three sided being convex on the sides and a few two sided with one convex and other more or less flat side, one edge of many seeds show a faint ridge or raphe on the whole margin; surface generally smooth and hard; colour, light to dark brown; odour unpleasant ; taste bitter.

Microscopic: Seed shows single layered epidermis covered exteranally with thick cuticle and filled with tannin, followed by 4-6 layers of thin-walled, collapsed parenchymatous cells and layer of radially elongated stone cells; parenchyma of top one or two layers longer than of the below with trianglualr intercellular spaces; innermost layer of parenchyma containing prismatic crystals of calcium oxalate; beneath stone cells layer quadrangular to octagonal, tangentially elongated cells filled with brownish contents; endosperm composed of polygonal, thin-walled parenchymatous cells having oil globules and aleurone grains; embryo spathulate in fleshy endosperm containing oil globules and aleurone grains.

Powder: Oily dark brown; under microscope shows groups of endospermic parenchyma, stone cells, oil globules and aleurone grains and shows fluorescence under U.V.light as following :-

Powder as such	:	Greenish-brown
Powder +1N NaOH in Methanol	:	Light green
Powder + Nitrocellulose in Amyl Acetate	:	Yellowish-green

IDENTITY, PURITY AND STRENGTH:

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

Total ash	:	Not more than 6 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 9 per cent, Appendix 2.2.7.
Oil Contents	:	Not less than 45 per cent, Appendix 2.2.8.

T.L.C.:

T.L.C of alcoholic extract of drug on Silica gel 'G' plate using Toluene: Ethylacetate (90:10) shows two spots at Rf. 0.82 (pink) & 0.94 (yellow) in visible light. Under U.V. (366nm) four fluorescent zones visible at Rf. 0.54, 0.82, 0.89 (all blue) & 0.94 (yellow). On exposure to Iodine Vapour eight spots appear at Rf. 0.04, 0.15, 0.20, 0.35, 0.54, 0.63, 0.82 & 0.89 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate at 105^0 C for ten minutes four spots appear at Rf. 0.35, 0.54 (both blue), 0.78 and 0.89 (both greenish blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Alkaloids, Oil and Tannins
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Bah, Muqawwi-e-Meda, Daf-e-Amraz-e-Balghamia
THERAPEUTIC USES	**:**	Zof-e-Bah, Zof-e-Meda, Amraz-e-Balghamia.
DOSE	**:**	500 mg-1 g
IMPORTANT FORMULATIONS	**:**	Raughan Malkangni, Tila Khas-ul- Khas.

MAWEEZ MUNAQQA
(Fruit)

The drug Maweez Munaqqa consists of dried mature fruits of *Vitis vinifera* Linn. (Fam. Vitaceae); a deciduous climber, mostly cultivated in north western India, Punjab, Himachal Pradesh -and Kashmir for their use as dessert fruit. However, the dried fruits, known in trade as 'Raisins', are mostly imported into India from the Middle East and Southern European countries.

OTHER NAMES:

Urdu	:	Munaqqa
Arabic	:	Zabeeb-ul-Jabal
Persian	:	Maweezak Kohi
English	:	Dry Grapes, Raisins
Hindi	:	Munkka
Bengali	:	Maneka
Gujarati	:	Drakh, Darakh
Kannad	:	Draksha
Tamil	:	Draksha Kottai, Drakshai
Malayalam	:	Munthringya
Marathi	:	Draksha, Angur
Oriya	:	Drakya, Gostoni
Punjabi	:	Munaca
Telugu	:	Drakshai, Kottai Drakshai

DESCRIPTION

Macroscopic : Fruit a berry, sticky and pulpy, dark brown to black; oblong or oval, sometimes spherical; 1.5 -2.5 cm long and 0.5-1.5 cm wide; outer skin irregularly wrinkled forming ridges and furrows; usually contain 1-4 seeds, 4-7 mm long, ovoid rounded to triangular or simply ovoid, brown to black; odour sweetish and pleasant; taste sweet.

Microscopic: A single layered epidermis cells filled with reddish-brown contents; mesocarp pulpy, made up of thin-walled, irregular cells containing prismatic crystals of calcium oxalate, measuring 13.75 -41 11 in diameter; some fibro-vascular bundles also present in this region; seeds composed of testa and endosperm; testa composed of thick-walled yellowish cells; endosperm composed of angular parenchymatous cells containing oil globules and cluster crystals of calcium oxalate, measuring 11-16 11 in diameter.

Powder: Yellowish – brown; shows xylem vessels with reticulate thickening, glandular hairs, simple, round and oval starch grains, measuring 4-14 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 3 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.2 per cent, Appendix 2.2.4

Alcohol-soluble extractive	:	Not less than 25 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 70 per cent, Appendix 2.2.7
Loss on drying	:	Not less than 15 per cent, Appendix 2.2.9

T.L.C. :

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid: Water (4: 1:5) shows under UV (366 nm) a fluorescent zone at Rf 0.29 (blue). On exposure to Iodine vapur four spots appear at Rf. 0.08,0.29,0.69 and 0.85 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for about ten minutes at 110°C three spots appear at Rf. 0.08 (black), 0.29 (black) and 0.98 (violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Malic, Tartaric & Oxalic Acids, Carbohydrates and Tannins.
TEMPERAMENT	**:**	Hot and Moist
ACTION	**:**	Mughazzi, Munjiz-e-Khilt galiz, Mufatteh Sudud, Mulaiyin-e-Shikam, Mohallil, Jali.
THERAPEUTIC USES	**:**	Zof-e-Meda, Zof-e-Aam, Qabz.
DOSE	**:**	9 - 11 nos.
IMPORTANT FORMULATION	**:**	Majoon Zabeeb

NARMUSHK
(Stamens)

The drug Narmushk consists of dried stamens of *Mesua ferrea* Linn. (Fam. Clusiaceae); an evergreen tree, about 15-18 m high with short trunk, often buttressed at the base, occurring in the Himalayas from Nepal eastwards, Bengal, Assam, evergreen rain forests of North Kanara, Konkan, forests of Western Ghats and Andhra Pradesh.

OTHER NAMES:

Urdu	:	Narmushk, Nagkesar
Persian	:	Nar Mushk
English	:	Cobras Saffron
Hindi	:	Nagkesara, Pila Nagkesara
Bengali	:	Nagesvara, Nagesar
Gujarati	:	Nagkesara, Sachunagkeshara, Nagchampa, Pilunagkesar, Tamranagkesar
Kannad	:	Nagsampige, Nagakesari
Tamil	:	Naugu, Naugaliral, Nagachampakam, Sirunagappu
Malayalam	:	Nangaa, Nauga, Peri, Veluthapala, Nagppu, Nagappovu
Marathi	:	Nagkesara
Oriya	:	Nageswar
Punjabi	:	Nageswar
Telugu	:	Nagachampakamu

DESCRIPTION :

Macroscopic: Stamen consists of anther, connective and filament; copper colour or golden brown; filament united at base forming a fleshy ring; each stamen 0.9-1.9 cm long; anther about 0.5 cm long, linear, basifixed, containing pollen grains; filament 0.8-1.0 cm long; slender, filiform, more or less twisted, soft to touch, quite brittle; connective not visible with naked eye; odour fragrant; taste astringent.

Microscopic: Anther shows golden-brown, longitudinally dehiscent anther wall, consisting of thin-walled, parenchymatous cels, pollen grains numerous in groups or in single, yellowish and thin-walled, many pollen grains having 1-3 minute, distinct protuberances on walls, thick-walled exine and intine distinct.

Powder : Brown; shows elongated cells of filament, connective and numerous golden yellow pollen grains having 1-3 protuberances.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 6 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 3 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 15 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not more than 12 per cent, Appendix 2.2.7.

CHEMICAL CONSTITUENTS	:	Essential oil and Oleo-resin.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Qabiz, Mujaffif, Mufarreh, Muqawwi-e-Qalb wa, Jigar, Meda wa Ama, Moharrik-e-Bah.
THERAPEUTIC USES	**:**	Amraz-e-Qalb wa Dimagh , Malikhooliya, Junoon, Bawaseer, Zof-e-Bah.
DOSE	**:**	5-7 g
IMPORTANT FORMULATIONS	**:**	Mufarreh Yaqooti, Halwa-e-Supari pak, Habb-e-Jarayan, Arq Ma-ul-Laham.

NEEM
(Stem bark)

The drug Neem consists of stem bark of *Azadirachta indica* A. Juss Syn. *Melia azadirachta* Linn. (Fam. Meliaceae); a moderate sized to fairly large evergreen tree, attaining a height of 12-15 m with stout trunk and spreading branches, occurring throughout the country up to an elevation of 900 m.

OTHER NAMES :

Urdu	:	Neem
Arabic	:	Neeb
Persian	:	Neeb
English	:	Margosa Tree
Hindi	:	Nim, Nimba
Bengali	:	Nim, Nimgach
Gujarati	:	Kohumba, Limba, Limbado, Limado
Kannad	:	Nimba, Bevu, Oilevevu, Kahibevu, Bevinama
Tamil	:	Vemmu, Veppu, Arulundi, Veppan
Malayalam	:	Veppu, Aryaveppu, Nimbam, Veppa
Marathi	:	Balantanimba, Limba, Bakayan, Nim, Kadunimb
Oriya	:	Nimba
Punjabi	:	Nimba, Bakan, Nim
Telugu	:	Vemu, Vepa

DESCRIPTION:

Macroscopic: Bark varies much in thickness according to age and parts of tree from where it is taken; external surface rough, fissured and rusty-grey; laminated inner surface yellowish, fracture, fibrous; odour characteristic; taste bitter.

Microscopic: Stem bark shows outer exfoliating pieces hard, woody, considerably thick in older barks; almost entirely dead elements of secondary phloem, alternating with discontinuous tangential bands of compressed cork tissue, former composed of several layers of stone cells occurring in regularly arranged groups together with collapsed phloem elements filled with brown contents; in between the successive zones of cork tissue 3-5 layers of fibre groups with intervening thin-walled and often collapsed phloem elements present; each zone of cork tissue consists of several layers of regular, thin-walled cells occasionally with a few compressed rows of thick-walled cells towards outer surface; within exfoliating portion a number of layers of newly formed cork composed of thin-walled, rectangular cells and one or two layers of cork cambium, below which a wide zone of secondary phloem present; secondary cortex absent in most cases; secondary phloem commonly composed of well-developed fibre bundles traversed by 2-4 seriate phloem rays and transversely separated by bands of parenchymatous tissue of phloem; phloem elements of outer bark mostly collapsed; a few fairly large secretory cavities also occur in phloem; most of phloem parenchyma contain starch grains and prismatic crystals of calcium oxalate; starch grains, simple, round with central hilum, measuring 2.75-5 μ; structure of bark varies considerably according to gradual formation of secondary cork bands.

Powder: Reddish-brown; shows numerous prismatic crystals of calcium oxalate, phloem fibres with narrow lumen and pointed ends; cork cells, stone cells mostly in groups, lignified rectangular to polygonal, having wide lumen and distinct striations, simple starch grains, measuring 2.75-5 μ in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 7 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 6 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not more than 5 per cent, Appendix 2.2.7.

T.L.C.:

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform : Ethylacetate; Formic acid (5:4:1) shows under UV (366 nm) three fluorescent zones at Rf. 0.72 (blue), 0.86 (blue), and 0.90 (green). On spraying with 5% Methanolic-Phosphomolybdic acid reagent and heating the plate for about ten minutes at 105^0C four spots appear at Rf. 0.20, 0.45, 0.63 and 0.90 (all blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Bitter principles Nimbin and Nimbiol.
TEMPERAMENT	:	Hot and Dry
ACTION	:	Mohallil, Musakkin, Mulaiyin, Munzij, Musaffi, Daf-e-Bukhar, Daf-e-Taaffun, Qatil-e-Jaraseem, Qatil-e-Kirm-e-Shikam.
THERAPEUTIC USES	:	Fasad-e-Dam, Amraz-e-Jildiya, Deedan-e-Ama.
DOSE	:	6-10 g (Decoction).
IMPORTANT FORMULATIONS	:	Habb-e-Surkh Badah, Habb-e-Musaffi-e-Khoon, Habb-e-Bawasir, Majoon Musaffi-e-Khoon, Marham Jadwar.

NEEM
(Leaf)

The drug Neem consists of dried leaf of *Azadirachta indica* A. Juss Syn. *Melia azadirachta* Linn. (Fam. Meliaceae); a moderate sized to fairly large evergreen tree, attaining a height of 12-15 m with stout trunk and spreading branches, occurring throughout the country up to an elevation of 900 m.

OTHER NAMES:

Urdu	:	Neem
Arabic	:	Neeb
Persian	:	Neeb
English	:	Margosa Tree
Hindi	:	Nim, Nimba
Bengali	:	Nim, Nimgach
Gujarati	:	Kohumba, Limba, Limbado, Limado
Kannad	:	Nimba, Bevu, Oilevevu, Kahibevu, Bevinama
Tamil	:	Vemmu, Veppu, Arulundi, Veppan
Malayalam	:	Veppu, Aryaveppu, Nimbam, Veppa
Marathi	:	Balantanimba, Limba, Bakayan, Nim, Kadunimb
Oriya	:	Nimba
Punjabi	:	Nimba, Bakan, Nim
Telugu	:	Vemu, Vepa

DESCRIPTION :

Macroscopic: Leaves **c**ompound, alternate, rachis 15-25 cm long, 0.1 cm thick; leaflet with oblique base, opposite, exstipulate, lanceolate, acute, serrate, 7-8.5 cm long and 1.0-1.7 cm wide, slightly yellowish-green; with characteristic odour, taste bitter.

Microscopic:

Leaf

Midrib **–** leaflet through midrib shows a biconvex outline; epidermis on either side covered externally with thick cuticle; below epidermis 4-5 layers of collenchyma present; stele composed of one crescent-shaped vascular bundle towards lower and two to three smaller bundle towards upper surface; rest of tissues composed of thin-walled, parenchymatous cells having secretory cells and rosette crystals of calcium oxalate; phloem surrounded by non-lignified fibre strand; crystals also present in phloem region.

Lamina – shows dorsiventral structure; epidermis on either surface, composed of thin-walled, tangentially elongated cells, covered externally with thick cuticle; anomocytic stomata present on lower surface only; palisade single layered; spongy parenchyma composed of 5-6 layered, thin-walled cells, traversed by a number of veins; rosette crystals of calcium oxalate present in a few cells; palisade ratio 3.0-4.5 on lower surface and 8.0-11.5 on upper surface.

Powder: Green, shows vessels, fibres, rosette crystals of calcium oxalate, fragments of spongy and palisade parenchyma.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2.
Total ash	:	Not more than 10 per cent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 13 per cent, Appendix 2.2.6.
Water-soluble extractive	:	Not more than 19 per cent, Appendix 2.2.7.

CHEMICAL CONSTITUENTS : Triterpenoids and Sterols.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Mohallil, Musakkin, Mulaiyin, Munzij, Musafi-e-khoon, Daf-e-Bukhar, Daf-e-Taaffun, Qatil-e-Jaraseem, Qatil-e-Kirm-e-Shikam.

THERAPEUTIC USES **:** Fasad-e-Khoon, Amraz-e-Jildiya, Deedan-e-Ama.

DOSE **:** 6-10 g (Decoction).

IMPORTANT FORMULATIONS **:** Habb-e-Surkh Badah, Habb-e-Musaffi-e-Khoon, Habb-e-Bawaseer, Majoon Musaffi-e-Khoon, Marham Jadwar.

NEELOFAR
(Flowers)

The drug Neelofar consists of dried flowers of *Nymphaea nauchali Burm.f.* Syn. *Nymphaea stellata* Willd. (Fam. Nymphaeaceae); an aquatic herb, generally found in tanks and ponds throughout the warmer parts of the country.

OTHER NAMES :

Urdu	:	Neelofar
Arabic	:	Neelofar
Persian	:	Neelofar
Hindi	:	Neel kamal, Kumudinee
Bengali	:	Kumud, Sundi
Gujarati	:	Poyanu
Kannad	:	Neeltare
Tamil	:	Alli, ambal
Malayalam	:	Ambal Poovu
Marathi	:	Kamoda, Neel Kamal
Punjabi	:	Neela Kamal, Kamalini
Telugu	:	Allitamara, Kaluvapoova

DESCRIPTION:

Macroscopic : Drug occurs mostly in broken form of varying sizes of dired pieces of flowers and buds, dark brown, attached with a pedicel of 0.5-1.0 cm long when present; sepals – 5-6 cm long, 1.5 – 2.0 cm wide, oblong, lanceolate, tip acute or subacute, free, adnate to base of disc; petals – 3.5 – 4.5 cm long 2.0-2.5 cm wide, linear-oblong or lanceolate, yellowish-brown; stamens 6 to indefinite, free, adnate to fleshy thalamus; filaments dilated at base; anther with lingual appendages, introrse, bithecous; gynecium indefinite, enclosed by thalamus; style short carples.

Microscopic: Sepal single layered epidermis on either side, unicellular hairs present on upper epidermis; both epidermis followed by 4-6 layers of elongated, thin-walled, spongy parenchymatous cells; large stellate air cavities and vascular tissues present in this region; tanniniferous content present in collenchymatous cells.

Petal – Epidermis on either side, followed by 2-3 layers of collenchymatous cells, central region composed of 3-4 layers, elongated spongy parenchyma; stellate air cavities present in this region; tanniniferous contents also found scattered in petals.

Powder: Brown shows groups of parenchymatous cells, stellate air canals, uniseriate hairs, yellowish-brown rounded pollen grains, measuring 22 – 27 μ in diameter having thick, smooth, exine and thin intine.

Stamen - single layered upper and lower epidermis, followed by 2-3 layers, rounded to oval, large parenchymatous cells; 3-4 layers elongated parenchymatous cells present in centre; stellate air cavities present in this region; anther shows 4 spliting pollen chambers attached with parenchymatous connective

tissues, vascular tissues and stellate idioblasts present in this region, endothecium consisting of single layered columar cells, stromium in both the chambers and a few rounded 22-27 μ in diameter, pollen grains having thick smooth, exine and a thin intine.

IDENTITY, PURITY AND STRENGTH

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total ash	:	Not more than 8 per cent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 %, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 5 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 22 per cent, Appendix 2.2.7

T.L.C. :

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Chloroform: Ethylacetate : Formic acid (5:4:1) shows in visible light three spots at Rf. 0.59, 0.68 and 0.81 (all bluish grey). On spraying with 10% Ferric Chloride solution (aqueous) two spots appear at Rf. 0.68 and 0.81 (both blue and correspond to that of Tannic acid). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Tannins
TEMPERAMENT	**:**	Cold and Moist
ACTION	**:**	Muqawwi Qalb, Muqawwi Dimagh, Musakkin, Hiddat Khoon, Muhallil –e-Waram
THERAPEUTIC USES	**:**	Zof-e-Qalb, Khafqan, Warm-e-Halaq, Khunaq, Bars, Bahaq, Namash.
DOSE	**:**	5.7 gm.
IMPORTANT FORMULATION	**:**	Sharabat Nilofar, Muffareh Azam, Qurs Kafoori, Mussafi khoon

APPENDICES

CONTENTS OF APPENDICES

PAGE

APPENDIX – 3

APPENDIX – 4

APPENDIX – 5

APPENDIX – 1

APPARATUS FOR TESTS AND ASSAYS

1.1.1 Nessler Cylinders

Nessler cylinder which are used for comparative tests are matched tubes of clear colorless glass with a uniform internal diameter and flat, transparent base. They comply with Indian standard 4161 –1967. They are transparent glasses with a nominal capacity of 50 ml. The overall height is about 150 mm, the external height to the 50 ml mark 110 to 124 mm, the thickness of the wall 1.0 to 1.5 mm and the thickness of the base 1.5 to 3 mm. The external height to the 50 ml mark of the cylinder used for a test must not vary by more than 1mm.

1.1.2 Sieves

Sieves for pharmacopoeial testing are constructed from wire cloth with square meshes, woven from wire of brass, bronze, stainless steel or any other suitable material. The wires should be of uniform circular cross-section and should not be coated or plated. There must be no reaction between the material of the sieve and the substance being sifted.

Sieves conform to the following specifications.:

Approximate sieve number*	Nominal mesh aperture size mm	Tolerance average aperture size +mm
4	4.0	0.13
6	2.8	0.09
8	2.0	0.07
10	1.7	0.06
12	1.4	0.05
16	1.0	0.03
–	µm	± µm
22	710	25
25	600	21
30	500	18
36	425	15
44	355	13
60	250	13(9.9)**
85	180	11(7.6)
100	150	9.4(6.6)
120	125	8.1(5.8)
150	106	7.4(5.2)
170	90	6.6(4.6)

200	75	6.1(4.1)
240	63	5.3(3.7)
300	53	4.8(3.4)
350	45	4.8(3.1)

*Sieve is the number of meshes in a length of 2.54 cm. in each transverse direction parallel to the wires.
**Figures in brackets refer to close tolerances, those without brackets relate to full tolerances.

1.1.3 Thermometers

Unless otherwise specified, thermometers suitable for pharmacopoeial tests conform to Indian Standard 4825-1968 and are standardized in accordance with the 'Indian Standard Method of Calibrating Liquid-in-glass Thermometers', 6274-1971.

The thermometers are of the mercury-in-glass type and are filled with a dried inert gas, preferably nitrogen. They may be standardized for total immersion or for partial immersion. Each thermometer should be employed according to the condition of immersion under which it was standardized. In the selection of the thermometer it is essential to consider the conditions under which it is to be used.

1.1.4 Volumetric Glasswares

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

Pharmacopoeial assays involving volumetric measurements require the use of accurately calibrated glassware. Volumetric apparatus must be suitably designed to assure accuracy. The design, construction and capacity of volumetric glassware should be in accordance with those laid down by the Indian Standards Institution. The tolerances on capacity for volumetric flasks, pipettes and burettes, as laid down in the relevant Indian Standards, are set out in the following table.

Volumetric Flask : I.S. 915-1975

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

One Mark Pipettes : I.S. 1117-1975

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

Graduated Pipettes : I.S. 4162-1967

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

Burettes : I.S. 1997-1967

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

1.1.5 Weights and Balances

Pharmacopoeial tests and assays require the use of analytical balances that vary in capacity, sensitivity, and reproducibility. The accuracy needed for weighing should indictate the type of balance. Where substances are to be "accurately weighed", the weighing is to be performed so as to limit the error to not more than 0.1 per cent. For example, a quantity of 50 mg is to be weighed to the nearest 0.05 mg; a quantity of 0.1 g is to be weighed to the nearest 0.1 mg; and a quantity of 10 g is to be weighed to the nearest 10 mg. A balance should be chosen such that the value of three times the standard deviation of the reproducibility of the balance, divided by the amount to be weighed, does not exceed 0.001.

APPENDIX - 2

TESTING OF DRUGS

2.1. Systematic study of Crude Drugs

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

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

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

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

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

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

2.1.1 Microscopical Methods of Examining Crude Vegetable Drugs

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

I Leaves, Herbs and Flowers

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

a) Entire and cut materials

(i) **Entire materials** - When examining entire leaves, herbs and flowers, take pieces of leaf (margin and vein of leaves only), herbs (only leaf) and flowers (only calyx and corolla) in a test tube. Add a solution of caustic alkali or nitric acid to the test tube and boil for 1-2 minutes, pour the contents into a porcelain dish, drain off the liquid, wash the material with water and leave for sometimes. Remove the pieces of the material from the water with a spatula and put on the slide, add a few drops of the solution of *glycerol and chloral hydrate*. Crush the material with scalpel and cover with cover slip before examining.

(ii) **Cut materials** - For examining cut leaves, herb and flowers, take several pieces in a test tube and employ the same methods as described for entire materials.

Other methods employed for clarification of the material (leaf and stem) are described below:-

(a) **Leaf** - Boil pieces of leaves in a test tube with chloralydrate for several minutes until completely clarified and then examine them in chloral hydrate solution. After clarification leaf pieces are divided into two parts with the help of a scalpel or needle, and carefully turn one part. The leaf can be examined from both the dorsal and ventral surfaces.

(b) **Stem** - To examine stem material (without leaf) boil pieces in a solution of *caustic alkali* or in *nitric acid*. Remove the epidermis with a scalpel or a needle for examining the surface. For

examining pressed specimen of stem, take separate tissue and press them with a scalpel on the slide.

b) Powder

For examining characters of the powder take sufficient amount of powder in Chloralhydrate solution on a slide and cover it with a cover slip, warm over a low flame for a short time.

II Fruits and Seeds

a) Entire materials

General Microscopical examination of fruit and seed is not done. If required then take the specimens of outer coat of seed or fruit and examine as described below:

(i) **Outer Coat** - For examining the outer coat boil 3 or 4 seeds or fruits in caustic alkali solution in a test tube for 1-2 minutes (outer coat specimens with intensive pigmentation are boiled for longer period). After boiling place the pieces on slide, remove the layers of the coat and examine them after mounting in glycerol solution.

(ii) **Section -** If fruits or seeds are too hard to cut then boil them for 15-30 minutes or more depending on their hardness or keep them in moistening chamber or absorb in water and chloroform solution or soften them with steam and then cut the specimen for examining purpose. For cutting small, flat seeds (which are difficult to hold) place them in a pith or potato slit for section cutting small round or smooth seeds can not be cut into section in the pith, then in such cases, they may be embedded in paraffin wax blocks for section cutting. For this, a block of paraffin (0.6x0.5x1.5 cms. in size) is made and the seed is embedded in the block by making a cavity or a pit in the block with a hot needle. Cut the section with a sharp razor (through the object) together with the paraffin, place them on to the slide, remove paraffin with a needle or wash it with xylene and examine the section in *chloral-hydrate solution.*

b) Powder

For examining the structure of the cells of the seed coat and the cells of the embryo take a small amount of powder of the material on a slide in glycerol and cover it with a cover slip and examine.

1. Starch - For examining the presence of starch in the seed, take two specimens, one in iodine solution and the other in water. With iodine solution starch turns blue. Shapes and the structure of starch grains can be seen in water and their size is measured.

When examining objects containing starch, prepare specimen by slightly warming in chloral-hydrate solution.

2. Fixed Oil - For examining the presence of fixed oil, prepare a specimen in a solution of sudan III droplets of fixed oil are coloured orange pink. When examining objects containing small

amount of fixed oil, prepare a specimen by slightly warming in chloral-hydrate solution, and when examining objects containing large amount of fixed oil then the powder is defatted and clarified as follows:

(i) Place 0.5-1g. of the powder in a porcelain dish, add 5-10 ml. of dilute nitric acid and boil for 1 minute, then strain off the liquid through a cloth, wash the residue with hot water and return it to the porcelain dish with a spatula, boil it with 5-10 ml. of caustic *alkali solution* for 1 minute and again strain it though the cloth and wash with water. Examine the residue in a glycerol solution, after the treatment the structure of the layers of the coat and their cells can be seen very distinctly.

3. Mucilage - Prepare a specimen in Indian Ink and examine it under a low power microscope or under dissecting microscope. Mucilage appears as colourless masses against the black back ground which spreads when slightly pressed with needle.

III Barks

a. Entire material

Prepare transverse of longitudinal section of bark. To soften bark break it into pieces of about 1-2 cm long and 0.5-1 cm wide and boil with water in a test tube for 1-3 minutes. Soft pieces are then straightened with a scalpel so as to have a exact transverse or longituinal direction. Cut the section with razor, moisten the surface of the bark with glycerol solution. Remove the sections with a brush and place them on the slide. Thin pieces of the bark are cut by placing them in the pith (potato or carrot). The sections are treated with various reagents before examining.

1. Lignified elements - For testing lignin add several drops of *phloroglucinol* and a drop of *concentrated hydrochloric acid* to the section on a slide then draw off the liquid, immerse the section in *chloral hydrate solution* and cover with a cover slip (the specimen should not be heated); the lignified elements are coloured crimson *Phloroglucinol* can be substituted by *saffranine,* and the lignified elements are coloured pink. The excessive stain can be washed out with acidified alcohol.

2. Starch - Starch is detected by treating with iodine solution.

3. Tannin - Tannin is detected by treating with *ferric ammonium sulphate* solution (blue-black or green black colour shows the presence of Tannin) or with *potassium-bi-chromate solution* (brown colour indicates the presence of Tannin).

4. Anthraquinone derivatives - Anthraquinone derivatives are detected by treating with alkali solution (blood-red colour shows the presence of anthraquinone derivatives).

b. Cut materials

Prepare small pieces or scraping of bark and boil them for 3-5 minutes in a solution of *caustic alkali or potassium hydroxide* or in *nitric acid solution* and then prepare pressed specimen and immerse in *glycerol* for examination on a slide covered with a cover slip.

c. Powder

Prepare specimen for examination by placing a little amount of powder on a slide, add 1-2 drops of *phlorogucinol* and a drop of *concentrated hydrochloric acid*, cover it with a cover slip, draw off the liquid from one side of the slide with filter paper, and then apply 1-2 drops of *chloral-hydrate solution* from the other side of the slide, lignified elements are stained crimson-red. Specimen may also be prepared with *caustic alkali* or *ferric ammonium sulphate* for this purpose.

IV Roots and Rhizomes

a. Entire materials

Generally anatomical examination of entire roots and rhizomes is not done but if required then cut transverse and longitudinal sections. For this soften small pieces of roots without heating in glycerol solution for 1-3 days, depending on their hardness. The soften roots are straightened with help of a scalpel in the right direction and then cut a section with the razor. First cut thicker entire slices and then make thin, smaller sections. Stain the entire slices with phloroglucinol and concentrated hydrochloric acid or with saffranine, examine the specimen under a dissecting microscope. For micro-chemical test the small and then sections are examined under microscope, as follows:

1. Starch - Starch is detected with iodine solution. If starch is present, prepare specimen with water to measure the granule of starch with an occular micrometer.

2. Inulin - Inulin is detected with Molish's reagent. For this place a little powder on a slide and apply 1-2 drops of naphthol and a drop of concentrated sulphuric acid, if inulin is present, the powder will appear reddish-violet coloured. Starch also gives this test, so the test for inulin can be done in the absence of starch.

3. Lignified elements - Lignified elements (fibrovascular bundles, mechanical tissue etc.) are detected with *phloroglucinol and concentrated hydrochloric acid* or *safranine solution* as mentioned above for barks.

4. Fixed Oil - For fixed oil detection use Sudan III, as mentioned above for fruits and seeds. If required for tannin, anthraquinone derivatives, test as mentioned above.

b. Cut material

Make small pieces or scrapping of roots of rhizomes and boil them for 3-5 minutes in caustic alkali, or in nitric acid and then make pressed specimen and immerse them in glycerol.

Microchemical tests can be performed with scrapings for various chemicals as mentioned above.

C. Powder

Prepare several specimens of the powder on slides in *chloral hydrate solution* and perform the

above mentioned standard tests for detection of starch, fixed oil, inulin, lignified elements, anthrquinone derivatives, tannins, mucilage, etc.

2.1.2 Types of Stomata

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

1. Anomocytic (irregular-celled) - Previously known as ranuculaceous. The stomata is surrounded by a varying number of cells in no way differing from those of the epidermis generally.

2. Anisocytic (unequal-celled) - Previously known as cruciferous or solanacaceous. The stomata is usually surrounded by three subsidiary cells of which one is markedly smaller than the others.

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

4. Paracytic (pareallel-celled) - Previously known as rubiaceous. The stoma has one each side one or more subsidiary cells parallel to the long axis of the pore and guard cells.

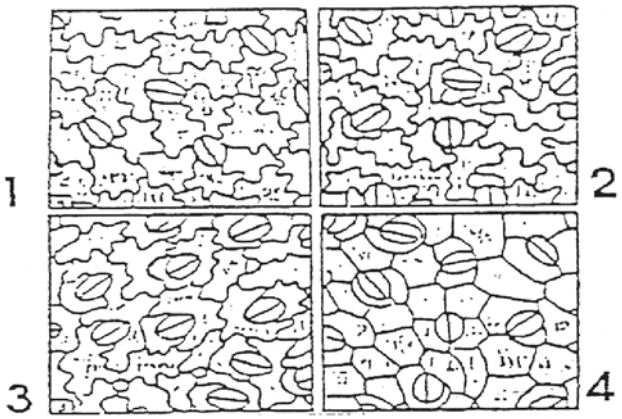

Fig. 1. Various types of stomata

2.1.3 Determination of Stomatal Index

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

Place leaf fragments of about 5x5 mm in size in a test tube containing about 5 ml of *Choral hydrate solution* and heat in a boiling water water-bath for about 15 minutes or until the fragments become transparent. Transfer a fragment to a microscopic slide and prepare the mount, the lower epidermis uppermost, in *chloral hydrate solution* and put a small drop of glycerol-ethanol solution on one side of the cover-glass to prevent the preparation from drying. Examine with a 40x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Mark on the drawing paper

a cross (x) for each epidermal cell and a circle (o) for each stomata. Calculate the result as follows:

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

Where S = the number of stomata in a given area of leaf; and
E = the number of epidermal cells (including trichomes) in the same area of leaf.

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

2.1.4 Determination of Palisade Ratio

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

Place leaf fragments of about 5 x 5 mm in size in a test-tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minute or until the fragment become transparent. Transfer a fragment to a microscopical Slide and prepare the amount, the upper epidermis uppermost, in chloral hydrate solution and put a small drop of glycerol solution on one side of the cover-glass to prevent the preparation from drying. Examine with a 40x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Trace four adjacent epidermal cells on paper; focus gently downward to bring the palisade into view and trace sufficient palisade cells to cover the area of the outlines of the four epidermal cells. Count the palisade cells under the four epidermal cells. Where a cell is intersected, include it in the court only when more than half of it is within the area of the epidermal cells. Calculate the average number of palisade cells beneath one epidermal cells, dividing the count by 4; this is the "Palisade ratio" (See figure 2).

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

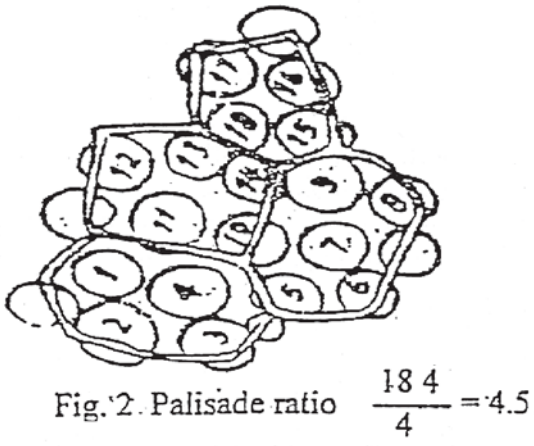

Figure 2

2.1.5 Determination of vein-Islet Number

The mesophyll of a leaf is divided into small portions of photosynthetic tissue by anastomosis of the veins and veinlets; such small portions or areas are termed "Vein-islets". The number of vein-islets per square millimeter is termed the "vein-islet number". This value has been shown to be constant for any given species and, for full-grown leaves, to be unaffected by the age of the plant or the size of the leaves. The vein-islet number has proved useful for the critical distinction of certain nearly related species. The determination is carried out as follows.

For Whole or Cut leaves - Take pieces of leaf lamina with an area of not less than 4 square millimeters from the central portion of the Lamina and excluding the midrib and the margin of the leaf. Clear the pieces of lamina by heating in a test tube containing *Chloral hydrate solution* on a boiling water-bath for 30 to 60 minutes or until clear and prepare a mount in *glycerol-solution* or, if desired, stain with *safranin solution* and prepare the mount in *Canada Balsam*. Place the stage micrometer on the microscope stage and examine with 4x objective and a 6x eyepiece. Draw a line representing 2 mm on a sheet of paper by means of a microscopical drawing apparatus and construct a square on the line representing an area of 4 square millimeters. Move the paper so that the square is seen in the centre of the field of the eyepiece. Place the slide with the cleared leaf piece on the microscope stage and draw in the veins and vainlets included within the square, completing the outlines of those vein-islets which overlap two adjacent sides of the square. Count the number of vein-islets within the square including those overlapping on two adjacent sides and excluding those intersected by the other two sides. The result obtained is the number of vein-islets in 4 square millimeters. For each sample of leaf make not fewer than three determinations and calculate the average number of vein-islets per square millimeter.

For Leaf Fragments Having An Area Less Than 4 Square Millimetres - Take fragments of leaf lamina each with an area of not less than 1 square millimeter, excluding the midrib and the margin of the *leaf.* Clear and prepare a mount as stated above. Use a 10x objective and a 6x eyepiece and draw a line representing 1mm on a sheet of paper by means of a microscopical drawing apparatus and construct a square on this line representing an area of 1 square millimeter. Carry out the rest of the procedures as stated above. The result obtained is the number of vein-islets in 1 square millimeter. For each sample of leaf make not less than 12 determinations and calculate the average number.

2.2 Determination of Quantitative Data of Vegetable Drugs

2.2.1 Sampling of Vegetable Drugs

Original Samples:

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

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

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

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

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

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

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

Test Sample

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

2.2.2 Foreign Matter and Determination of Foreign Matter

A. ***Foreign Matter***

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

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

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

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

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

B. Determination of Foreign Matter

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

2.2.3 Determination of Total Ash

Incinerate about 2 to 3g accurately weighed of the ground drug in a tared platinum or silica dish at a temperature not exceeding 450°C until free from carbon, cool and weigh. If a carbon free ash cannot be obtained in this way exhaust the charred mass with hot water, collect the residue on an ashless filter paper, incinerate the residue and filter paper, add the filtrate, evaporate to dryness, and ignite at a temperature not exceeding 450°C.

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

2.2.4 Determination of Acid-insoluble Ash

Boil the ash obtained in (2.2.3) for 5 minutes with 25ml, of *dilute hydrochloric acid*; collect the insoluble matter in a Gooch crucible, or on an ashless filter paper, wash with hot water and ignite to constant weight. Calculate the percentage of acid-insoluble ash with reference to the air dried drug.

2.2.5 Determination of Water-soluble Ash

Boil the ash for 5 minutes with 25 ml of water; collect insoluble matter in a Gooch crucible, or on an ashless filter paper, wash with hot water, and ignite for 15 minutes at a temperature not exceeding 450°C. Subtract the weight of the insoluble matter from the weight of the ash; the difference in weight represents the water-soluble ash. Calculate the percentage of water-soluble ash with reference to the air-dried drug.

2.2.6 Determination of Alcohol-soluble extractive

Macerate 5g of the air dried drug, coarsely powdered, with 100 ml of Ethyl alcohol of the specified strength in a closed flask for twenty-four hours, shaking frequently during six hours and allowing to stand for eighteen hours. Filter rapidly, taking precautions against loss of solvent, evaporate 25 ml of the filtrate to dryness in a tared flat bottomed shallow dish and dry at 105°C to constant weight and weigh. Calculate the percentage of alcohol-soluble extractive with reference to the air-dried drug.

2.2.7 Determination of Water-soluble extractive

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

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

Transfer a suitable weighed quantity (depending on the fixed oil content) of the air dried, crushed drug to an extraction thimble, extract with *solvent ether* (or *petroleum ether*, b.p. 40°C to 60°C) in a continuous extraction apparatus (soxhlet extractor) for 6 hours. Filter the extract quantitatively into a tared evaporating dish and evaporate off the solvent on a water bath. Dry the residue at 105°C to constant weight. Calculate the percentage of ether-soluble extractive with reference to the air-dried drug.

2.2.9 Determination of Moisture Content (Loss on drying)

Procedure set forth here determines the amount of volatile matter (i.e., water drying off from the drug). For substances appearing to contain water as the only volatile constituent, the procedure given below, is appropriately used.

Place about 10g. of drug (without preliminary drying) after accurately weighing (accurately weighed to within 0.01 g) it in a tared evaporating dish. For example, for underground or unpowdered drug, prepare about 10g, of the sample by cutting, shredding, so that the parts are about 3 mm in thickness.

Seeds and fruits smaller than 3 mm should be cracked. Avoid the use of high speed mills in preparing the samples, and exercise care that no appreciable amount of moisture is lost during preparation and that the portion taken is representative of the official sample. After placing the above said amount of the drug in the tared evaporating dish dry at 105°C for 5 hours, and weigh. Continue the drying and weighing at one hour interval until difference between two successive weighings corresponds to not more than 0.25 per cent. Constant weight is reached when two consecutive weighting after drying for 30 minutes and cooling for 30 minutes in an desccator, show not more than 0.01g difference.

2.2.10 Thin Layer Chromatography

Preparation of chromatoplates

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

Method

Unless unsaturated conditions are prescribed, prepare the tank by lining the walls with sheets of filter paper; pour into the tank, saturating the filter paper in the process, sufficient of the mobile phase to form a layer of solvent 5 to 10 mm deep, close the tank and allow to stand for one hour at room temperature.

Remove a narrow strip of the coating substance, about 5 mm wide, from the vertical sides of the chromatoplate. Apply the solutions being examined in the form of circular spots about 2 to 4 mm in diameter, on a line parallel with, and 20 mm from, one end of the plate, and not nearer than 20 mm to the sides; the spots should be 15 mm apart, if necessary, the solutions may be applied in portions, drying between applications. Mark the sides of the chromatoplate 15 cm, or the distance specified in the monograph, from the starting line. Allow the solvent to evaporate and place the chromatoplate in the tank, ensuring that it is as nearly vertical as possible and that the spots are above the level of the mobile phase. Close the tank and allow to stand at room temperature, unless otherwise stated in the monograph, until the mobile phase has ascended to the marked line. Remove the chromatoplate and dry and visualize as directed in the monograph; where a spraying technique is prescribed it is essential that the reagent be evenly applied as a fine spray.

2.2.11 Determination of Sulphated Ash

Heat a silica or platinum crucible to redness for 10 minutes, allow to cool in a desiccator and weigh. Put 1 to 2 g of the substance, accurately weighed, into the crucible, ignite gently at first, until the substance is thoroughly charred. Cool, moisten the residue with 1 ml of *sulphuric acid,* heat gently until white fumes are no longer evolved and ignite at 800°C±25°C until all black particles have disappeared. Conduct the ignition in a place protected from air currents. Allow the crucible to cool, add a few drops of *sulphuric acid* and heat. Ignite as before, allow to cool and weigh. Repeat the operation until two successive weighings do not differ by more than 0.5 mg.

2.2.12 Determination of Phenolics

Dissolve 5 gm of drug in water and filter. The filtrate is shaken with petroleum ether to remove greasy matter. It is precipitated with a saturated solution of lead acetate, digest for few minutes on water bath let the ppt. settle and filter. Dry the residue, then suspend it in alcohol and slightly warm on water bath and decompose by passing H2S. 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 H2S gas. The residue is transferred to a weighed petridish with alcohol and excess of alcohol evaporated on waterbath. The residue is dried at 105^0C till constant weight.

2.3 Limit Tests

2.3.1 Limit Test for Arsenic

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

Apparatus

A wide-mouthed bottle capable of holding about 120 ml is fitted with a rubber bung through which passes a glass tube. The latter, made from ordinary glass tubing, has a total length of 200 mm and an internal diameter of exactly 6.5 mm (external diameter about 8 mm). It is drawn out at one end to a diameter of about 1 mm and a hole not less than 2 mm in diameter is blown in the side of the tube, near the constricted part. When the bung is inserted in the bottle containing 70 ml of liquid, the constricted end of the tube is above the surface of the liquid, and the hole in the side is below the

bottom of the bung. The upper end of the tube is cut off square and is either slightly rounded or ground smooth.

Two rubber bungs (about 25 mm x 25 mm), each with a hole bored centrally and true, exactly 6.5 mm in diameter are fitted with a rubber band or sparing clip for holding them tightly together. Alternatively the two bungs may be replaced by any suitable contrivance satisfying the conditions described under the General Test.

Reagents

Ammonium Oxalate AsT - Ammonium oxalate which complies with the following additional test:

Heat 5 g with 15 ml of water, 5 ml of nitric acid AsT and 10 ml of Sulphuric acid AsT in a narrow necked round-bottomed flask until frothing ceases, cool and apply the General test; no visible stain is produced.

Arsenic solution, dilute, AsT:	
Strong arsenic solution AsT	1 ml
Water sufficient to produce	100 ml
Dilute arsenic solution AsT must be freshly prepared	
1 ml contains 0.01 mg of arsenic, As	

Arsenic Solution, strong, AsT:	
Arsenic trioxide	0.132g
Hydrochloric acid	50 ml
Water sufficient to produce	100 ml

Brominated hydrochloric acid AsT:	
Bromine solution AsT	1 ml
Hydrochloric acid AsT	100 ml

Bromine solution AsT:	
Bromine	30 g
Potassium bromide	30 g
Water Sufficient to produce	100 ml
It complies with the following test:	

Evaporate 10 ml on a water-bath nearly of dryness, add 50 ml of water, 10 ml of hydrochloric acid AsT and sufficient stannous chloride solution AsT to reduce the remaining bromine and apply the General test; the stain produced is not deeper than 1 ml standard stain, showing that the proportion of arsenic present does not exceed 1 part per million.

Citiric acid AsT: Citric acid which complies with the following additional tests: Dissolve 10 g in 50 ml of water add 10 ml of stannated hydrochloric acid AsT and apply the General test; no visible stain is produced.

Hydrochloric acid AsT: Hydrochloric acid diluted with water to contain about 32 percent w/ w of HC1 and complying with the following additional tests:

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

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

Hydrochloric acid (constant-boiling composition) AsT - Boil hydrochloric acid AsT to constant boiling Composition in the presence of hydrazine hydrate, using 1 ml of a 10 percent w/v in solution in water per liter of the acid.

Mercuric chloride paper - Smooth white filter paper, not less than 25 mm in width, soaked in a saturated solution of mercuric chloride, pressed to remove superfluous solution, and dried at about 60, in the dark. The grade of the filter paper is such that the weight is between 65 and 120 g per sq. mm; the thickness in mm 400 papers is approximately equal numerically, to the weight in g per sq. mm.

Nitric acid AsT - Nitric acid which complies the following additional test:

Heat 20 ml in a porcelain dish with 2 ml of sulphuric acid AsT until white fumes are given off. Cool, add 2 ml of water, and again heat until white fumes are given off; cool, add 50 ml of water, and 10 ml of stannated hydrochloric acid AsT, and apply the General test; no visible stain is produced.

Potassium Chlorate AsT - Potassium chlorate which complies with the following additional test:

Mix 5 g in the cold with 20 ml of water and 22 ml of hydrochloric acid AsT; when the first reaction has subsided, heat gently to expel chlorine, remove the last traces with a few drops of stannous chloride solution AsT add 20 ml of water, and apply the General test; no visible stain is produced.

Potassium iodide AsT - Potassium iodide which complies with the following additional test:

Dissolve 10 g in 25 ml of hydrochloric acid AsT and 35 ml of water, add 2 drops of stannous chloride solution AsT and apply the General test; no visible stain is produced.

Sodium carbonate, anhydrous AsT - Anhydrous sodium carbonate which complies with the following additional test:

Dissolve 5 g in 50 ml water, add 20 ml of brominated hydrochloric acid AsT, remove the excess of bromine with a few drops of stannous chloride solution AsT, and apply the General test; no

visible stain is produced.

Stannated hydrochloric acid AsT:
Stannous chloride solution AsT 1 ml
Hydrochloric Acid AsT 100 ml

Stannous Chloride solution AsT - Prepared from stannous chloride solution by adding an equal volume of hydrochloric acid, boiling down to the original volume, and filtering through a fine-grains filter paper.

It complies with the following test:

To 10 ml add 6 ml of water and 10 ml of hydrochloric acid AsT, distil and collect 16 ml. To the distillate add 50 ml of water and 2 drops of stannous chloride solution AsT and apply the General test; the stain produced is not deeper than a 1 ml standard stain, showing that the proportion of arsenic present does not exceed 1 part per million.

Sulphuric acid AsT - Sulphuric acid which complies with the following additional test:

Dilute 10 g with 50 ml of water, add 0.2 ml of stannous chloride solution AsT, and apply the General test; no visible stain is produced.

Zinc AsT - Granulated zinc which complies with the following additional tests:

Add 10 ml of stannated hydrochloric acid AsT to 50 ml of water, and apply the General test, using 10 of the zinc and allowing the action to continue for one hour; no visible stain is produced (limit of arsenic). Repeat the test with the addition of 0.1 ml of dilute arsenic solution AsT; a faint but distinct yellow stain is produced (test for sensitivity).

General Method of Testing - By a variable method of procedure, suitable to the particular needs of each substance, a solution is prepared from the substance being examined which may or may not contain that substance, nut contains the whole of the arsenic (if any) originally present in that substance. This solution, referred to as the ‘test solution’, is used in the actual test.

General test - The glass tube is lightly packed with cotton wool, previously moistened with lead acetate solution and dried, so that the upper surface of the cotton wool is not less than 25 mm below the top of the tube. The upper end of the tube is then inserted into the narrow end of one of the pair of rubber bungs, either to a depth of about 10 mm when the tube has a rounded-off end, or so that the ground end of the tube is flush with the larger end of the bung. A piece of mercuric chloride paper is placed flat on the top of the bung and the other bung placed over it and secured by means of the rubber band or spring clip in such a manner that the borings of the two bungs (or the upper bung and the glass tube) meet to form a true tube 6.5 mm in diameter interrupted by a diaphragm of mercuric chloride paper.

Instead of this method of attaching the mercuric chloride paper, any other method may be used provided (1) that the whole of the evolved gas passes through the paper; (2) that the portion of the

paper in contact with the gas is a circle 6.5 mm in diameter; and (3) that the paper is protected from sunlight during the test. The test solution prepared as specified, is placed in the wide-mouthed bottle, 1 g of potassium iodide AsT and 10 g of zinc AsT are added, and the prepared glass tube isj placed quickly in position. The action is allowed to proceed for fourty minutes. The yellow stain which is produced on the mercuric chloride paper if arsenic is present is compared by day light with the standard stains produced by operation in a similar manner with known quantities of dilute arsenic solution AsT. The comparison of the stains is made immediately at the completion of the test. The standard stains used for comparison are freshly prepared; they fade on keeping.

NOTE: Mercuric chloride paper should be stored in a stoppered bottle in the dark. Paper which has been exposed to sunlight or to the vapour of ammonia affords a lighter stain or no stain at all when employed in the limit test for arsenic.

By matching the depth of colour with standard stains, the proportion of arsenic in the substance may be determined. A stain equivalent to the 1-ml standard stain produced by operating on 10 g of substance indicates that the proportion of arsenic is 1 part per million.

NOTES:(1) The action may be accelerated by placing the apparatus on a warm surface, care being taken that the mercuric chloride paper remains dry throughout the test.

(2) The most suitable temperature for carrying out the test is generally about 400 but because the rate of the evolution of the gas varies somewhat with different batches zinc AsT, the temperature may be adjusted to obtain a regular, nut not violent, evolution of gas.

(3) The tube must be washed with hydrochloric acid AsT, rinsed with water and dried between successive tests.

Standard stains - Solutions are prepared by adding to 50 ml of water, 10 ml of stannated hydrochloric acid AsT and quantities of dilute arsenic solutions AsT varying from 0.2 ml to 1 ml. The resulting solutions, when treated as described in the General test; yield stains on the mercuric chloride paper referred to as the standard stains.

Preparation of the Test Solution - In the various methods of preparing the test solution given below, the quantities are so arranged unless otherwise stated, that when the stain produced from the solution to be examined is not deeper that the 1 ml standard stain, the proportion of arsenic present does not exceed the permitted limit.

Ammonium chloride - Dissolve 2.5 g in 50 ml of water, and add 10 ml of stannated hydrochloric acid AsT.

Boric acid - Dissolve 10 g with 2 g of citric acid AsT in 50 ml of water, and add 12 ml of stannated hydrochloric acid AsT.

Ferrous sulphate - Dissolve 5 g in 10 ml of water and 15 ml of stannated hydrochloric acid AsT and distil 29 ml; to the distillate add a few drops of bromine solution AsT. Add 2 ml of stannated

hydrochloric acid AsT, heat under a reflex condenser for one hour, cool and add 10 ml of water and 10 ml of hydrochloric acid AsT.

Glycerin - Dissolve 5 g in 50 ml of water, and add 10 ml of stannated hydrochloric acid AsT.

Hydrochloric acid - Mix 10 g with 40 ml of water and 1 ml of stannous chloride solution AsT.

Magnesium Sulphate - Dissolve 5 g in 50 ml of water, and add 10 ml of stannated hydrochloric acid AsT.

Phosphoric acid:

Dissolve 5 g in 50 ml of water, and add 10 ml of stannated hydrochloric acid AsT.

Potassium iodide - Dissolve 5 g in 50 ml of water, and add 2 ml of stannated hydrochloric acid AsT.

Sodium bicarbonate - Dissolve 5 g in 50 ml of water, add 15 ml of brominated hydrochloric acid AsT and remove the excess of bromine with a few drops of stannous chloride solution AsT.

Sodium hydroxide - Dissolve 2.5 g in 50 ml of water, add 16 ml of brominated hydrochloric acid AsT and remove the excess of bromine with a few drops of stannous chloride solution AsT.

2.3.2 Limit Test for Chlorides

Dissolve the specified quantity of the substance in water or prepare a solution as directed in the text and transfer to a Nessler cylinder. Add 10 ml of dilute nitric acid, except when nitric acid is used in the preparation of the solution, dilute to 50 ml with water, and add 1 ml of silver nitrate solution. Stir immediately with a glass rod and allow to stand for 5 minutes. The opalescence produced is not greater than the standard opalescence, when viewed transversely.

Standard Opalescence - Place 1.0 ml of a 0.05845 percent w/v solution of sodium chloride and 10 ml of dilute nitric acid in a Nessler cylinder. Dilute to 50 ml with water and add 1 ml of silver nitrate solution, stir immediately with a glass rod and allow to stand for five minutes.

2.3.3 Limit Test for Heavy Metals

The test for heavy metals is designed to determine the content of metallic impurities that are coloured by sulphide ion, under specified conditions. The limit for heavy metals is indicated in the individual monographs in terms of the parts of lead per million of the substance (by weight), as determined by visual comparison of the colour produced by the substance with that of a control prepared from a standard lead solution.

Determine the amount of heavy metals by one of the following methods and as directed in the individual monographs: Method A is used for substances that yield clear colourless solutions under the specified test conditions. Method B is used for substances that do not yield clear, colourless solutions

under the test conditions specified for Method A. or for substances which, by virtue of their complex nature, interfere with the precipitation of metals by sulphide ion. Method C is used for substances that yield clear colourless solutions with sodium hydroxide solutions.

Special Reagents -

Acetic acid Sp. : Acetic acid which complies with the following additional test:

Make 25 ml alkaline with dilute ammonia solution Sp., add 1 ml of potassium cyanide solution Sp., dilute to 50 ml with water and add two drops of sodium sulphide solution; no darkening is produced.

Dilute acetic acid Sp.: Dilute acetic acid which complies with the following additional test: Evaporate 20 ml in a porcelain dish, nearly to dryness on a water-bath. Add to the residue 2 ml of the acid and dilute with water to 25 ml, add 10 ml hydrogen sulphide solution. Any dark colour produced is not more than that of a control solution consisting of 2 ml of the acid and 4 ml of standard lead solution diluted to 25 ml with water.

Ammonia solution Sp.: Strong ammonia solution which complies with the following additional test: Evaporate 10 ml jot dryness on a waterbath to the residue add 1 ml of dilute hydrochloric acid Sp. and evaporate to dryness. Dissolve the residue in 2 ml of dilute acetic acid Sp. and sufficient water to produce 25 ml. Add 10 ml of hydrogen sulphide solution if any darkening produced is not greater that in a blank solution containing 2 ml of dilute acetic acid Sp. 1 ml of standard lead solution and sufficient water to produce 25 ml.

Dilute ammonia solution Sp.: Dilute ammonia solution which complies with the following additional test:

To 20 ml add 1 ml of Potassium cyanide solution Sp., dilute to 50 ml with water, and add two drops of sodium sulphide solution; no darkening is produced.

Hydrochloric acid: Hydrochloric acid which complies with the following additional test: Evaporate of the acid in a beaker to dryness on a water-bath. Dissolve the residue in 2 ml of dilute acid sp., dilute 17 ml with water and add 10 ml of hydrogen sulphide solution; any darkening produced is not greater than in a blank solution containing 2 ml of standard lead solution, 2 ml of dilute acetic acid Sp., and dilute to 40 ml with water.

Dilute hydrochloric acid Sp.: Dilute hydrochloric acid, which complies with the following additional test: Treat 10 ml of the acid in the manner described under Hydrochloric acid Sp.

Lead nitrate stock solution: Dissolve 0.1598 g of lead nitrate in 100 ml of water to which has been added 1 ml of nitric acid, then dilute with water to 1000 ml. This solution must be prepared and stored in polyethylene or glass containers free from soluble lead salts.

Standard lead solution: One the day of use, dilute 10 ml of lead nitrate stock solution with water to 100 ml. Each ml of standard lead solution contains the equivalent of 10 mg of lead. A control

comparison solution prepared with 2 ml of standard lead solution contains, when compared to a solution representing 1 g of the substance being tested, the equivalent of 20 parts per million of lead.

Nitric acid Sp. : *Nitric acid* which complies with the following additional test : Dilute 10 ml with 10 ml of *water*, make alkaline with *ammonium solution Sp.* Add 1 ml of *potassium cyanide solution Sp.* Dilute to 50 ml with water, and add two drops of *sodium sulphide solution;* no darkening is produced.

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

Method A

Standard Solution : In a 50 ml *Nessler cylinder,* pipette 2 ml of *standard lead solution* and dilute with *water* to 25 ml. Adjust with *dilute acetic acid Sp.* Or *dilute ammonia solution Sp.* To a pH between 3 and 4, dilute with water to about 35 ml., and mix.

Test Solution : In a 50 ml *Nessler cylinder,* place 25 ml of the solution prepared for the test as directed in the individual monograph; or using the stated volume of acid when specified in the individual monograph, dissolve and dilute with *water* to 25 l the specified quantity of the substance being tested. Adjust with *dilute acetic acid Sp.* Or *dilute ammonia solution Sp.* To a pH between 3 and 4 *dilute with water* to about 35 ml and mix.

Procedure : to each of the cylinders containing the *standard solution* and *test solution* respectively add 10 ml of freshly prepared *hydrogen sulphide solution,* mix, dilute with *water* to 50 ml, allow to stand for five minutes, and view downwards over a white surface; the colour produced in the *test solution. n*ot darker than that produced in the *standard solution.*

Method B

Standard Solution : Proceed as directed under Method A.

Test Solution : Weigh in a suitable crucible the quantity of the substance specified in the individual monograph, add sufficient *sulphuric acid Sp.* to wet the sample, and ignite carefully at a low temperature until thoroughly charred. Add to the charred mass 2 ml of *nitric acid Sp.* and five drops of *sulphuric acid Sp.* and heat cautiously until white fumes are no longer evolved. Ignite, preferably in a muffle furnace, at 500°C to 600°C until the carbon is completely burnt off. Cool, add 4 ml of *hydrochloric acid Sp.,* cover, digest on a water bath for 15 minutes, uncover and slowly evaporate to dryness on a water-bath. Moisten the residue with one drop of *hydrochloric acid Sp.,* add 10 ml of hot water and digest for two minutes. Add *ammonia solution Sp.,* dropwise, until the solution is just alkaline to *litmus paper,* dilute with water to 25 ml and adjust with *dilute acetic acid Sp.* to a pH between 3 and 4. Filter if necessary, rinse the crucible and the filter with 10 ml of *water,* combine the filtrate and washings in a 50 ml *Nessler Cylinder.,* dilute with water, to about 35 ml, and mix. Procedure : Proceed as directed under Method A.

Method C

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

Test Solution : In a 50 ml *Nessler Cylinder,* Place 25 ml of the solution prepared for the test as directed in the individual monograph; or, if not specified otherwise in the individual monograph, dissolve the specified quantity in a mixture of 29 ml of *water* and 5 ml of *dilute sodium hydroxide solution.* Dilute 50 ml with *water* and mix.

Procedure : To each of the cylinders containing the *standard solution* and the *test solution,* respectively add 5 drops of *sodium sulphide solution,* mix, allow to stand for five minutes and view downwards over a white surface; the colour produced in the test *solution* is not darker than that produced in the *standard solution.*

2.3.4 Limit Test for Iron

Standard iron solution : Weigh accurately 0.1726 g of *ferric ammonium sulphate* and dissolve in 10 ml of 0.1 N *Sulphuric acid* and sufficient *water* to produce 1000.0 ml. Each ml of this solution contains 0.02mg of Fe.

Method

Dissolve the specified quantity of the substance being examined in 40 ml of water, or use 10 ml of the solution prescribed in the monograph, and transfer to a *Nessler Cylinder* Add 2 ml of a 20 per cent w/v solution of *iron-free citric acid* and 0.1 ml of *thioglycollic acid,* mix make alkaline with *iron-free ammonia solution,* dilute to 50 ml with water and allow to stand for five minutes. Any colour produced is not more intense than the standard colour.

Standard Colour : Dilute 2 ml of *standard iron solution* with 40 ml of *water* in a *Nessler Cylinder.* Add 2 ml of a 20 per cent w/v solution of *iron free citric acid* 0.1ml of *thioglycollic acid,* mix make alkaline with *iron-free ammonia solution,* dilute to 50 ml with *water* and allow to stand for five minutes.

2.3.5 Limit Test for Lead

The following method is based on the extraction of lead by solutions of dithizone. All reagents used for the test should have as low a content of lead as practicable. All reagents solutions should be stored in containers of borosilicate glass. Glassware should be rinsed thoroughly with warm *dilute nitric acid,* followed by *water.*

Special Reagents -

(1) Ammonia-cyanide solution Sp : Dissolved 2g of *potassium cyanide* in 15 ml of *strong ammonia solution* and dilute with *water* to 100 ml.

(2) Ammonia citrate solution Sp. : Dissolve 40g of *citric acid* in 90 ml of water. Add two drops of *phenol red solution* then add slowly *strong ammonia solution* until the solution acquires a reddish colour. Remove any lead present by extracting the solution with 20 ml quantities of *dithizone extraction solution* until the dithizone solution retains its orange-green colour.

(3) Dilute standard lead solution : Dilute 10 ml of *standard lead solution* with sufficient 1 per cent v/v solution of nitric acid to produce 100 ml. Each ml of this solution contains 1 u g of lead per ml.

(4) Dithizone extraction solution : Dissolve 30 mg of *diphenylthiocarbazone in 1000 ml of chloroform* and add 5 ml of *alchohol.* Store the solution in a refrigerator. Before use, shake a suitable volume of the solution with about half its volume of 1 per cent v/v solution of *nitric acid* and discard the acid.

(5) Hydroxylamine hydrochloride solution Sp.: Dissolve 20g of *hydroxylamine hydrochloride* in sufficient *water* to produce about 65 ml. Transfer to separator, add five drops of *thymol blue solution,* add *strong ammonia solution* until the solution becomes yellow. Add 10 ml of a 4 per cent w/v solution of *sodium diethyldithiocarbamate* and allow to stand for five minutes. Extracts with successive quantities, each of 10 ml of *chloroform* until a 5 ml portion of the extract does not assume a yellow colour when shaken with *dilute copper sulphate solution.* Add *dilute hydrochloric acid* unitl the solution is pink and then dilute with sufficient water to produce 100 ml.

(6) Potassium cyanide solution Sp.: Dissolve 50 g of *potassium cyanide* in sufficient water to produce 100 ml. Remove the lead from this solution by extraction with successive quantities, each of 20 ml of *eithizone extraction solution* until the dithizone solution retains its orange-green colour. Extract any dithizone remaining in the cyanide solution by shaking with *chloroform.* Dilute this cyanide solution with sufficient *water* to produce a solution containing 10 g of *potassium cyanide* in each 100 ml.

(7) Stadard dithizone solution : Dissolve 10 mg of *diphenylthiocarbazone* in 1000 ml of *chloroform.* Store the solution in a glass-stoppered, lead-free bottle, protected from light and in a refrigerator.

(8) Citrate-cyanide wash solution : To 50 ml of *water* add 50 ml of *ammonium citrate solution Sp.* and 4 ml of *potassium cyanide solution Sp.,* mix and adjust the pH, if necessary, with *strong ammonia solution* to 9.0.

(9) Buffer solution pH 2.5. : To 25 ml of 0.2 *M Potassium hydrogen phthalate add 37.0 ml of 0.1 N hydrochloric acid,* and dilute with sufficient *water* to produce 100.0 ml.

(10) Dithizone-carbon tetrachloride solution : Dissolve 10 mg of *diphenylthiocarbazone* in 1000 ml of *carbon tetrachloride.* Prepare this solution fresh for each determination.

(11) pH 2.5 wash solution : To 500 ml of a 1 per cent v/v *nitric acid* add *strong ammonia solution* until the pH of the mixture is 2.5, then add 10 ml of *buffer solution* pH 2.5 and mix.

(12) Ammonia-cyanide wash solution : To 35 ml of pH 2.5 *wash solution* add 4 ml of *ammonia-cyanide solution Sp.,* and mix.

Method

Transfer the volume of the prepared sample directed in the monograph to a separator, and unless otherwise directed in monograph, add 5 ml of *ammonium citrate solution Sp.,* and 2 ml of *hydroxylamine hydrochloride solution Sp.,* (For the determination of lead in iron salts use 100 ml of *ammonium citrate solution Sp.)* Add two drops of *phenol red solution* and make the solution just alkaline (red in colour) by the addition of *strong ammonia solution.* Cool the solution if necessary, and add 2 ml of *potassium cyanide solution Sp.* Immediately extract the solution with several quantities each of 5 ml of *dithizone extraction solution,* draining off each extract into another separating funnel, until the dithizone extraction solution retains its green colour. Shake the combine and discard the chloforom layer. Add to the acid solution exactly 5 ml of *standard dithizone solution* and 4 ml of *ammonia-cyanide solution Sp.* and shake for 30 seconds; the colour of the chloroform layer is of no deeper shake of violet than that of a control made with a volume of *dilute standard lead solution* equivalent to the amount of lead permitted in the sample under examination.

2.3.6 Limit Test for Sulphates

Reagents -

Barium sulphate reagent : Mix 15 ml of 0.5 M *barium chloride,* 55 ml of *water,* and 20 ml of *sulphate-free alcohol,* add 5 ml of a 0.0181 per cent w/v solution of *potassium sulphate,* dilute to 100 ml with *water,* and mix. Barium Sulphate Reagent must be freshly prepared.

0.5 M Barium chloride: *Barium Chloride* dissolved in *water* to contain in 1000 ml. 122.1 g of $BaC1_{2,}\ 2H_2O$.

Method

Dissolve the specified quantity of the substance in *water,* or prepare a solution as directed in the text, transfer to a *Nessler cylinder,* and add 2 ml of *dilute hydrochloric acid,* except where *hydrochloric acid* is used in the preparation of the solution. Dilute to 45 ml with *water,* add 5 ml of *barium sulphate reagent* stir immediately with a glass rod, and allow to stand for five minutes. The turbidity produced is not greater than the *standard turbidity,* when viewed transversely. Standard turbidity: Place 1 ml of 0.1089 per cent w/v solution of potassium sulphate and 2 ml of *dilute hydrochloric acid* in a *Nessler cylinder,* dilute to 45 ml with water, add 5 ml of barium sulphate reagent, stir immediately with a glass rod and allow to stand for five minutes.

APPENDIX 3

3.1 PHYSICAL TESTS AND DETERMINATIONS

3.1.1 Determination of Boiling or Distilling Range

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

Apparatus --

Use an apparatus consisting of the following:

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

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

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

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

Method

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

Assemble the apparatus, and place in the flask 100 ml of the liquid under examination, taking care not to allow any of the liquid to enter the side-arm. Insert the thermometer and seal the entire heating and flask assembly from external air currents. Add a few pieces of porous material and heat rapidly to boiling using a Bunsen burner an asbestos plate pierced by a hole 33 mm in diameter. Record the temperature at :h the first drop of distillate faJls into the cylinder, and adjust the rate of heating to in a regular distillation rate of 4 to 5 ml per minute. Record the temperature when the drop of liquid

evaporates from the bottom of the flask or when the specified entage has distilled over. Correct the observed temperature readings for any variation le barometric pressure from the normal (760 torr) using the following expression:

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

where

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

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

3.1.2 Determination of congealing range of temperature

The congealing temperature is that point at which there exists a mixture of the liquid (fused) phase of a substance and a small but increasing proportion of the solid phase. It is distinct from the freezing point, which is the temperature at which the liquid and solid se of a substance are in equilibrium.

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

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

Apparatus -–

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

Method

Melt the substance, if solid, at a temperature not more than 20°C above its expected congealing point and pour it into the inner test-tube to height of 50 to 57 mm. Assemble the apparatus with the bulb of the thermometer immersed half-way between the top and bottom of the sample in the sample in the test-tube. Fill the bath to almost 20 mm from the tube with a suitable fluid at a temperature 4°C 'to 5°C below the expected congealing point. If the substance is a liquid at room temperature, carry out the determination using a bath temperature about 15°C below the expected congealing point. When the sample has cooled to about 5°C above its expected congealing point stir it continuously by moving the loop up and down between the top and bottom of the sample, at a regular rate of 20 complete cycles per minute. Record the reading of the thermometer every 30 seconds and continue stirring only so long as the temperature is falling. Stop the stirring when the temperature is constant or starts to rise slightly. Continue recording the temperature for atleast three minutes after the temperature again begins to fall after remaining constant.

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

3.1.3 Determination of pH Values

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

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

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

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

TABLE 1 - pH of Reference Solutions at various Temperatures.

Temperature	Buffer Solutions							
T^O	A	B	C	D	E	F	G	H
15	1.67	-	3.80	4.00	6.90	7.45	9.28	10.12
20	1.68	-	3.79	4.00	6.88	7.43	9.22	10.03
25	1.68	3.56	3.78	4.01	6.86	7.41	9.18	10.01
30	1.68	3.55	3.77	4.02	6.85	7.40	9.14	9.97
35	1.69	3.55	3.76	4.02	6.84	7.39	9.10	9.98
$\Delta pH/\Delta t$	+ 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°C for two hours before use. Buffer solutions should be stored in bottles made of alkali-free glass, and must not be used later than three months after preparation.

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

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

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

NOTE - This solution must be freshly prepared.

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

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

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

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

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

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

Method

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

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

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

3.1.4 Determination of melting range of temperature

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

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

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

Method I

Apparatus :

(a) A glass heating vessel of suitable construction and capacity containing one of the following or any other suitable bath liquid, to a height of not less than 14 cm.
  (i) Water for temperatures upto 60°C
  (ii) Glycerin for temperatures upto 150°C
  (iii) Liquid paraffin for sufficiently high boiling range for temperatures upto 250°C
  (iv) Sesame oil or a suitable grade of liquid silicone for temperatures upto 300°C

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

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

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

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

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

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

Method II

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

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

Method III

Apparatus:

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

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

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

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

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

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

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

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

3.1.5 Optical rotation and specific optical rotation

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

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

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

The *specific optical rotation* $(\alpha)^{D25}$ of a solid substance is the angle of rotation œ of the plane of polarisation at the wavelength of the D line of sodium (λ -589.3 mm) measured at 25^0 C calculated with reference to 1.0 dm thick layer of the liquid, and divided by the specific gravity.

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

Apparatus

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

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

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

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

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

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

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

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

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

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

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

Concentration (g/100 ml)	Angle of Rotation (+) at 25^0
10.0	13.33
20.0	26.61
30.0	39.86
40.0	53.06
50.0	66.23

Method

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

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

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

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

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

id

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

Where

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

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

3.1.6 Powder fineness

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

The following terms are used in the description of powders:

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

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

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

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

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

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 ìm, 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

---

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° ($\pm$ 0.5) with reference to the wavelength of the $_D$ line of sodium (λ = 589.3 mm). The temperature should be carefully adjusted and maintained since the refractive index varies significantly with temperature.

The Abbe refractometer is convenient for most measurements of refractive index but other refractometer of equal or greater accuracy may be used. Commercial refractometers are normally constructed for use with white light but are calibrated to give the refractive index in terms of the $_D$ line of sodium light.

To achieve accuracy, the apparatus should be calibrated against *distilled water:* which has a refractive index of 1.3325 at 25°C or against the reference liquids given in the following Table:-

TABLE

Reference Liquid	n_D^{200} Temperature Co-efficient <n/<t
Carbon tetrachloride	1.4603 -0.00057
Toluene	1.4969 -0.00056
a-Methylnaphthalene	1.6176 -0.00048

References index value for the $_D$ line of sodium measured at 20^0

The cleanliness of the instrument should be checked frequently by determining the refractive index of distilled water which at 25°C is 1.3325.

3.1.8 Weight Per Milliliter and Specific Gravity

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

Method - Select a thoroughly clean and dry pycnometer. Calibrated the pyconometer by filling it with recently boiled and cooled *water* at 25°C and weighing the contents. Assuming that the weight of 1 ml of *water* at 25°C when weighed in air of density 0.0012 g per ml , is 0.99602 g calculate the capacity of the pycnometer. (Ordinary deviations in the density of air from the value given do not affect the result of a determination significantly). Adjust the temperature of the substance to be examined, to about 20°C and fill the pycnometer with it. Adjust the temperature of the filled pycnometer to 25°C, remove any excess of the substance and weigh. Substract the tare weight of the pycnometer from the filled weight of the pycnometer. Determine the weight per milliliter dividing the weight in air, expressed in g, of the quantity of liquid which fills the pycnometer at the specified temperature, by the capacity expressed in ml, of the pycnometer at the same temperature.

Specific Gravity - The specific gravity of a liquid is the weight of a given volume of the liquid at 25°C (unless otherwise specified) compared with the weight of an equal volume of *water* at the same temperature, all weighing being taken in air.

Method - Proceed as. described under Wt. per ml. - Obtain the specific gravity of the liquid by dividing the weight of the liquid contained in the pycnometer by the weight of *Water* contained, both determined at 25°C unless otherwise directed in the individual monograph.

APPENDIX – 4

4.1 REAGENTS AND SOLUTIONS

Acetic Acid - Contains approximately 33 per cent w/v of $C_2H_4O_2$ Dilute 315 ml of *glacial acetic acid* to 1000 ml with *water*.

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

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

Acetic Acid Glacial - CH_3 COOH=60.05.

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

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

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

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

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

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

Heavy Metals - Evaporate 5 ml to dryness in a porcelain dish on water-bath, warm the residue with 2 ml of 0.1 N hydrochloric acid and add water to make 25°C ml; the limit of heavy metals is 10 parts per million, Appendix 2.3.3

Chloride - 5 ml complies with the limit test for chlorides, Appendix 2.3.2.

Sulphate - 5 ml complies with the limit test for sulphates, Appendix 2.3.6

Certain Aldehydic Substances - To 5 ml add 10 ml of mercuric chloride solution, and make alkaline with sodium hydroxide solution, allow to stand for five minutes and acidify with dilute sulphuric acid the solution does not show more than a faint turbidity.

Formic Acid And Oxidisable Impurities - Dilute 5 ml with 10 ml of water, to 5 ml of this solution add 2 ml of 0.1 N potassium dichromate and 6 ml of sulphuric acid, and allow to stand for one minute, add 25 ml of water, cool to 15°C and add 1 ml of freshly prepared potassium iodine

solution and titrate the liberated iodine with 0.1 N sodium thiosulphate, using starch solution as indicator. Not less than 1 ml of 0.1 N sodium thiosulphate is required.

Odorous Impurities - Neutralise 1.5 ml with sodium hydroxide solution; the solution has no odour other than a faint acetous odour.

Readily Oxidasable Impurities - To 5 ml of the solution prepared for the test for Formic Acid and Oxidisable Impurities, add 20 ml of water and 0.5 ml of 0.1 N potassium permaganate; the pink colour does not entirely disappear within half a minute.

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

Assay - Weigh accurately about 1 g into a stoppered flask containing 50 ml of water and titrate with *N sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *sodium hydroxide* is equivalent to 0.06005 g of $C_2H_4O_2$.

Acetic acid, lead free - Acetic acid which complies with following additional test, boil 15 ml until the volume is reduced to about 15 ml, cool, make alkaline with lead-free ammonia solution, add 1 ml of lead free *potassium cyanide solution*, dilute to 50 ml with water, add 2 drops of *sodium sulphide solution*; no darkening is produced.

Acetone - Propan - 2 one; $(CH_3)_2$ CO=58.08.

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

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

Distillation Range - Not less than 96 per cent distils between 55.5°C and 57°C, Appendix 3.1.1

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

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

Methyl Alcohol - Dilute 10ml with water to 100ml to 1 ml of the solution add 1 ml of water and 2ml of potassium permaganate and phosphoric acid solution. Allow to stand for ten minutes and add 2ml of oxalic acid and sulphuric acid solution; to the colourless solution add 5 ml of decolorised magenta solution and set aside for thirty minutes between 15°C and 30°C no colour is produced.

Oxidisable Substances - To 20 ml add 0.1 ml of 0.1 N potassium permanganate, and allow to stand for fifteen minutes; the solution is not completely decolorised.

Water - Shake 10 ml with 40 ml of carbon disulphide; a clear solution is produced.

Non-Volatile Matter - When evaporated on a water-bath add dried to constant weight at 105°C, leaves not more than 0.01 per cent w/v of residue.

Acetone Solution, Standard - A 0.05 per cent v/v solution of acetone in water.

Alcohol -

Description - Clear, colourless, mobile, volatile liquid, odour, characteristic and spirituous; taste, burining readily volatilised even at low temperature, and boils at abut 78°C, flammable. Alcohol containing not less than 94.85 per cent v/v and not more than 95.2 per cent v/v of C_2H_5OH at 15.56.

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

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

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

Clarity of Solution - Dilute 5 ml to 100 ml with water in glass cylinder, the solution remains clear when examined against a black background. Cool to 10°C for thirty minutes; the solution remains clear.

Methanol - To one drop add one drop of *water*, one drop of *dilute phosphoric acid*, and one drop of *potassium permanganate solution.* Mix, allow to stand for one minute and add *sodium bisulphite solution* dropwise, until the permaganate colour is discharged. If a brown colour remains, add one drop of *dilute phosphoric acid* to the colourless solution add 5 ml of freshly prepared *chromotropic acid solution* and heat on a water-bath at 60°C for ten minutes; no violet colour is produced.

Foreign Organic Substances - Clean a glass-stoppered cylinder thoroughly with *hydrochloric acid*, rinse with *water* and finally rinse with the alcohol under examination. Put 20 ml in the cylinder, cool to about 15°C and then add from a carefully cleaned pipette 0.1 ml of 0.1 *N Potassium permaganate*. Mix at once by inverting the stoppered cylinder and allow ato stnd at 15°C for five minutes; the pink colour does not entirely disappear.

Isopropyl Alcohol and T-Butyl Alcohol - To 1 ml add 2 ml of water and 10 ml of *mercuric sulphate solution* and heat in a boiling water-bath; no precipitate is formed within three minutes.

Aldehydes and Ketones - Heat 100 ml of *hydroxyl amine hydrochloride solution* in a loosely stoppered flask on a water-bath for thirty minutes, cool, and if necessary, add sufficient 0.05 *N sodium hydroxide* to stored the green colour. To 50 ml of this solution add 25ml of the *alcohol* and heat on a water bath for ten minutes in a loosely stoppered flask. Cool, transfer to a Nessler cylinder, and titrate with 0.05 *N sodium hydroxide* unitl the colour matches that of the remainder of the *hydroxylamine*

hydrochloride solution contained in a similar cylinder, both solutions being viewed down the axis of the cylinder. Not more than 0.9 ml of 0.05 *N sodium hydroxide* is required.

Fuse Oil Constituents - Mix 10 ml of *water* and 1 ml of *glycerin* and allow the mixture to evaporate spontaneously from clean, odourless absorbent paper; no foreign odour is perceptible at any stage of the evaporation.

Non-Volatile Matter - Evaporate 40 ml in a tared dish on a water-bath and dry the residue at 105°C for one hour; the weight of the residue does not exceed 1 mg.

Storage - Store in tightly-closed containers, away from fire.

Labelling - the label on the container states "Flammable".

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

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

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

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

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

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

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

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

Aldehyde - To 25ml, contained in a 300 ml flask, add 75 ml of dinitrophenyl hydrazine solution heat on a water bath under a reflux condenser for twenty four hours, remove the alcohol by distillation, dilute to 200 ml with a 2 per cent v/v solution of sulphuric acid, and set aside for twenty four hours; no crystals are produced.

Alcohol Sulphate-free - Shake alcohol with an excess of an ion exchange resin for thirty minutes and filter.

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

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

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

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

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

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

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

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

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

Solubility - Miscible with *water* in all proportions.

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

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

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

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

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

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

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

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

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

Ammonia Solution, iron-free - Dilute *ammonia solution* which complies with the following additional test :-

Evaporate 5 ml nearly to dryness on a water-bath add 40 ml of *water*, 2 ml of 20 per cent w/v solution of iron free *citric acid* and 2 drops of *thioglycollic acid*, mix, make alkaline with *iron-free ammonia solution* and dilute to 50 ml with *water*, no pink colour is produced.

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

Ammonium Chloride - NH_4 CI=53.49.

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

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

Arsenic - Not more than 4 parts per million.

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

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

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

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

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

Assay - Weigh accurately about 0.1g. dissolve in 20 ml of *water* and add a mixture of 5ml of *formaladehyde solution,* previously neutralised to *dilute phenolphtale in solution* and 20ml of *water.* After two minutes, titrate slowly with 0.1 *N sodium hydroxide*, using a further 0.2 ml of *dilute phenolphthale in solution*. Each ml. of 0.1 *N sodium hydroxide* is equivalent to 0.005349g of NH_4CI.

Storage - Store in tightly closed container.

Ammonium Chloride Solution - A 10 per cent w/v solution of *ammonium chlorid*e in water.

Ammonium Citrate Solution - Dissolve with cooling, 500g *citric acid* in a mixture of 200ml of *water* and 200ml of 13.5 *M ammonia*, filter and dilute with *water* to 1000ml.

Ammonium Nitrate - NH_4NO_3 = 80.04.

Description - Colourless crystals.

Solubility - Freely soluble in water.

Acidity - A solution in water is slightly acid to litmus solution.

Chloride - 3.5g complies with the limit test for chloride Appendix 2.3.2.

Sulphate - 5g complies with the limit test for sulphates, Appendix 2.3.6

Sulphated Ash - Not more than 0.05 per cent, Appendix 2.2.11

Ammonium Oxalate - $(CO_2NH_4)_2H_2O$ = 142.11.

Description - Colourless crystals.

Solubility - Soluble in water.

Chloride - 2g, with an additional 20 ml of *dilute nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - Dissolve 1 g in 50ml of water, add 2.5 ml of *hydrochloric acid* and 1 ml of *barium chloride solution* and allow to stand for one hour; no turbidity or precipitate is produced.

Sulphated Ash - Not more than 0.005 per cent, Appendix - 2.2.11

Ammonium oxalate solution - A 2.5 per cent w/v solution of *ammonium oxalate* in water.

Ammonium Phosphate - $(NH_4)_2$ HPO_4

Description - White crystals or granules.

Solubility - Very soluble in water; insoluble in alcohol.

Reaction - 1g dissolved in 100 ml of *carbon dioxide-free water* has a reaction of about pH8.0, using solution of cresol red as indicator.

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

Chloride - 2g with an additional 3.5ml of nitric acid complies with the limit test for chlorides appendix 2.3.2.

Sulphate - 2.5g with an additional 4ml of *hydrochloric acid*, complies with the limit test for sulphate, appendix 2.3.6

Ammonium Phosphate, Solution - A 10 per cent w/v solution of *ammonium phosphate* in water.

Ammonium Thiocyanate - NH_4SCN = 76.12.

Description - Colourless crystal.

Solubility - Very soluble in water, forming a clear solution, add 1g of *sodium hydroxide*, warm gently, rotate the flask until a vigorous reaction commences and allow to stand until the reaction is complete; add a further 30 ml of *hydrogen peroxide solution* boil for two minutes, cool and add 10 ml of *dilute nitric acid* and 1 ml of *silver nitrate solution*; any opalescence produced is not greater than that obtained by treating 0.2ml of 0.01 *N hydrochloric acid* in the same manner.

Sulphated Ash - Moisten 1g with *sulphuric acid* and ignite gently, again moisten with *sulphuric acid* and ignite; the residue weighs not more than 2.0mg.

Ammonium Thiocyanate, 0.1N - NH_4SCN=76.12; 7.612g in 1000ml. Dissolve about 8g of *ammonium thiocyanate* in 1000ml of water and standardize the solution as follows:

Pipette 30ml of standardized 0.1 *N silver nitrate* into a glass stoppered flask, dilute with 50ml of *water* than add 2ml of *nitric acid* and 2ml of *ferric ammonium sulphate solution* and titrate with the *ammonium thiocyanate solution* to the first appearance of a red brown colour. Each ml of 0.1 *N Silver nitrate* is equivalent to 0.007612g of NH_4SCN.

Ammonium thiocyanate solution - A 10.0 per cent w/v solution of *ammonium thiocyanate solution.*

Arsenic Trioxide - $As_2 O_3$ =197.82. Contains not less than 99.8 per cent of As_2O_3

Description - Heavy White Powder.

Solubility - Sparingly soluble in water; more readily soluble in water on the addition of *hydrochloric acid*, or solutions of *alkali hydroxides* or *carbonates.*

Arsenious Sulphide - Weigh acccurately 0.50g and dissolve in 10ml of *dilute ammonia solution*; forms a clear colourless solution which, when diluted with an equal volume of water and acidified with *hydrochloric acid*, does not become yellow.

Non-Volatile Matter - Leaves not mere than 0.1 per cent of residue when valatilised.

Assay - Weigh accurately about 0.2 g and dissolve in 20ml of boiling water and 5ml of *N sodium hydroxide*, cool, add 5ml of *N hydrochloric acid* and 3 g of *sodium bicarbonate*, and titrate with 0.1 *N iodine*. Each ml of 0.1 *N iodine* is equivalent to 0.004946 g of As_2O_3.

Barium Chloride - $BaC1_2$, $2H_2$ O=244.27.

Description - Colourless crystals.

Solubility - Freely soluble in water.

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

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

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

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

Description - White, micro crystalline powder.

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

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

Borax - Sodium Tetraborate, Na_2 B_4 O_7 $10H_2O$ = 381.37 Contains not less than 99.0 per cent and not more than the equivalent of 103 per cent of Na_2 B_4 O_7 $10H_2$ O.

Description - Transparent, colourless crystals, or a white, crystalline powder, colourless, taste saline and alkaline, Effloreces in dry air, and, on ignition, loses all its water of crystallisation.

Solubility - Soluble in *water*, practically insoluble in *alcohol*.

Alkalinity - A solution if alkaline to *litmus solution*.

Heavy Metals - Dissolve 1g in 16ml of *water* and 6ml of *N hydrochloric acid* and add *water* to make 25ml; the limit of heavy metals is 20 parts per million, Appendix 2.3.3.

Iron - 0.5g complies with the *limit test for iron*. Appendix 2.3.4.

Chlorides - 1g complies with the *limit test of chlorides*. Appendix 2.3.2.

Sulphates - 1g complies with the *limit test for sulphates*. Appendix 2.3.6

Assay - Weigh accurately about 3 g and dissolve in 75ml of *water* and *titrate* with 0.5 *N hydrochloric acid*, using *methyl red solution* as indicator. Each ml of 0.5 *N hydrochloric* acid is equivalent to 0.09534 g of $Na_2 B_4 O_7. 10.H_2 O$.

Storage - Preserve Borax in well-closed container.

Boric Acid - $H_3 BO_3 = 61.83$.

Description - Colourless plates or white crystals or white crystallin powder, greasy to the touch; odourless; taste, slightly acid and bitter with a sweetish after taste.

Solubility - Soluble in *water* and in *alcohle*: freely soluble in boiling *water*, in boiling alchole and in *glycerin*.

Sulphate - Boil 3 g with 30ml of water and 1 ml of *hydrochloric acid*, cool and filter; 25ml of the filtrate complies with the *limit test for sulphates*, Appendix 2.3.6

Arsenic - Not more than 10 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 20 parts per million, determined by Method A on a solution obtained by dissolving 1.0g in 2ml of *dilute acetic acid* and sufficient *water* to produce 25ml, Appendix 2.3.3.

Assay - Weigh accurately about 2 g, and dissolve in a mixture of 50ml of *water* and 100ml of *glycerine* previously neutralized to *phenolphthalein solution*. Titrate with *N Sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *N Sodium hydroxide* is equivalent to 0.06183 g of $H_3 BO_3$.

Storage - Store in well-closed container.

Labelling - The label on the container states “Not for internal use”.

Boric acid Solution - Dissolve 5 g of *boric acid* in a mixute of 20ml of *water* and 20ml of *absolute ethanol* and dilute with *absolute ethanol* to 250 ml.

Bromine - $Br_2 = 159.80$.

Description - Reddish-brown, fuming, corrosive liquid.

Solubility - Slightly soluble in *water*, soluble in most organic solvents.

Iodine - Boil 0.2 ml with 20 ml of *water*, 0.2 ml of *N sulphuric acid* and a small piece of marble until the liquid is almost colourless. Coool, add one drop of *liquified phenol*, allow to stand for two minutes, and then add 0.2 g of *potassium iodide* and 1 ml of *starch solution*; no blue colour is produced.

Sulphate - Shake 3 ml with 30 ml of dilute *ammonia solution* and evaporate to dryness on a water-bath, the residue complies with the *limit test for sulphates*, Appendix 2.3.6

Bromine Solution - Dissolve 9.6 ml of *bromine* and 30g of *potassium bromide* in sufficient *water* to produce 100ml.

Bromocresol Purple - 4,4 - (3H-2, Benzoxathiol -3-ylidene)bis (2,6- dibromoo-cresol) SS-dioxide; $C_{21}H_{14}Br_2\ O_4\ S$ = 540.2.

Gives a yellow colour in moderately acid solutions, and a bluish-voilet in weakly acid and alkaline solutions. (pH range, 2.8 to 4.6).

Bromophenol purple solution - Warm 0.1g of *bromophenol purple* with 5.0 ml of ethnol (90%) until dissolve, at 100 ml of ethnol (20%), 3.7 ml of 0.5 m *M Sodium hydroxide* and sufficient ethnol (20 per cent) to produce 250 ml.

Complies with following test:

Sensitivity - A mixture of 0.2 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.05 ml of 0.2 *M Sodium hydroxide VS* has been added in bluish violet. Not more than 0.20 ml of 0.2 *M hydrochloric acid V*S is required to change the colour to yellow.

Bromothymol Blue – 4,4' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-6 dibromothymol) SS-dioxide $C_{19}H_{19}\ Br_4\ O_5\ S$=670.

Gives a yellow colour in moderately acid solution and a bluish violet in weakly acid and alkaline solutions (pH range, 2.8 to 4.6).

Bromothymol blue solution - Warm 0.1g of *bromothymol blue* with 3.0 ml of 0.05 *N Sodium hydroxide* and 5 ml of *alcohol* (90 per cent); after solution is effected add sufficient *alcohol* (20 per cent) to produce 250 ml.

Complies with the following tests:

Sensitivity - A mixture of 0.5 ml of the solution and 20 ml of *carbon dioxide - free water* to which 0.05 ml of 0.1 *N hydrocholoric acid* has been added is yellow. Not more than 0.10 ml of 0.1 *N Sodium hydroxide* is required to change the colour to bluish violet.

Bromothymol Blue - 6,6' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-bromothymol) SS-dioxide $C_{19}H_{19}$ Br_4 O_5 S=624.

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

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

Complies with the following tests:

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

Cadmium Iodide - CdI_2 = 366.23.

Description - Pearly white flakes or a crystalline powder.

Solubility - Freely soluble in water.

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

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

Calcium Carbonate - $CaCO_3$ = 100.1

Analytical reagent grade of commerce.

Calcium Chlordie - $CaCI_2H_2$ 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°C to 179°C , Appendix 3.1.4

Specific Optical Rotation - + 41° to + 43°, determined in a 10 per cent w/v solution of Natural Camphor in alcohol, Appendix 3.1.5 Synthetic Camphor is the optically inactive, racemic form.

Water - A 10 per cent w/v solution in *light petroleum* (boiling range 40°C to 60°C) is clear.

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

Assay - Weigh accurately about 0.2g and dissolve in 25 ml of *aldehyde-free alcohol*, in a 300ml flask. Slowly add while stirring 75 ml of *dinitrophenylhydrazine solution* and heat on a water-bath for four hours under a reflux condenser. Remove the alcohol by distillation, allow to cool, dilute to 200ml with a 2 per cent v/v solution of *sulphuric acid* in water. Set aside for twenty-four hours, filter in a tared Gooch crucible, and wash the precipitate with successive quantities of 10 mlof cold *water* unitl the washings are neutral of *litmus paper*. Dry to constant weight at 80°C and weigh. Each g of precipitate is equivalent to 0.458g of $C_{10}H_{16}O$.

Storage - Preserve Camphor in a well-closed container in a cool place.

Canada balsam reagent - General reagent grade of commerce.

Carbon Dioxide - CO_2 = 44.01.
Commercially available carbon dioxide.

Carbon Disulphide - CS_2 = 76.14.

Description - Clear, almost colourless, flammable liquid.

Distillation Range - Not less than 95 per cent distils between 46°C 47°C Appendix 3.1.1

Wt. per ml. - At 25°C, about 1.263 g. Appendix 3.1.8

Non-Volatile Matter - When evaporated to dryness on a water bath, and dried to constant weight at 105°C, leaves not more than 0.005 per cent w/v of residue.

Carbon Tetrachloride - CCI_4 = 153.82.

Description - Clear, colourless, volatile, liquid; odour, characteristic.

Solubility - Practically insoluble in water, miscible with ethyl alcohol, and with solvent ether.

Distillation Range - Not less than 95 per cent distils between 76°C and 77°C, Appendix 3.1.1

Wt. per ml. - At 20°C, 1.592 to 1.595g, Appendix 3.1.8.

Chloride - Free Acid - Shake 20 ml of freshly boiled and cooled *water* for three minutes and allow separation to take place; the aqueous layer complies with the following test:

Chloride - To 10 ml add one drop of *nitric acid* and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Free Acid - To 10 ml add a few drops of *bromocresol purple solution*; the colour produced does not indicate more acidity than that indicated by the addition of the same quantity of the indicator to 10 ml of freshly boiled and cooled *water*.

Free Chloride - Shake 10 ml with 5 ml of *cadmium iodide solution* and 1 ml of *starch solution*, no blue colour is produced.

Oxidisable Impurities - Shake 20 ml for five minutes with a cold mixture of 10 ml of *sulphuric acid* and 10 ml of 0.1 *N potassium dichromate*, dilute with 100 ml of water and add 3 g of *potassium iodide* : The liberated iodine required for decolourisation not less than 9 ml of 0.1 *N sodium thiosulphate*.

Non-volatile Matter - Leaves on evaporation on a water-bath and drying to constant weight at 105 not more than 0.002 per cent w/v of residue.

Caustic Alkali Solution, 5 per cent - 5 g of *potassium* or *sodium hydroxide* in water and dilute to 100 ml.

Charcoal, decolourising - General purpose grade complying with the following test.

Decolourising Power - Add 0.10 g to 550 ml of a 0.006 per cent w/v solution of *bromophenol blue* in *ethanol* (20 per cent) contained in a 200 ml flask, and mix. Allow to stand for five minutes, and filter; the colour of the filtrate is not deeper than that of a solution prepared by diluting 1 ml of the *bromophenol blue solution* with *ethanol* (20 per cent) to 50 ml.

Chloral Hydrate CCI_3 CH $(OH)_2$ Mol Wt. 165.40.

Description - Colourless, transparent crystals, odour, pungent but no acrid; taste, pungent and slightly bitter, volatilises slowly on exposure to air.

Solubility - Very soluble in *water*; freely soluble in *alcohol*: in *chloroform* and in *solvent ether.*

Chloral Alcoholate : Warm 1g with 6 ml of *water* and 0.5 ml of *sodium hydroxide solution*: filter add sufficient 0.1 *N iodine* to impart a deep brown colour, and set aside for one hour; no yellow crystallin precipitate is produced and no smell of iodoform is perceptible.

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

Assay : Weigh accurately about 4 g and dissolve in 10 ml of *water* and add 30 ml of *N sodium hydroxide.* Allow the mixute to stand for two minutes, and then titrate with *N sulphuric acid* using *phenophthalien solution* as indicator. Titrate the neutralised liquid with 0.1 *N silver nitrate* using potassium *chromate solution* as indicator. Add two-fifteenth of the solution amount of 0.1 *N Silver nitrate* used to the amount of *N sulphuric acid* used in the first titration and deduct the figure so obtained from the amount of *N sodium hydroxide* added. Each ml of *N sodium hydroxide*, obtained as difference; is equivalent to 0.1654g of C_2 H_2 $C1_3$ O_2.

Storage - Store in tightly closed, light resistant container in a cool place.

Chloral Hydrate Solution - Dissolve 20g of *chloral hydrate* in 5 ml of *water* with warming and add 5 ml of *glycerin*.

Chloral Iodine Solution - Add an excess of crystalline *iodine* with shaking to the *chloral hydrate solution*, so that crystals of undissolved iodine remain on the bottom of bottle. Shake before used as the iodine dissolves and crystals of the iodine to the solution. Store in a bottle of amber glass in a place protected from light.

Chlorinated Lime - Bleaching Powder.
Contains not less than 3.0 per cent of available chlorine.

Description - Dry dull white powder, odour, characteristic.
On expose to air it becomes moist and gradually decomposes.

Solubility - Slightly soluble in *water* and in *alcohol*.

Stability - Losses not more than 3.0 per cent of its available chlorine by weight when heated to 100 for two hours (The available chlorine is determined by the Assay described below).

Assay - Weigh accurately about 4 g. triturate in a mortar with successive small quantities of *water* and transfer to a 1000ml flask. Add sufficient water to produce 1000 ml and shake thoroughly. To 100 ml of this suspension add 3 g of *potassium iodide* dissolved in 100ml of *water*, acidify with 5 ml of *acetic acid* and titrate the liberated iodine with 0.1 *N sodium thiosulphate*. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.003545 g of available chlorine.

Storage - Preserve in a well-closed container.

Chlorinated Lime Solution - Mix 100g of *chlorinated lime* with 1000 ml of *water* transfer the mixture to a stoppered bottle; set aside for three hours, shaking occasionally; filter through calico.

Chlorinated Lime Solution must be recently prepared.

Chloroform - $CHC1_3$ = 119.38.

Description - Colourless, volatile liquid; odour, characteristic, taste, sweet and burning.

Solubility - Slightly soluble in *water*; freely miscible with *ethyl alcohol* and with *solvent ether.*

Wt. per ml. - Between 1.474 and 1.478g. Appendix 3.1.8.

Boiling Range : A variable fraction, not exceeding 5 per cent v/v, destils below 60 and the remainder distils between 50°C to 62°C , Appendix 3.1.1

Acidity : Shake 10 ml with 20 ml of freshly boiled and cooled *water* for three minutes, and allow is separate. To a 5 ml portion of the aqueous layer add 0.1 ml of *litmus solution*; the colour produced to not different from that produced on adding 0.1 ml of *litmus solution* to 5 ml of freshly boiled and cooled water.

Chloride : To another 5 ml portion of the aqueous layer obtained in the test for acidity, add 5 ml of water and 0.2 ml of *silver nitrate solution*; not opalescence is produced.

Free, Chlorine - To another 10 ml portion of the aqueous layer, obtained in the test for Acidity, add 1 ml of *Cadmium iodide solution* and the two drops of *starch solution*; no blue colour is produced.

Aldehyde : Shake 5 ml with 5 ml of water and 0.2 ml of *alkaline potassium mercuri-iodide solution* in a stoppered bottle and set aside in the dark for fifteen minutes; not more than a pale yellow colour is produced.

Decomposition Products : Place 20 ml of the *chloroform* in a glass-stoppered vessel, previously mixed with *sulphuric acid* add 15 ml of *sulphuric acid* and four drops of *formaldehyde solution*, shake the mixture frequently during half an hour and set aside for further half an hour, the vessel being protected from light during the test; the acid layer is not more than slightly coloured.

Foreign Organic Matter - Shake 20 ml with 10 ml of *sulphuric acid* in a stoppered vessel previously rinsed with *sulphuric acid* for five minutes and set aside in the dark for thirty minutes, both the acid and chloroform layers remain colourless. To 2 ml of the acid layer add 5 ml of water; the liquid remains colourless and clear, and has no unpleasant odour. Add a further 10 ml of water and 0.2 ml of *silver nitrate solution*; no opalescence is produced. Foreign Chlorine Compounds : Shake 15 ml of the chloroform layer obtained in the test for foreign organic matter with 30 ml of water in a stoppered bottle for three minutes and allow separation to take place; to the aqueous layer add 0.2ml of *silver nitrate solution* and set aside in the dark for five minutes; no opalescence is produce.

Foreign Odour - Allow 10 ml of evaporate from a large piece of filter paper placed on a warm plate; no foreign colour is detectable at any stage of the evaporation.

Non volatile matter - Not more than 0.004 per cent w/v determined on 25ml by evaporation and drying at 105°C

Storage - Store in tightly-closed , glass-stoppered, light-resistant bottles.

NOTE: Care should be taken not to vaporise chloroform in the presence of a flame because of the production of harmful gases.

Chloroform Water

Chloroform	-	2.5 ml.
Purified Water	-	Sufficient to produce 1000 ml.

Dissolve the *chloroform* in the purified *water* by shaking.

Chromic-sulphuric Acid Mixture - A saturated solution of Chromium trioxide in *sulphuric acid*.

Chromium Trioxide - $Cr\ O_3$ = 99.99.
Analytical reagent grade.

Chromotropic Acid - $C_{10}H_8O_8S_2 2H_2O$=356.32.

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

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

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

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

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

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

Analytical reagent grade.

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

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

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

Description - Blue-green crystals or powder, having a faint odour of acetic acid.

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

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

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

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

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

Cooper Sulphate - Cu SO_4 $5H_2$ O = 249.68.

Contains not less than 98.5 per cent and not more than the equivalent to 101.0 per cent of Cu SO_4 $5H_2$ O

Description - Blue triclinic prisms or a blue, cystalline powder.

Solubility - Soluble in water, very soluble in boiling *water*, almost insoluble in *alcohol*; very slowly soluble in *glycerin*.

Acidity and Clarity of Solution - 1g. dissolved in 20 ml of *water*, forms a clear blue solution, which becomes green on the addition of 0.1 ml of *methyl orange solution*.

Iron - To 5g. add 25ml of *water*, and 2 ml of *nitric acid*, boil and cool. Add excess of *strong ammonia solution*, filter, and wash the residue with *dilute ammonia solution* mixed with four times its, volumes of water, dissolve the residue, if any, on the filter with 2 ml of *hydrochloric acid*, diluted with 10 ml of *water* to be *acid solutions* add dilute *ammonia solution* till the precipitation is complete; filter and wash the residue after ignition weighs not more than 6 mg.

Copper Sulphate, Anhydrous - $CuSo_4$ = 159.6.
Prepared by heating copper sulphate to constant weight at about 230°C.

Copper Sulphate Solution - A 10 per cent w/v solution of *copper sulphate* in *water*.

Catechol Violet - 4,4' - (3H-2,I-Benzoxathil-3-ylidene) dipyrocatechol' SS-dioxide.

Gives a blue colour with bismuth ions in moderately acid solution. When metal ion are absent, for example, in the presence of an excess of *disodium ehylene diamine tetra acetate*, the solution if yellow.

Catechol Violet Solution - Dissolve 0.1 g of *catechol violet* in 100 ml of *water*.

Cresol Red - 4,4' – (3H-2 1-benzoxathiol-3 ylidone) di-o-cresol SS-dioxide; $C_{12}H_{18}O_5S$ =382.4,

Gives a red colour in very strongly acid solutions, a yellow colour in less strongly acid and neutral solutions, and a red colour in moderately alkaline solutions (pH ranges, 0.2 to 1.8 and 7.2 to 8.8).

Cresol Red Solution - Warm 50 mg of *cresol red* with 2.65 ml of 0.05 *M Sodium hydroxide* and 5 ml of *ethanol* (90 per cent) after solution is effected, add sufficient *ethanol* (20 per cent) to produce 250 ml.

Complies with the following test.

Sensitivity - A mixture of 0.1 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.15 ml of 0.02 *M Sodium hyderoxide* has been added is purplish-red. Not more than 0.15 ml of 0.02 *M hydrochloric acid* is required to change the colour to yellow.

Dimethyl Yellow - CI 11020; 4 - Dimethyl aminoagolenzone; C_{14} H_{15} N_3 = 225.3

Gives a red colour in moderately acid alcoholic solutions, and a yellow colour in weakly acid and alkaline solution (pH range, 2.8 to 4.6).

Complies with the following test :

Dimethyl Yellow Solution- A 0.2 per cent w/v solution of *dimethyl yellow* in *alcohol* (90 per cent).

Sensitivity - A solution containing 2 g of *ammonium chloride* in 25 ml of *carbon dioxide-free water* to which is added 0.1 ml of the *dimethyl yellow solution*, is yellow, Not more than 0.10 ml of 0.1 *N hydrochloric acid* is required to change the colour to red.

Dinitrophenyl Hydrazine - 2,4 - Dinitrophenyl hydrazine; $(NO_2)_2\ C_6\ H_3\ ,\ NH\ NH_2 = 198.14$.

Description - Orange-red crystals or a crystalline powder.

Solubility - Practicaly insoluble in *water* slightly soluble in *alcohol*.

Clafity and Colour or Solution - 0.5 g yields a clear yellow solution on heating with a mixture of 25 ml of water and 25 ml of *hydrochloric acid*.

Melting Range - 197°C to 200°C , with decomposition Appendix 3.1.4.

Sulphated Ash - Not more than 0.5 per cent, Appendix 2.3.6

Dinitrophenyl Hydrazine Solution - Dissolve 1.5 gm of *dinitrophenyl hydrazine* in 20 ml of *sulphuric acid* (50 per cent v/v/). Dilute to 100 ml with *water* and filter.

Dinitrophenyl hydrazine solution must be freshly prepared.

Diphenyl Benzidine - $(C_6\ H_5\ ,\ NH.\ C_6\ H_4\ ) = 336.42$.

Description - White of faintly Grey coloured, crystalline powder.

Melting Range - 246°C to 250°C . Appendix 3.1.4.

Nitrate - Dissolve 8 mg in a cooled mixture of 45 ml of *nitrogen free sulphuric acid* and 5 ml of *water*, the solution is colourless or not more than very pale blue.

Sulphated Ash- Not more than 0.1 per cent, Appendix 2.3.6

Diphenly Carbazide - 1,5 - Diphenyl Carbazide : $C_6\ H_5\ NH.\ NH)_2\ CO = 242.27$.

Description - White crystalline powder which gradually acquires a pink tint on exposure to air.

Solubility - Practically insoluble in water; soluble in alcohol.

Diphenyl Carbazine Solution - A 0.2 per cent w/v solution of *diphenyl Carbazide* in a mixture of 10 ml of *glacial acetic acid* and 99 ml of *alcohol* (90 per cent).

Diphenyl Thiocarbazone - Dithizone : 1.5 - Diphenylthio Carbazone; C_6 H_5 N NCS, NH NH C_6 H_5 - 256.32.

Description - Almost black powder.

Solubility - Practically insoluble in *water*; soluble in *chloroform* in *carbon tetrachloride* and in other organic solvents, yielding solutions of an intense green colour.

Lead - Shake 5 ml of 0.1 per cent w/v solution in *chloroform* with a mixture of 5 ml of water, 2 ml of *lead free potassium cyanide solution*, and 5 ml of *strong ammonia solution*; the chloroform layer may remain yellow but has no red tint.

Sulphated Ash - Not more than 0.5 per cent. Appendix 2.3.6

Disodium Ethylene Diamine Tetra Acetate - (Disodium Acetate) C_{10} H_{14} N_2 Na_2 O_8, $2H_2$ O = 372.2.

Analytical reagent grade.

Dragendorff Reagent

Solution 1- Dissolve 0.85 g of *bismuth oxy nitrate* in 40 ml of *water* and 10 ml of *acetic acid.*

Solution 2 - Dissolve 8 g of *potassium iodide* in 20 ml of water.

Mix equal volumes of solution 1 and 2 and to 10 ml of the resultant mixture add 100 ml of *water* and 20 ml of *acetic acid.*

Eosin - CI 45380; Acid Red 87; Tetrabromo flurescein Disodium Salt; C_{20} H_6 O_5 Br_4 Na_2 = 691.86.

Description - Red powder, dissolves in water to yield a yellow to purplish-red solution with a greenish-yellow fluorescence.

Solubility - Soluble in *water* and in *alcohol*.

Chloride - Dissolves 50 mg in 25 ml of *water*, add 1 ml of *nitric acid*, and filter; the filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphated Ash - Not more than 24 per cent, calculate with reference to the substance dried at 110°C for two hours. Appendix 2.3.6

Eosin Solution - A 0.5 per cent w/v solution of *eosin* in *water*.

Eriochrome Black T - CI 14645 ; Mordant Black 11; Sodium 2 (1-hydroxy-2- naphthylazo) 5=nitro-2-naphtol-4-sulphonate; C_{20} H_{12} N_3 NaO_7 S = 461.38.

Brownish black powder having a faint, metallic sheen soluble in alcohol, in methyl alcohol and in hot water.

Ether, Diethyl Ether - $(C_2 H_5)_2 O$ = 74.12.

Analytical reagent grade.

A volatile, highly flammable, colourless liquid, boilding point, about 34 ; weight per ml about 0.71 g.

Warning - It is dangerous to distil or evaporate ether to dryness unless precautions have been taken to remove peroxides.

Ethyl Acetate - $C_2 H_2 OH$ = 46.07.

Absolute Alcohol - Dehydrated Alcohol.

Description - Clear, colourless, mobile volatile liquid; odour, characteristic and spirituous; taste, burning; hygroscopic. Readily volatilisable even at low temperature and boils at 78 . Is flammable.

Solubility - Miscible with *water*, with *solvent ether* and with *chloroform*. Contains not less than 99.5 per cent w/w or 99.7 per cent v/v of $C_2 H_5 OH$.

Identification - Acidity of Alkalinity : Clarity of solution; Methanol: Foreign organic substances; Isopropyl alcohol and butyl alcohol; Aledehydes and ketones; Fuse Oil constitutents; Non-volatile matter; complies with the requirements described under Alcohol.

Specific Gravity - Between 0.7871 and 0.7902, at 25°C , Appendix 3.1.8.

Storage - Store in tightly closed containers in a cool place away from fire and protected from moisture.

Labelling - The label on the container states “Flammable”.

Ferric Ammonium Sulphate - Ferric Alum, Fe (NH_4) $(SO_4)_2$ $12H_2 O$ = 482.18.

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

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

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

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

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

NOTE - Store 0.1 N Ferric Ammonium Sulphate in tightly-closed, light resistant containers.

Ferric Chloride - Anhydrous Ferric Chloride; Ferric Chloride ; $FeC1_3$ = 162.22

Description - Greenish-black crystals or a crystalline powder, free from the orange colour of the hydrated salt, which is readily acquired by exposure to atmospheric moisture.

Solubility - Soluble in water, yielding an orange coloured opalescent solution.

Ferrous Salts - Dissolve 2 g in 100 ml of water, add 2 ml of *phosphoric acid* and titrate with 0.1 *N potassium permanganate* until a pink colour is produced, no more than 0.1 ml is required.

Free Chloride - Dissolve 5 g in 10 ml of *water* and boil the solution; no blue colour is produced on a starch iodide paper exposed to the vapours.

Ferric Chlordie Solution - Contains not less than 14.25 per cent and not more than 15.75 per cent w/v of $FeC1_3$.

Description - Clear, Yellowish-brown liquid.

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

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

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

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

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

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

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

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

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

Ferrous Sulphate Solution must be freshly prepared.

Ferrous Sulphate Solution, Acid - A 0.45 per cent w/v solution of *ferrous sulphate* in freshly boiled and cooled *water* containing 0.5 ml of *hydrochloric acid.*

Formaldehyde Solution - Formalin ; HCHO = 30.03.

Formalidehyde Solution is a solution of *formaldehyde* in *water* with *methyl alcohol* added to prevent plymerisation. It contains not less than 34.0 per cent w/w/ and not more than 38 per cent w/ w of CH_2O.

Description - Colourless liquid; odour, characteristic, pungent and irritating; taste, burning. A slight white cloudy deposit is formed on long standing, especially in the cold, due to the separation of paraformaldehyde. This white deposit disappears on warming the solution.

Solubility - Miscible with *water*, and with *alcohol*.

Acidity - To 10 ml add 10 ml of *carbon dioxide free water* and titrate with 0.1 *N sodium hydroxide* using *bromothymol blue solution* as indicator; not more than 5 ml of 1 *N sodium hydroxide* is required.

Wt. per ml. - At 20°C, 1.079 g. Appendix 3.1.8.

Assay - Weigh accurately about 3 g and add to a mixture of 25 ml of *hydrogen peroxide solution* and 50 ml of *N sodium hydroxide*, warm on a water bath until effervescence ceases and titrate the exces of alkali with *N sulphuric acid* using *phenolphthalein solution* as indicator. Repat the experiment with the same quantities of the same reagents in the same manner omitting the *formaldehyde solution*. The difference between the titrations represents the sodium hydroxide required to neutralise the formic acid produced by the oxidation of the *formaldehyde*. Each ml of *N sodium hydroxide* is equivalent to 0.03003 g of CH_2 O.

Storage - Preserve Formaldehyde Solution in a well-closed container preferably at a temperature not below 15°C.

Formaldehyde Solution, Dilute.

Dilute 34 ml of *formaldehyde solution* with sufficient water to produce 100 ml.

Glycerin - C_3 H_8 O_3 =82.09.

Description - Clear, colourless liquid of syrupy consistancy; odourless, taste sweet followed by a sensation of warmth. It is hygroscopic.

Solubility - Miscible with *water* and with *alcohol*; practically, insoluble in *chloroform*. In *solvent-ether* and in fixed oils.

Acidity - To 50 ml of a 50 per cent w/v solution add 0.2 ml of *dilute phenolphthalin solution*; not more than 0.2ml of 0.1 *N sodium hydroxide* is required to produce a pink colour.

Wt. per ml. - Between 1.252 g and 1.257g, Appendix-3.1.8, corresponding to between 98 per cent and 100 per cent w/w of C_3 H_8 O_3 .

Refractive Index - Between 1.470 and 1.474 determined at 20°C. Appendix 3.1.7

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

Copper - To 10 ml add 30 ml of *water*, add 1 ml of *dilute hydrochloric acid,* add 10 ml of *hydrogen sulphide solution;* no colour is produced.

Iron - 10g complies with the *limit test for iron,* Appendix 2.3.4.

Heavy Metals - Not more than 5 parts per million, determined by Method A on a solution of 4g in 2 ml of 0.1 *N hydrochloric acid* and sufficient *water* to produce 25ml. Appendix 2.3.3.

Sulphate - 1 ml complies with the *limit test for sulphates,* Appendix 2.3.6

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

Acraldehyde and Glucose - Heat strongly; it assumes not more than a faint yellow and not a pink colour. Heat further; it burns with little or not charring and with no odour of burnt sugar.

Aldehydes and Related Substances - To 12.5 ml of a 50 per cent w/v solution in a glass-stoppered flask add 2.5 ml of *water* and 1 ml of *decolorised magenta solution.* Close the flask and allow to stand for one hour. Any violet colour produced is not more intense than that produced by mixing 1.6ml of 0.1 *N potassium permaganate* and 250 ml of water.

Sugar - Heat 5 g with 1 ml of *dilute sulphuric acid* for five minutes on a water-bath. Add 2 ml of *dilute sodium hydroxide solution* and 1 ml of *coppr sulphate solution.* A clear, blue coloured solution is produced. Continue heating on the water-bath for five minutes. The solution remains blue and no precipitate is formed.

Fatty Acids and Esters - Mix 50 g with 50 ml of freshly boiled *water* and 50.0 ml of 0.5 *N sodium hydroxide*, boil the mixute for five minutes. Cool, add a few drops of *phenolphthalein solution* and *nitrate* the excess alkali with 0.5 *N hydrochloric acid*. Perform a blank determination. Not more than 1 ml of 0.5 *N sodium hydroxide* is consumed.

Sulphated Ash - Not more than 0.01 per cent, Appendix 2.2.11

Storage - Store in tightly-closed containers.

Glycerin Solution - Dilute 33 ml of *glycerin* to 100 ml with water and add a samll piece of camphor or liquid phenol.

Hexamine $(CH_2)_6\ N_4$ = 140.2
Analytical reagent grade.

Hydrazine Hydrate - $NH_2\ NH_2\ H_2\ O$ =50.06.
Analytical reagent grade.
A colourless liquid with an ammonical odour; weight per ml. about 1.03 g.

Hydrochloric Acid - HC1=36.46
Concentrated Hydrochloric Acid.

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

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

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

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

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

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

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

Sulphated Ash - Not more than 0.01 percent, Appendix 2.2.11

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

Storage - Store in glass- stoppered containers at a temperature not exceeding 30^0

Hydrochloric Acid, x N - Solution of nay normality x N may be prepared by diluting 84Xml of *hydrochloric acid* to 1000 ml with *water*.

Hydrochloric Acid - (1 percent w/v).

Dilute 1 g of *hydrochloric acid* to 100 ml with *water*.

Dilute Hydrochloric Acid

Description - Colourless liquid.

Arsenic Heavy Metals - *Bromide and iodide; sulphate; Free chlorine*-Complies with the tests described under *Hydrochloric acid,* when three times the quantity is taken for each test.

Assay - Weigh accurately about 10 g and carry out the Assay described under Hydrochloric Acid.

Storage - Store in stoppered containers of glass or other inert material, at temperature below 30^0.

Hydrochloric Acid: N: HCI=36.46
36.46 g in 1000 ml

Dilute 85 ml of *hydrochloric acid* with *water* to 1000 ml and standardize the solution as follows:

Weigh accurately about 1.5 g of *anhydrous sodium carbonate* P.S., previous heated at about 270^0 for one hour. Dissolve it in 100 ml of *water* and add two drops of *methyl red solution*. Add the

acid slowly from a burette with constant stirring, until the solution becomes faintly pink. Heat again to boiling and titrate further as necessary until the faint pink colour no longer affected by continued boiling. Each 0.5299 g of *anhydrous* and *sodium carbonate* is equivalent to 1 ml of *N. hydrochloric acid*.

Hydrochloric Acid Iron free- Hydrochloric acid which complies with the following additional test.

Evaporate 5 ml on a water-bath nearly to dryness, add 40 ml of *water*, 2 ml of a 20 percent w/v solution of *citric acid* and two drops of *thioglycollic acid*, mix, make alkaline with *dilute ammonia solution*, and dilute to 50 ml with *water*; no pink colour is produced.

Hydrogen Peroxide Solution- (20 Vol.) H_2O_2=34.02

Analytical reagent grade of commerce or *hydrogen peroxide solution* (100 Vol) diluted with 4 volumes of water.

A colourless liquid containing about 6 percent w/v of H_2O_2 ; weigh per ml. about 1.02 g.

Hydrogen Sulphide- H_2S=34.08

Use laboratory cylindergrade, or prepared the gas by action of *hydrochloric acid*, diluted with an equal volume of *water*, on iron sulphide, the resulting gas is washed by passing it through *water*.

A colourless, poisonous gas, which a characteristic unpleasant odour.

Hydrogen Sulphide Solution – A recently prepared, saturated solution of hydrogen sulphide in water at 20^0.

Hydrogen Sulphide solution contains about 0.45 percent w/v of H_2s.

Hydroxylamine Hydrochloride; Hydroxylamonium Chloride:- NH_2.OH,HC1 = 69.49.

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

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

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

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

Sulphated ash – Not more than 0.2 percent, Appendix 2.2.11

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

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

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

Analytical regent grade.

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

Indigo Carmine Solution – To a mixture of 10 ml of *hydrochloric acid* and 990 ml of a 20 percent w/v solution of *sulphuric acid* in *water*, add sufficient indigo carmine to produce a solution which complies with the following test.

Add 10 ml to a solution 1.0 mg of *potassium nitrate* in 10 ml of *water*, add rapidly, 20 ml of *sulphuric acid* and heat to boiling; the blue colour is just discharged in one minute.

***Indian ink –** General purpose grade:

Iodine : I_2 = 253.8

Description - Heavy, bluish-black, brittle, rhombic prisms or plates with a metallic lustre; odour characteristic; volatile at ordinary temperatures.

SOLUBILITY - Very slightly soluble in *water*; soluble in *alcohol* freely soluble in *carbon disulphide* and *in chloroform in solvent ether*; *in carbon tetrachloride* and in concentrated aquous solutions of iodides.

Chloride Bromide - Triturate 3.5 g thoroughly with 35 ml of *water*, filter and decolorise the filtrate by the addition of a little *zinc powder*. To 25 ml of the filtrate so obtained, add 5 ml of *dilute ammonia solution*, and then 5 ml of *silver nitrate solution* added gradually, filter; dilute the filtrate to 50 ml, and acidify gradually with 4 ml of *nitric acid*; the opalescence in the *limit test for chloride*, Appendix 2.3.2.

Cyanides - To 5 ml of the filtrate obtained in the test for *Chloride and bromide* add a few drops of *ferrous sulphate solution* and 1 ml of *sodium hydroxide solution*, warm gently and acidify with *hydrochloric acid*, no blue or green colour is produced.

Non-Volatile Matter - Leaves not more than 0.1 percent as residue when volatilized on a water-bath.

Assay - Weigh accurately about 0.5 g and dissolve in a solution of 1 g of *potassium iodide* in 5 ml of *water*. Dilute to 250 ml with *water*, add 1 ml of *dilute acetic acid*, and titrate with 0.1N *sodium thiosulphate*, using starch solution as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.01269 g of 1.

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

Iodine, 0.IN: I=126.90; 12.69 g in 1000 ml

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

Weigh accurately about 0.15 g of *arsenic trioxide* P.S., previously dried at 1050 for one hour, and dissolve in 20 ml of *N sodium hydroxide* by warming, if necessary. Dilute with 40 ml of *water*, add two drops of *methyl orange solution* and follow with *dilute hydrochloric acid* until the yellow colour is changed to pink. Then add 2 g of *sodium bicarbonate*, dilute with 50 ml of water, and add 3 ml of *starch solution*, slowly add the *iodine solution* from a burette until a permanent blue colour is produced. Each 0.004946 g of *arsenic trioxide* is equivalent to 1 ml of 0.1 N iodine.

Iodine solution- Dissolve 2.0 g of *iodine* and 3 g of *potassium iodide* in *water* to produce 100 ml.

Kieselguhr- A natural diatomaceous earth, purified by heating with dilute hydrochloric acid, washing with water and drying.

Lactic Acid - $CH_3CHOH.COOH$-90.08
Analytical reagent grade of commerce

Lactophenol – Dissolve 20 g *phenol* in a mixture of 20 g of *lactic acid*, 40 g of *glycerol,* and 20 ml of *water.*

Lead Acctate - Sugar of lead; $(CH_3CO_2)_2Pb$, $3H_2O$=379.33

Contains not less than 99.5 percent and not more than the equivalent of 104.5 percent of $C_4H_6O_4Pb,3H_20$.

Description - Small, white, transparent, monoclinic prisms, or heavy, crystalline bases; odour, acetous, taste, sweet and astringent. Efflorescent in warm air. Becomes basic when heated.

Solubility - Freely soluble in *water*, and in *glycerin*; sparingly soluble in *alcohol.*

Water Insoluble Matter - Dissolve 1 g in 10 ml of recently boiled and cooled *water* solution is produced which is at most faintly opalescent and becomes clear on the addition of one drop of *acetic acid*.

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

Copper, Iron, Silver and Zinc – Dissolve 0.5 g in 10 ml of *water*, add 2 ml of *dilute sulphuric acid*, allow to stand for thirty minutes, and filter, to the filtrate add an excess of potassium ferrocyanide solution no precipitate or colour is produced.

Assay - Weigh accurately about 0.8 g and dissolve in a mixture of 100 ml of *water* and 2 ml of *acetic acid*, add 5 g of hexamine, and titrate with 0.05 *M disodium ethylenediaminetertraacetate,* using 0.2 ml of *xylenol orange solution* as indicator, until the solution becomes pale bright yellow. Each ml of 0.05 *M disodium ethylenediaminetertraacetate* is equivalent to 0.01897 g of $C_4H_6O_4Pb,3H_20$.

Storage - Preserve lead acetate in a well closed container.

Lead acetate solution- A 10 percent w/v solution of *lead acetate in carbon dioxide-free water.*

Lead nitrate: $Pb(NO_3)_2$=331.21

Contains not less than 99 percent of $Pb(NO_3)_2$

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

Solubility - Soluble in *water*, forming a clear, colourless solution.

Assay - Weigh accurately about 0.3 g and dissolve in 150 ml of *water*, add 5 ml of *dilute acetic acid*, heat to boiling, add a slight excess of *potassium chromate* solution, and boil gently until the precipitate becomes granular; collect the precipitate in a Gooch crucible, wash it with hot *water*, and dry to constant weight at 120^0 each g of residue is equivalent to 1.025 g of $Pb(NO_3)_{2.}$

Lead solution standard - See limit test for heavy metals. Appendix, 2.3.3.

Liquid paraffin- General reagent grade.

Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility -Practically insoluble in water, and in alcohol, soluble in chloroform, in solvent either and in volatile oils.

Wt. per ml. - At 25^0C, 0.860 to 0.904 g Appendix 3.1.8

Litmus- Fragments of blue pigment prepared from various species of *Rocella lacanora* or other lichens. It has a characteristic odour.

Partly soluble in water and in alcohol. Gives a red colour with acids and a blue colour with alkalies ($_{P}$H range, 5.0 to 8.0).

Litmus solution - Boil 25 g of coarsely powered litmus with 100 ml of *alcohol* (90 percent) under a reflux condenser for one hour, and pour away the clear liquid; repeat this operation using two successive quantities, each of 75 ml, of *alcohol* (90 percent). Digest the extracted litmus with 250 ml of water.

Litmus paper, blue - Boil 10 parts of coarsely powdered litmus under reflux for one hour with 100 parts of *alcohol*, decant the *alcohol* and discard. Add to the residue a mixture of 45 parts of alcohol and 55 parts of water. After two days decant the clear liquid. Impregnate the strips of filter paper with the extract and allow to dry the paper complies with the following test.

Sensitivity - Immerse a strip measuring 10 mmX60 mm in 100 ml of a mixture of 10 ml of 0.02 *N hydrochloric acid* and 90 ml of *water*. On shaking the paper turns red within forty five seconds.

Liquid paraffin- General reagent grade.

Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility - Practically insoluble in *water*, and in *alcohol*, soluble in *chloroform*, in *solvent ether* and in volatile oils.

Wt. per ml - At 25^{0}, 0.860 to 0.904 g Appendix 3.1.8

Litmus paper, red - To the extract obtained in the preparation of blue litmus paper add 2 *N hydrochloric acid* drop-wise until the blue colour becomes red. Impregnate strips of filter paper with the solution and allow to dry.

The paper complies with the following test:

Sensitivity- Immerse a strip measuring 10 mmX60mm in 100 ml of 0.002 *N Sodium hydroxide*. On shaking the paper turns blue within forty-five minutes.

Magenta Basic: CI 42510: Funchsin; Rosaniline hydro-chloride; $[(H_2NC_6H_4)_2C{:}C_6H_3(CH_3){:}NH_2+]CI=337.85$

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

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

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

Sulphated Ash - Not more than 5 percent, Appendix 2.3.6

Magenta solution, Decolorized- Dissolve 1 g of *basic magnenta* in 600 ml of *water* and cool in an ice-bath; add 20 g of *sodium sulphite* dissolved in 100 ml of *water*; cool in an ice-bath and add, slowly with constant stirring, 10 ml of *hydrochloric acid*; dilute with *water* to 1000 ml.

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

Decolourised Magenta Solution should be protected from light.

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

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

Magnesium Sulphate: $MgSO_4.\ 7H_2O$-246.47

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

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

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

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

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

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

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

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

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

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

Storage - Store in well-closed container.

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

Analytical reagent grade of commerce.

Magnesium Sulphate, Dried, $MgSO_4$aq

Dried, general reagent grade of commerce.

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

Mercuric chloride: $HgCI_2$=271.50

Contains not less than 99.5 percent of $HgCI_2$;

Description - Heavy, colourless are white, crystalline masses, or a white crystalline a powder.

Solubility - Soluble in *water*; freely soluble in *alcohol*.

Non-Volatile Matter - When volatilized, leaves not more than 0.1 percent of residue.

Assay - Weigh accurately about 0.3 g and dissolve in 85 ml of *water* in a stoppered-flask, add 10 ml of *calcium chloride solution*, 10 ml of *potassium iodide solution*, 3 ml of *formaldehyde solution* and 15 ml of *sodium hydroxide solution*, and shake continuously for two minutes. Add 20 ml of *acetic acid* and 35 ml of 0.1 *N iodine*: Shake continuously for about ten minutes, or until the precipitated mercury is completely redissolved, and titrate the excess of iodine with 0.1 *N sodium thiosulphate.* Each ml of 0.1 *N iodine* is equivalent to 0.01357 g of $HgCI_2$.

Mercuric chloride, 0.02 M

Dissolve 54.30 g of *mercuric chloride* in sufficient *water* to produce 1000 ml.

Mercuric chloride solution - A 5 percent w/v solution of *mercuric chloride* in *water*.

Mercuric oxide, Yellow: HgO = 216.59.

Contains not less than 99 percent of HgO, calculated with reference to the substance dried at 105^0 for one hour.

Description - Orange-yellow, heavy, amorphous powder; odourless, stable in air but becomes discoloured on exposure to light.

Solubility - Practically insoluble in *water* and in *alcohol*; freely soluble in dilute *hydrochloric acid* and in *dilute nitric acid*, forming colourless solutions.

Acidity for Alkalinity - Shake 1 g with 5 ml of *water* and allow to settle; the supernatant liquid is neutral to *litmus solution*.

Mercurous Salts - A solution of 0.5 g in 25 ml of *dilute hydrochloric acid* is not more than slightly turbid.

Chloride - To 0.2 g add 1g of *zinc powder* and 10 ml of *water*. Shake occasionally during ten minutes and filter; the solution complies with the *limit test for chlorides*; Appendix 2.3.2.

Sulphated Ash - When moistened with *sulphuric acid* in a silica dish and heated strongly to constant weight, leaves not more than 0.5 percent of residue.

Assay - Weigh accurately about 0.4 g dissolve in 5 ml of *nitric acid* and 10 ml of *water* and dilute with *water* to 150 ml. Titrate with 0.1 *N ammonium thiocyanate*, using *ferric ammonium sulphate solution* as indicator. Carry out the titration at a temperature not above 20^0. Each ml of 0.1 *N ammonium thiocyante* is equivalent to 0.01083 g of HgO.

Storage - Preserve yellow mercuric oxide in well-closed container, protected from light.

Mercuric Potassium Iodide

See Potassio-Mercuric iodide solution.

Mercuric Sulphate - Mercury (II) Sulphate $HgSO_4$=296.68

Contains not less than 99 percent of $HgSO_4$.

Description - A white; crystalline powder, Hydrolysis in water.

Solubility - Soluble in *dilute sulphuric acid.*

Chloride - Dissolve 2 g in a mixture of *dilute sulphuric acid* and 10 ml of *water*. Add 2 g of *zinc powder*, shake frequently for five minutes and filter. The filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Nitrate - Dissolve 0.40 g in a mixture of 9 ml of *water* and 1 ml of *dilute sulphuric acid*, add 1 ml of indigo carmine solution and 10 ml of *nitrogen free sulphuric acid* and heat to boiling, the blue

colour is not entirely discharged.

Assay- Dissolve 0.6 g in a mixture of 10 ml of *dilute nitric acid* and 40 ml of *water*. Titrate with 0.1 *N ammonium thiocyanate*, using *ferric ammonium sulphate solution* as indicate. Each ml of 0.1 *N ammonium thiocyanate* is equivalent to 0.01483 g of $HgSO_4$.

Mercury Sulphate Solution - Mix 5 g of *yellow mercuric oxide* with 40 ml of *water*, and while stirring add 20 ml of *sulphuric acid*, and 40 ml of *water*, and stir until completely dissolved.

Methyl Alcohol - Methanol: CH_3OH=32.04

Description - Clear, colourless liquid with a characteristic odour.

Solubility - Miscible with *water,* forming a clear colourless liquid.

Specific Gravity - At 25^0C, not more than 0.791, Appendix 3.1.8.

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

Refractive Index - At 20^0C, 1.328 to 1.329, Appendix 3.1.7

Acetone - Place I ml in a *Nessler Cylinder*, add 19 ml of *water*, 2 ml of a 1 percent w/v solution of 2-*nitrobenzaldehyde* in *alcohol* (50 percent), 1 ml of 30 percent w/v solution sodium hydroxide and allow to stand in the dark for fifteen minutes. The colour developed does not exceed that produced by mixing 1 ml of standard acetone solution, 19 ml of water, 2 ml of the solution of 2-*nitrobenzaldehyde* and 1 ml of the *solution of sodium hydroxide* and allowing to stand in the dark for fifteen minutes.

Acidity - To 5 ml of *carbon dioxide-free water*, and titrate with 0.1 N *sodium hydroxide* using *bromothymol blue solution* as indicator; not more than 0.1 ml is require.

Non-Volatile Matter - When evaporated on a water-bath and dried to constant weight at 105^0, leaves not more than 0.005 percent w/v of residue.

Mythyl alcohol, dehydrated - Methyl alcohol which complies with the following additional requirements. *Water* -Not more than 0.1 percent w/w.

Methylene Blue- $C_{16}H_{18}ClN_3S$, $3H_2O$. Tetramethylthionine chloride.

A dark green or bronze crystalline powder, freely soluble in water, soluble in alcohol.

Loss on drying: Not less than 18 percent and not more than 22 percent, determined by drying in an oven at 100^0 C to 105^0C.

Methylene Blue Solution - Dissolve 0.18 g of *methylene blue* in 100 ml of *water*. To 75 ml of this solution, add 5 ml of 0.1 *N sodium hydroxide* and 20 ml of *water*.

Methyl Orange - Sodium-p-dimethylamineazobenzene sulphate, $C_{14}H_{14}O_3N_3$ Sna.

An orange-yellow powder or crystalline scales, slightly soluble in cold water; insoluble in alcohol, readily soluble in hot water.

Methyl Orange Solution - Dissolve 0.1 g of *methyl orange* in 80 ml of *water* and dilute to 100 ml with alcohol.

Test for sensitivity - A mixture of 0.1 ml of the methyl orange solution and 100 ml of freshly boiled and cooled water is yellow. Not more than 0.1 of 0.1 N hydrochloric acid is required to change the colour to red.

Colour change: pH 3.0 (red) to pH 4.4 (yellow)

Methyl Red – p -Dimethylaminoazobenzene-o-carboxylic acid, $C_{15}H_{15}O_2N_3$.

A dark red powder or violet crystals, sparingly soluble in water; soluble in alcohol.

Methyl Red Solution - Dissolve 100 mg in 1.86 ml of 0.1 *N Sodium hydroxide* and 50 ml of *alcohol* and dilute to 100 ml with water.

Test for sensitivity - A mixture of 0.1 ml of the *methyl red solution* and 100 ml of freshly boiled and cooled *water* to which 0.05 ml of 0.02 *N hydrochloric acid* has been added is red. Not more than 0.01 ml of 0.02 N sodium hydroxide is required to change the colour to yellow.

Colour change: pH 4.4(red) to pH 6.0 (yellow).

Molish's Reagent - Prepared two solutions in separate bottles, with ground glass stoppers:

A. Dissolve 2 g of "–naphthol in 95 percent *alcohol* and made upto 10 ml with alcohol ("-naphthol can be replaced by *thymol* or *resorcinol*). Store in a place protected from light. The solution can be used for only a short period.

B. Concentrated sulphuric acid.

Mordant Black II - See Eriochrome black T.

Mordant Balck II Mixture - *Mordant black mixture.*

A mixture of 0.2 part of mordant black 11 with 100 parts of sodium chloride. Mordant Black II Mixture should be recently prepared.

∞-**Naphthol**: I-Naphthol; $C_{10}H_7OH$=144.17

Description - Colourless or white crystals or a white, crystalline powder; odour, characteristic.

Solubility - Freely soluble in alcohol yielding not more than slightly opalescent, colourless or almost colourless solution, with no pink tint.

Melting Range - 90^0C to 96^0 C, Appendix 3.1.4.

Sulphated Ash - Not more than 0.05 percent, Appendix 2.2.11

∞-Nephthol Solution - I-Naphthol solution.

Dissolve 1 g of "-naphthol in a solution of 6 g of *sodium hydroxide* and 16 g of *anhydrous sodium carbonate* in 100 ml of water.

∞-naphthnol solution must be prepared immediately before use.

I-Naphthylamine - $C_{10}H_9N$=143.2-Analytical reagent grade.
Almost colourless crystals, or a white crystalline powder; melting point, about 50^0.

Naphthylamine-Sulphanilic Acid Reagent - Immediately before use mix equal volumes of solutions A and B prepared as follows.

Solution A - Dissolve 0.5 g of *sulphanilic acid* in 30 ml of 6 M *acetic acid* and dilute to 150 ml with water.

Solution B - Dissolve 0.15 g of *I-naphthylamine* in 30 ml of 6M *acetic acid* and dilute to 150 ml with water.

Nitric Acid - Contains 70 percent w/w of HNO_3 (limits, 69 to 71). About 16 N in strength.

Description - Clear, colourless, fuming liquid.

Wt. per ml. - At 20^0 C, 1.41 to 1.42 g, Appendix 3.1.8.

Copper and Zinc - Dilute I ml with 20 ml of *water*, and add a slight excess of *dilute ammonia solution*; the mixture does not become blue. Pass *hydrogen sulphide*; a precipitate is not produced.

Iron - 0.5 ml complies with the *limit test for iron*, Appendix 2.3.4.

Lead - Not more than 2 parts per million, Appendix 2.3.5.

Chloride - 5 ml neutralized with *dilute ammonia solution*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - To 2.5 ml add 10 mg of *sodium bicarbonate* and evaporate to dryness on a water-bath the residue dissolved in water, complies with the *limit test for sulphates*, Appendix 2.3.6

Sulphated Ash - Not more than 0.01 percent w/w, Appendix 2.2.11

Assay - Weigh accurately about 4 g into a stoppered flask containing 40 ml of *water*, and titrate with *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.06301 of HNO_3.

Nitric Acid, XN - Solutions of any normality XN may be prepared by diluting 63x ml of *nitric acid* to 1000 ml with *water*.

Nitric Acid, Dilute- Contains approximately 10 percent w/w of HNO_3. Dilute 106 ml of *nitric acid* to 1000 ml with *water*.

2-Nitrobenzaldehyde - 0-Nitrobenzaldehyde $NO_2C_6H_4CHO$=151.12

Description - Yellow needles, odour, resembling that of benzaldehyde.

Solubility - Soluble in *alcohol.*

Melting range - 40^0Cto 45^0C Appendix 3.1.4.

Sulphated Ash - Not more than 0.1 percent, Appendix 2.2.11

Oxalic Acid - $(CO_2H)_2$, $2H_2O$=126.07.

Contains not less than 99.5 percent of $C_2H_2O_4$, $2H_2O$, as determined by both parts of the Assay.

Description - Colourless crystals.

Solubility - Soluble in *water* and in *alcohol.*

Chloride - To 1 g dissolved in 20 ml of *water* add 5 ml of *dilute nitric acid* and 1drop of *silver nitrate solution*; no turbidity is produced.

Sulphated Ash - Not more than 0.05 percent, Appendix 2.2.11

Assay - (A) Weigh accurately about 3 g and dissolve in 50 ml of *carbon dioxide* free *water* and titrate with *N sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *N sodium hydroxide* is equivalent ot 0.06304 g of $C_2H_2O_4$, $2H_2O$.

(B) Weigh accurately about 3 g dissolve in *water*, and add sufficient *water* to produce 250 ml. To 25 ml of this solution add 5 ml of *sulphuric acid* previously diluted with a little *water*, and titrate

at a temperature of about 70^0 with 0.1 *N potassium permanganate*. Each ml of 0.1 *N potassium permanganate* is equivalent to 0.006303 g of $C_2H_2O_4$, $2H_2O$.

Oxalic Acid, O.IN - $H_2C_2O_4$, $2H_2O$=1,6,07, 6.303 g in 100 ml.

Dissolve 6.65 g of oxalic acid in sufficient water to produce 1000 ml and standardize the solution as follows:

Pipette 30 ml of the solution into a beaker, add 150 ml of *water*, 7 ml of *sulphuric acid* and heat to about 70^0C. Add slowly from a burette freshly standardized 0.1 *N potassium permanganate* with constant stirring, until a pale-pink colour, which persists for fifteen seconds, is produced. The temperature at the conclusion of the titration should not be less than 60^0C. Each ml 0.1 *N Potassium permanganate* is equivalent to 0.006303 g of $H_2C_2O_4$, $2H_2O$.

Petroleum light - Petroleum Spirit

Description - Colourless, very volatile, highly flammable liquids obtained from petroleum, consisting of a mixture of the lower members of the paraffin series of hydrocarbons and complying with one or other of the following definitions:

Light Petroleum - (Boiling range, 30^0Cto 40^0C)
Wt. per ml. - At 20^0C, 0,620 to 0.630 g, Appendix 3.1.8

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

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

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

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

Light Petroleum - (Boiling range, 120^0 C to 160^0 C).
Wt. per ml. - At 20^0 C, about 0.75g, Appendix 3.1.8

Non-Volatile Matter- When evaporated on a water-bath and dried at 105^0, leaves not more than 0.002 percent w/v of residue.

Phenacetin, $C_{10}H_{13}O_2N$=179.2

Analytical reagent grade.

White, glistening, crystalline seeds, or a fine white, crystalline powder; odourless; taste, slightly bitter

Melting range - 134^0 C to 136^0 C

Phenol - C_6H_5OH=94.11.
Analytical reagent grade.

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

Phenol Liquified - General reagent grade

A solution in water containing about 80 percent w/w of C_6H_6O.

Phenol Red - $C_{19}H_{14}O_5S$. Phenolsulphonphthalein.

A light to dark red crystalline powder, very slightly soluble in water, slightly soluble in alcohol soluble in dilute alkaline solutions.

Phenol Red Solution - Dissolve 0.01 g of *phenol red* in 2.82 ml of o.1 *N sodium hydroxide* and 20 ml of *alcohol* and dilute to 100 ml with *water.* Test for sensitivity: A mixture of 0.1 ml of the *phenol red solution* in 100 ml of freshly boiled and cooled water is yellow. Not more than 0.1 ml of 0.02 *N sodium hydroxide* is required change the colour to red-violet.

Colour change- pH 6.8 (yellow) to pH 8.4 (red-violet).

Phenolphthalein - $C_{20}H_{14}O_4$.

A white to yellowish-white powder, practically insoluble in *water*, soluble in alcohole.

Phenolphthalein Solution –Disolve, 0.10g in 80 ml of alcohol and dilute to 100 ml with water.

Test for sensitivity - To 0.1 ml of the *phenolphthalein solution* add 100 ml of freshly boiled and cooled water, the solution is colourless. Not more than 0.2 ml of 0.02 *N sodium hydroxide* is required to change the colour to pink.

Colour change- pH 8.2 (colourless) to pH 10.0 (red).

Phloroglucinol - 1:3:5- Trihydroxybenzene, C_6H_3 $(OH)_3$, $2H_2O$.

Description - White or yellowish crystals or a crystalline powder.

Solubility - Slightly soluble in water; soluble in alcohol, and in solvent ether.

Melting Range - After drying at 110^0C for one hour, 215^0C to 219^0C, Appendix 3.1.4.

Sulphated Ash - Not more than 0.1 percent, Appendix 2.2.11

Phloroglucinol Solution of - A I percent w/v solution of *phloroglucinol* in *alcohol* (90 percent).

Phosphoric Acid - H_3PO_4=98.00

(Orthophosphoric Acid; Concentrated Phosphoric Acid).

Description - Clear and colourless syrupy liquid. Corrosive.

Solubility - Miscible with water and with *alcohol*.

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

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

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

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

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

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

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

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

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

Storage - Store in a well-closed glass containers.

Phosphoric Acid, xN

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

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

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

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

Description - White, crystalline powder.

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

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

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

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

Potassium Antimonate Solution should be freshly prepared.

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

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

Description - Fused, white lumps, hygroscopic.

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

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

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

Potassium Bromate - $KbrO_3$=167.00

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

Description - White, crystalline powder.

Solubility - Soluble in *water*, freely soluble in boiling *water*, almost insoluble in *alcohol*.

Acidity or Alkalinity - A 5 percent w/v solution in *water* is clear and colourless and neutral to *litmus solution*.

Sodium - A warm 10 percent w/v solution in *water*, tested on platinum wire, imparts no distinct yellow colour to a colourless flame.

Bromide - To 20 ml of a 5 percent w/v solution in *water*, add 1 ml of 0.1 N *sulphuric acid*: no yellow colour develops within one minute, comparison being made with a control solution to which no acid has been added.

Sulphate - 1 g complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1 g, dissolve in *water* and dilute to 250 ml. To 25 ml of this solution add 3 g of *potassium iodide* and 10 ml of *hydrochloric acid*, dilute with 100 ml of water and titrate with 0.1 *N sodium thiosulphate*, using starch solution as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.002783 g of $KBrO_3$.

Potassium Bromide - Kbr=119.0.
Analytical reagent grade.

Potassium Bromide - 0.001 N.
Dissolve 0.1190 g of *potassium bromide* in sufficient *water* to produce 1000 ml.

Potassium Carbonate - K_2CO_3=138.21.
Contains not less than 98 percent of K_2CO_3.

Description - White, granular powder, hygroscopic.

Solubility - Very soluble in water, forming a clear solution.

Iron - 1 g with the addition of 1.5 ml of *hydrochloric acid*, complies with the *limit test for iron*, Appendix 2.3.4.

Chloride - 1 g with the addition of 5 ml of *nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 1 g, with the addition of 5 ml of *hydrochloric acid*, complies with the *limit test for sulphates*, Appendix 2.3.6

Chromium - To 25 ml of a 2 percent w/v solution in *water*, add about 0.2 g of *sodium peroxide* and boil gently for five minutes, cool, acidify with dilute sulphuric acid and add 2 drops of *diphenylcarbazide solution*; no violet colour is produced.

Assay - Weigh accurately about 3 g, dissolve in 50 ml of *water*, and titrate with *N hydrochloric* acid using *bromophenol blue solution* as indicator. At the first colour change, boil the solution, cool, and complete the titration. Each ml of *N hydrochloric acid* is equivalent to 0.06911 g of K_2CO_3.

Potassium Carbonate, Anhydrous - Potassium carbonate dried at 135^0C for two hours spread in a thin layer and then cooled in a desiccator.

Potassium Chlorate - $KC10_3$=122.55.
Contains not less than 99 percent of $KC10_3$.

Description - White powder or colourless crystals. In admixture with organic or readily oxidisable substances, it is liable to explode if heated or subjected to percussion or trituration.

Solubility - Soluble in *water*, and in *glycerin*, practically insoluble in alcohol.

Lead - Not more than 10 parts per million, Appendix 2.3.5.

Chloride - 0.5 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 0.5 g complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 0.3 g and dissolve in 10 ml of *water* in a stoppered-flask, add 1 g of *sodium nitrate*, dissolved in 10 ml *water* and then 20 ml of *nitric acid*; stopper the flask and allow to stand for ten minutes; add 100 ml of water and sufficient *potassium permanganate* solution to produce a permanent pink colour; decolorise by the addition of trace of *ferrous sulphate* and add 0.1 g of *urea*. Add 30 ml of 0.1 *N silver nitrate*, filter, wash with water and titrate the filtrate and washing with 0.1 *N ammonium thiocyanate* using *ferric ammonium sulphate solution* as indicator. Each ml of 0.1 *N silver nitrate* is equivalent to 0.01226 g of $KC10_3$.

Potassium Chloride - KC1=74.55
Analytical reagent grade.

Potassium Chromate - K_2CrO_4=194.2
Analytical reagent grade.

Potassium Chromate Solution - A 5 percent w/v solution of potassium chromate.

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

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

A. Copper Solution - Dissolve 34.66 g of carefully selected small crystals of **copper sulphate**, showing no trace of efflorescence or of adhering moisture, in sufficient water to make 500 ml. Keep this solution in small, well-stoppered bottles.

B. Alkaline Tartrate Solution - Dissolve 176 g of sodium *potassium tartrate* and 77 g of *sodium hydroxide* in sufficient water to produce 500 ml.

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

Potassium Cyanide - KCN=65.12.

Contains not less than 95 percent of KCN.

Description - White, crystalline powder, gradually decomposing on exposure to air.

Solubility - Readily soluble in *water*, forming a clear, colourless solution.

Heavy Metals - To 20 ml of a 5 percent w/v solution in *water*, add 10 ml of *hydrogen sulphide solution*; no darkening is produced immediately or on the addition of 5 ml of *dilute hydrochloric acid.*

Assay - Weigh accurately about 0.5 g and dissolve in 50 ml of *water*, add 5 ml of *dilute ammonia solution* and 1 drop of *potassium iodide solution*; titrate with 0.1 *N silver nitrate* until a faint permanent turbidity appears. Each ml of 0.1 *N silver nitrate* is equivalent to 0.01302 g of KCN.

Potassium Cyanide Solution - A 10 percent w/v solution of *potassium cyanide* in *water*.

Potassium Cyanide Solution, Lead-free - Weigh accurately about 10 g of *potassium cyanide* and dissolve in 90 ml of water, add 2 ml of *hydrogen peroxide solution*, allow to stand for twenty-four hours, and make up to 100 ml with *water*. It complies with the following tests:

Mix 2 ml with 5 ml of *lead-free ammonia solution* and 40 ml of water, and add 5 ml of standard lead solution; no darkening is produced.

Potassium Dichromate - $K_2Cr_2O_7$=294.18.

Contains not less than 99.8 percent of $K_2Cr_2O_7$.

Description - Orange-red crystals or a crystalline powder.

Solubility - Soluble in *water*.

Chloride - To 20 ml of a 5 percent w/v solution in *water* and 10 ml *nitric acid*, warm to about 50^0C and add a few drops of *silver nitrate solution*; not more than a faint opalescence is produced.

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

Potassium Dichromate Solution - A 7 percent w/v *solution of potassium dichromate* in *water.*

Potassium Dichromate Solution, 0.1N: $K_2Cr_2O_7$=294.18, 4.903 g in 1000 ml.

Weigh accurately 4.903 g of *potassium dichromate* P.S. previously powdered and dried at 20^0 for four hours and dissolve in sufficient *water* to produce 1000 ml.

Potassium Dihydrogen Phosphate - KH_2PO_4=136.1

Analytical reagent grade of commerce.

Potassium Ferricyanide - $K_3Fe\ (CN)_6$=329.25

Contains not less than 99 percent of $K_3Fe\ (CN)_6$.

Description - Ruby-red crystals.

Solubility - Very soluble in *water*.

Ferrocyanide - Rapidly wash 1 g with *water*, then dissolve in 100 ml of water and add 1 drop of *ferric ammonium sulphate solution*; no blue colour is produced.

Assay - Weigh accurately about 1 g and dissolve in 50 ml of *water* add 5 g of *potassium iodide* and 3 g of *zinc sulphate*, and titrate the liberated iodine with 0.1 N *sodium thiosulphate*, using *starch solution*, added towards the end of the titration, as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.03293 g of $K_3Fe\ (CN)_6$.

Potassium Ferricyanide Solution - Wash about 1 g of potassium ferricyanide crystals with a little water, and dissolve the washed crystals in 100 ml of water.

Potassium Ferricyanide solution must be freshly prepared.

Potassium Ferrocyanide - $K_4Fe\ (CN)_6,\ 3H_2O$=422.39

Contains not less than 99 percent of $K_4Fe\ (CN)_6,\ 3H_2O$.

Description - Yellow, crystalline powder.

Solubility: Soluble in water.

Acidity or Alkalinity: A 10 percent w/v solution in *water* is neutral to litmus paper.

Assay: Weigh accurately about 1 g and dissolve in 200 ml of *water*, add 10 ml of *sulphuric acid* and titrate with 0.1 *N Potassium permanganate*. Each ml of 0.1 *N potassium permanganate* is equivalent to 0.04224 g of $K_4Fe(CN)_6, 3H_2O$.

Potassium Ferrocyanide Solution: A 5 percent w/v solution of *potassium ferrocyanide* in *water*.

Potassium Hydrogen Phthalate: $CO_2H.C_6H_4.CO_2K$=204.22.

Contains not less than 99.9 percent and not more than the equivalent of 100.1 percent of $C_8H_5O_4K$ calculated with reference to the substance dried at 110^0C for one hour.

Description: White, crystalline powder.

Solubility: Slowly soluble in *water*, forming clear, colourless solution.

Acidity: A 2 percent w/v solution in *carbon dioxide-free water* gives with *bromophenol blue solution* the grey colour indicative of pH 4.0.

Assay: Weigh accurately about 9 g, dissolve in 100 ml of *water* and titrate with *N sodium hydroxide* using phenolphthalein solution as indicator. Each ml of *N. sodium hydroxide* is equivalent to 0.2042 g of $C_8H_5O_4K$.

Potassium Hydrogen Phthalate, 0.02 M
Dissolve 4.084 g of *potassium hydrogen phthalate* in sufficient *water* to produce 1000 ml.

Potassium Hydrogen Phthalate, 0.2 M

Dissolve 40.84 g of potassium hydrogen phthalate in sufficient water to produce 1000 ml.

Potassium Hydroxide: Caustic Potash: KOH=56.11

Contains not less than 85 percent of total alkali, calculated as KOH and not more than 4 percent of K_2CO_3.

Description - Dry, white sticks, pellets or fused or fused mass; hard, brittle and showing a crystalline fracture; very deliquescent; strongly alkaline and corrosive.

Solubility - Freely soluble in *water*, in *alcohol* and in *glycerin*; very soluble in boiling *ethy alcohol*.

Aluminium, iron and matter insoluble in hydrochloric acid - Boil 5 g with 40 ml of *dilute hydrochloric acid*, cool, make alkaline with *dilute ammonia solution*, boil, filter, and wash the residue with a 2.5 percent w/v solution of *ammonium nitrate*; the insoluble residue, after ignition to constant weight, weighs not more than 5 mg.

Chloride - 0.5 g dissolved in water with the addition of 1.6 ml of *nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Heavy Metals - Dissolve 1 g in a mixture of 5 ml of *water* and 7 ml of *dilute hydrochloric acid*. heat to boiling, add 1 drop of *phenolphthalein solution* and *dilute ammonia solution* dropwise to produce a faint pink colour. Add 2 ml of *acetic acid* and *water* to make 25 ml; the *limit of heavy metals* is 30 parts per million, Appendix 2.3.3.

Sulphate - Dissolve 1 g in *water* with the addition of 4.5 ml of *hydrochloric acid*; the solution complies with the *limit test for sulphates*, Appendix 2.3.6

Sodium - To 3 ml of a 10 percent w/v solution add 1 ml of water, 1.5 ml of *alcohol*, and 3 ml of *potassium anti-monate solution* and allow to stand; no white crystalline precipitate or sediment is visible to the naked eye within fifteen minutes.

Assay - Weigh accurately about 2 g, and dissolve in 25 ml of *water*, add 5 ml of *barium chloride solution*, and titrate with *N hydrochloric acid*, using *phenolphthalein solution* as indicator. To the solution in the flask add *bromophenol blue solution*, and continue the titration with *N hydrochloric acid*. Each ml of *N hydrochloric acid*, used in the second titration is equivalent to 0.06911 g of K_2CO_3. Each ml of *N hydrochloric acid*, used in the combined titration is equivalent to 0.05611 g of total alkali, calculated as KOH.

Storage - Potassium Hydroxide should be kept in a well-closed container.

Potassium Hydroxide, xN

Solution of any normality, xN, may be prepared by dissolving 56.11x g of *potassium hydroxide* in *water* and diluting to 1000 ml.

Potassium Hydroxide Solution - Solution of Potash.

An aquous solution of *potassium hydroxide* containing 5 percent w/v of total alkali, calculate as KOH (limits, 4.75 to 5.25).

Assay - Titrate 20 ml with *N sulphuric acid*, using solution of methyl orange as indicator. Each ml of *N sulphuric acid* is equivalent to 0.05611 g of total alkali, calculated as KOH.

Storage - *Potassium hydroxide* solution should be kept in a well-closed container of lead-free glass or of a suitable plastic.

Potassium Iodate - KIO_3=214.0

Analytical reagent grade.

Potassium Iodate Solution - A 1 percent w/v solution of potassium iodate in water.

Potassium Iodate, 0.05M: KIO_3=214.00; 10.70 g in 1000 ml.

Weigh accurately 10.700 g of *potassium iodate* P.S., previously dried at 110^0 to constant weight, in sufficient water to produce 1000 ml.

Potassium Iodide - KI=166.00

Description - Colourless crystals or white powder; odourless, taste, saline and slightly bitter.

Solubility - Very soluble in *water* and in glycerin; soluble in *alcohol*.

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

Heavy Metals - Not more than 10 parts per million, determined on 2 g by Method A, Appendix 2.3.3.

Barium - Dissolve 0.5 g in 10 ml of *water* and add 1 ml of *dilute sulphuric acid*; no turbidity develops within one minute.

Cyanides - Dissolve 0.5 g in 5 ml of warm water, add one drop of *ferrous sulphate solution* and 0.5 ml of *sodium hydroxide solution* and acidify with *hydrochloric acid*; no blue colour is produced.

Iodates - Dissolve 0.5 g in 10 ml of freshly boiled and cooled *water*, and add 2 drops of *dilute sulphuric acid* and a drop of *starch solution*; no blue colour is produced within two minutes.

Assay - Weigh accurately about 0.5 g dissolve in about 10 ml of *water* and add 35 ml of *hydrochloric acid* and 5 ml of *chloroform*. Titrate with 0.05 *M potassium iodate* until the purple colour of iodine disappears from the *chloroform*. Add the last portion of the iodate solution drop wise and agitate vigorously and continuously. Allow to stand for five minutes. If nay colour develops in the chloroform layer continue the titration. Each ml of 0.05 *M potassium iodate* is equivalent to 0.0166 mg of KI.

Storage - Store in well-closed containers.

Potassium Iodide, M - Dissolve 166.00 g of *potassium iodide* in sufficient *water* to produce 1000 ml.

Potassium Iodide and Starch Solution - Dissolve 10 g *potassium iodide* in sufficient water to produce 95 ml and add 5 ml of *starch solution*.

Potassium iodide and *starch solution* must be recently prepared.

Potassium Iodide Solution - A 10 percent w/v solution of *potassium iodide* in *water*.

Potassium Indobismuthate Solution - Dissolve 100 g of tartaric acid in 400 ml of *water* and add 8.5 g of *bismuth oxynitrate*. Shake during one hour, add 200 ml of a 40 percent w/v solution of

potassium iodide, and shake well. Allow to stand for twenty four hours and filter.

Potassium Iodobismuthate Solution, Dilute - Dissolve 100 g of *tartaric acid* in 500 ml of *water* and add 50 ml of *potassium iodobismuthate solution*.

Potassium Mercuri-Iodide Solution - Mayer's Reagent.

Add 1.36 g of *mercuric chloride* dissolved in 60 ml of *water* to a solution of 5 g of *potassium iodide* in 20 ml of *water* mix and add sufficient water to produce 100 ml.

Potassium Mercuri-Iodide Solution, Alkaline (Nessler's Reagent)

To 3.5 g of *potassium iodide* add 1.25 g of *mercuric chloride* dissolved in 80 ml of *water*, add a cold saturated solution of *mercuric chloride* in *water*, with constant stirring until a slight red precipitate remains. Dissolve 12 g of *sodium hydroxide* in the solution, add a little more of the cold saturated solution of *mercuric chloride* and sufficient *water* to produce 100 ml. Allow to stand and decant the clear liquid.

Potassium Nitrate - KNO_3=101.1
Analytical reagent grade.

Potassium Permanganate - KM_nO_4=158.03
Anti-infective (topical)

Description - Dark purple, slender, prismatic crystals, having a metallic lustre, odourless, taste, sweet and astringent.

Solubility - Soluble in *water*; freely soluble in *boiling water.*

Chloride and Sulphate - Dissolve 1 g in 50 ml of *boiling water*, heat on a water-bath, and add gradually 4 ml or a sufficient quantity of *alcohol* until the meniscus is colour-less; filter. A 20 ml portion of the filtrate complies with the *limit test for chloride*. Appendix 2.3.2. and another 20 ml portion of the filtrate complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 0.8 g, dissolve in *water* and dilute to 250 ml. Titrate with this solution 25 ml of 0.1 *N oxalic acid* mixed with 25 ml of water and 5 ml of *sulphuric acid*. Keep the temperature at about 70^0 throughout the entire titration. Each ml of 0.1 *N oxalic acid* is equivalent to 0.00316 g of KM_nO_4.

Storage - Store in well-closed containers.

Caution - *Great care should be observed in handling potassium permanganate, as dangerous explosions are liable to occur if it is brought into contact with organic or other readily oxidisable substance, either in solution or in the dry condition.*

Potassium Permanganate Solution - A 1 percent w/v solution of potassium permanganate in water.

Potassium permanganate 0.1 N Solution - 1158.03; 3.161 g in 1000 ml.

Dissolve about 3..3 g of *potassium permanganate* in 1000 ml of *water*, heat on water-bath for one hour and allow to stand for two days. Filter through glass wool and standardize the solution as follows:-

To an accurately measure volume of about 25 ml of the solution in a glass stoppered flask add 2 g of *potassium iodide* followed by 10 ml of N Sulphuric acid. Titrate the liberated iodine with standardized 0.1 *N sodium thiosulphate*, adding 3 ml of *starch solution* as the end point is approached. Correct for a blank run on the same quantities of the same reagents. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.003161 g of KM_nO_4.

Potassium Tetraoxalate - KH_3 (C_2O_4) $2H_2O$=254.2

Analytical reagent grade of commerce.

Potassium thiocyanate - KCNS=97.18

Analytical reagent grade.

Purified water - H_2O=18.02

Description - Clear, colourless liquid, odourless, tasteless.

Purified water is prepared from potable water by distillation, ion-exchange treatment, reverse osmosis or any other suitable process. It contains no added substances.

pH: Between 4.5 and 7.0 determined in a solution prepared by adding 0.3 ml of a saturated solution of *potassium chloride* to 100 ml of the liquid being examined, Appendix 3.1.3.

Carbon Dioxide - To 25 ml add 25 ml of *calcium hydroxide solution*, no turbidity is produced.

Chloride - To 10 ml add 1 ml of dilute *nitric acid* and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Sulphate - To 10 ml add 0.1 ml of *dilute hydrochloric acid* and 0.1 ml of *barium chloride solution*: the solution remains clear for an hour.

Nitrates and Nitrites - To 50 ml add 18 ml of acetic acid and 2 ml of *naphthylamine-sulphanilic acid* reagent. Add 0.12 g of *zinc* reducing mixture and shake several times. No pink colour develops within fifteen minutes.

Ammonium - To 20 ml add 1 ml of *alkaline potassium mercuri-iodide solution* and after five minutes view in a Nessler cylinder placed on a white tile; the colour is not more intense than that given on adding 1 ml of *alkaline potassium mercuri-iodide solution* to a solution containing 2.5 ml of *dilute ammonium chloride solution* (Nessler's) and 7.5 ml of the liquid being examined.

Calcium - To 10 ml add 0.2 ml of *dilute ammonia solution* and 0.2 ml of *ammonium oxalate solution*; the solution remains clear for an hour.

Heavy Metals - Adjust the pH of 40 ml to between 3.0 and 4.0 with *dilute acetic acid*, add 10 ml of freshly prepared *hydrogen sulphide solution* and allow to stand for ten minutes; the colour of the solution is not more than that of a mixture of 50 ml of the liquid being examined and the same amount of *dilute acetic acid* added to the sample.

Oxidisable matter - To 100 ml add 10 ml of *dilute sulphuric acid* and 0.1 ml of 0.1 *N potassium permanganate* and boil for five minutes. The solution remains faintly pink.

Total Solids - Not more than 0.001 percent w/v determined on 100 ml by evaporating on a water bath and drying in an oven at 105^0C for one hour.

Storage - Store in tightly-closed containers.

Resorcional - Benzene-1, 3 diol; C_6H_4 $(OH)_2$=110.1
Analytical reagent grade.
Colourless crystals or crystalline powder, melting point about 111^0C.

Resorcinol Solution - Shake 0.2 g of resorcinol with 100 ml of toluene until saturated and decant.

Safranine - CI 50240: Basic red 2
Microscopical staining grade.
A reddish-brown powder.

Safranine Solution - Saturated solution of *Safranine O* in *ethanol* (70 percent).
Seasame oil

Description - A pale yellow oil.

Solubility - Slightly soluble in alcohol; miscible with *chloroform*, with solvent *ether with light petroleum* (b.p. 40^0C to 60^0C) and with carbon disulpide.

Refractive Index - At 40^0C, 1.4650 to 1.4665, Appendix 3.1.7

Wt. per ml. - At 25^0C, 0.916 to 0.921 g; Appendix 3.1.8

Storage - Preserve seasame oil in a well-closed container protected from light, and avoid exposure to excessive heat.

Silver Carbonate - $Ag_2\ CO_3$=214

Prepared from *silver nitrate* and soluble *carbonate solution*. Light yellow powder when freshly precipitated, but becomes darker on drying and on exposure to light.

Silica Gel - Partially dehydrated, polymerized, colloidal silicic acid containing cobalt chloride as an indicator.

Description - Blue granules, becoming pink when the moisture absorption capacity is exhausted.

Silica Gel absorbs about 30 percent of its weight of water at 20^0 C. Its absorptive capacity may be regenerated by heating at 150^0 C for two hours.

Silver Nitrate - $AgNO_3$=169.87

Description - Colourless crystals or white crystalline powder; odourless, taste, bitter and metallic.

Solubility - Very soluble in *water*, sparingly soluble in *alcohol*; slightly soluble in *solvent ether*.

Clarity and colour of solution - A solution of 2 g in 20 ml of water is clear and colourless.

Bismuth, copper and lead - To a solution of 1 g in 5 ml of *water*, add a slight excess of *dilute ammonia solution*: the mixture remains clear and colourless.

Foreign substances - To 30 ml of a 4 percent w/v solution add 7.5 ml of 2N *hydrochloric acid*, shake vigorously, filter and evaporate 10 ml of the filtrate to dryness on a water-bath; the residue weighs not more than 1 mg.

Assay - Weigh accurately about 0.5 g and dissolve in 50 ml of water, add 2 ml of nitric acid, and titrate with 0.1 *N ammonium thiocyanate*, using ferric *ammonium sulphate solution* as indicator. Each ml 0.1 *N ammonium thiocyanate* is equivalent to 0.01699 g of $AgNO_3$.

Storage - Store in tightly-closed, light-resistant containers.

Silver Nitrate Solution - A freshly prepared 5 percent w/v solution of silver nitrate in water.

Silver Nitrate - 0.1N: $AgNO_3$=169.87; 16.99 g in 1000 ml. Dissolve about 17 g in sufficient *water* to produce 1000 ml and standardize the solution as follows.

Weigh accurately about 0.1 g of *sodium chloride* P.S. previously dried at 110^0C for two hours and dissolve in 5 ml of *water*. Add 5 ml of *acetic acid*, 50 ml of *methyl alcohol* and three drops of eosin solution is equivalent to 1 ml of 0.1 *N silver nitrate*.

Sodium Bicarbonate - $NaHCO_3$=84.01

Description - White, crystalline powder or small, opaque, monoclinic crystals; odourless, taste saline.

Solubility - Freely soluble in *water*; practically insoluble in *alcohol*.

Carbonate - pH of a freshly prepared 5 percent w/v solution in *carbon dioxide-free water*, not more than 8.6, Appendix 3.1.3.

Aluminium, calcium and insoluble matter - Boil 10 g with 50 ml of *water* and 20 ml of *dilute ammonia solution*, filter, and wash the residue with *water*; the residue, after ignition to constant weight, not more than 1 mg.

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

Iron - Dissolve 2.5 g in 20 ml of *water* and 4 ml of *iron-free* hydrochloric *acid*, and dilute to 40 ml with *water;* the solution complies with the *limit test for iron*, Appendix 2.3.4.

Heavy Metals - Not more than 5 parts per million, determined by Method A on a solution prepared in the following manner:

Mix 4 g with 5 ml of *water* and 10 ml of *dilute hydrochloric acid*, heat to boiling, and maintain the temperature for one minute. Add one drop of phenolphthalein solution and sufficient ammonia solution drop wise to give the solution a faint pink colour. Cool and dilute to 25 ml with *water*, Appendix 2.3.3.

Chlorides - Dissolve 1 g in *water* with the addition of 2 ml of *nitric acid*; the solution complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphates - Dissolve 2 g in water with the addition of 2 ml of *hydrochloric acid*; the solution complies with *the limit test for sulphates*, Appendix 2.3.6

Ammonium Compounds - 1 g warmed with 10 ml of *sodium hydroxide solution* does not evolve ammonia.

Assay - Weigh accurately about 1 g dissolve in 20 ml of *water*, and titrate with 0.5 *N sulphuric acid* using *methyl orange solution* as indicator. Each ml of 0.5 *N sulphuric acid* is equivalent to 0.042 g of $NaHCO_3$.

Storage - Store in well-closed containers.

Sodium Bicarbonate Solution - A 5 percent w/v *solution of sodium bicarbonate* in water.

Sodium Bisulphite - Consists of *sodium bisulphite* ($NaHSO_3$) and *sodium metabisulphite* ($Na_2S_2O_3$) in varying proportions. If yields not less than 58.5 percent and not more than 67.4 percent

of SO_2.

Description - White or yellowish-white crystals or granular powder, odour of sulphur dioxide. It is unstable in air.

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

Assay - Weigh accurately about 0.2 g and transfer to a glass-stoppered flask and 50 ml of 0.1 *N iodine* and insert the stopper of the flask. Allow to stand for five minutes, add 1 ml of *hydrochloric acid*, and titrate the excess of iodine with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of the titration. Each ml of 0.1 *N iodine* is equivalent to 0.003203 g of SO_2.

Storage: Preserve *Sodium Bisulphite* in tightly-closed containers in a cool place.

Sodium Bisulphite Solution - Dissolve 10 g of sodium bisulphite in sufficient *water* to make 30 ml.

Sodium Bisulphite Solution must be freshly prepared.

Sodium Carbonate - $Na_2CO_3.\ 10H_2O$=286.2

Analytical reagent grade.

Sodium Chloride - NaCI=58.44

Analytical reagent grade.

Sodium Cobaltinitrite - $Na_2CO(NO_2)_6$=403.94

Description - An orange-yellow powder.

Solubility - Readily soluble in *water*, forming a clear orange-red solution.

Potassium - Dissolve 3 g in 10 ml of *water*, add the solution to a mixture of 5 ml of water and 2 ml of dilute *acetic acid*, and allow to stand for one hour; no precipitate is produced.

Sodium Cobaltinitrite Solution - A 30 percent w/v solution of *sodium cobaltinitrite in water*.

Sodium Diethyldithiocarbamate - $(C_2H_5)_2$, N. CS.SNa, $3H_2O$=225.30

Description - White or colourless crystals.

Solubility - Readily soluble in water, yielding a colourless solution.

Sensitivity - Add 10 ml of a 0.1 percent w/v solution to 50 ml of *water* containing 0.002 mg of copper previously made alkaline with *dilute ammonia solution*. A yellowish-brown colour should be

apparent in the solution when compared with a blank test containing no copper.

Sodium Diethyldithiocarbamate Solution - A 0.1 percent w/v solution of *sodium diethyldithiocarbamate* in *water*.

Sodium Hydroxide - NaOH=40.00

Description - White sticks, pellets, fused masses, or scales; dry, hard brittle, and showing a crystalline fracture, very deliquescent; strongly alkaline and corrosive.

Solubility - Freely soluble in water and in alcohol.

Aluminium, iron and matter insoluble in hydrochloric acid: Boil 5 g with 50 ml of *dilute hydrochloric acid*, cool, make alkaline with *dilute ammonia solution*, boil, filter, and wash with a 2.5 percent w/v solution of *ammonium nitrate*; the insoluble residue after ignition to constant weight weighs not more than 5 mg.

Arsenic - Not more than 4 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 30 parts per million, determined by Method A, Appendix 2.3.3. on a solution prepared by dissolving 0.67 g in 5 ml of *water* and 7 ml of 3 *N hydrochloric acid*. Heat to boiling, cool and dilute to 25 ml with water.

Potassium - Acidify 5 ml of a 5 percent w/v solution with *acetic acid* and add 3 drops of *sodium cobaltinitrite solution*, no precipitate is formed.

Chloride - 0.5 g dissolved in water with the addition of 1.8 ml of *nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 1g dissolved in water with the addition of 3.5 ml of *hydrochloric acid* complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1.5 g and dissolve in about 40 ml of *carbon dioxide-free water*. Cool and titrate with *N sulphuric acid* using *phenolphthalein solution* as indicator. When the pink colour of the solution is discharged, record the volume of acid solution required, add methyl orange solution and continue the titration until a persistent pink colour is produced. Each ml of *N sulphuric acid* is equivalent to 0.040 g of total alkali calculated as NaOH and each ml of acid consumed in the titration with *methyl orange* is equivalent to 0.106 g of Na_2CO_3.

Storage - Store in tightly-closed containers.

Sodium Hydroxide, xN - Solutions of any normality, xN may be prepared by dissolving 40 xg of *sodium hydroxide* in *water* and diluting to 1000 ml.

Sodium Hydroxide Solution - A 20 percent w/v solution of *sodium hydroxide* in *water*.

Sodium Hydroxide Solution, Dilute

A 5 percent w/v solution of sodium hydroxide in water.

Sodium Nitrite - $NaNO_2$-69.00, Analytical reagent grade.

Sodium Nitroprusside - (Sodium penta cyano nitrosyl ferrate (iii) dihydrate; $Na_2[Fe(CN)_5(NO)]$, $2H_2O$=298.0

Analytical reagent grade of commerce.

Sodium Peroxide - Na_2O_2=77.98

Analytical grade reagent.

Sodium Potassium Tartrate: Rochelle Salt COONa.CH(OH). CH(OH), COOK, $4H_2O$=282.17

Contains not less than 99 percent and not more than the equivalent of 104 percent of $C_4H_4O_6Kna$, $4H_2O$.

Description - Colourless crystals or a white, crystalline powder; odourless, taste saline and cooling. As it effloresces slightly in warm, dry air, the crystals are often coated with a white powder.

Solubility - Soluble in *water*; practically insoluble in *alcohol*.

Acidity or Alkalinity - Dissolve 1 g in 10 ml of recently boiled and cooled *water*, the solution requires for neutralization not more than 0.1 ml of 0.1 N sodium hydroxide or of 0.1 *N hydrochloric acid*, using *phenolphthalein solution* as indicator.

Iron - 0.5 g complies with the *limit test for iron*, Appendix 2.3.4.

Chloride - 0.5 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 0.5 g complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 2 g and heat until carbonized, cool and boil the residue with 50 ml of *water* and 50 ml of 0.5 *N sulphuric acid*, filter, and wash the filter with *water*; titrate the excess of acid in the filtrate and washings with 0.5 *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of 0.5 *N sulphuric acid* is equivalent to 0.07056 g of $C_4H_4O_6$ KNa, $4H_2O$.

Sodium Sulphide - Na_2Saq.

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

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

Sodium Sulphite, Anhydrous: $Na_2 SO_3$=126.06

Description - Small crystals or powder.

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

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

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

Solubility - Very soluble in *water*; insoluble in *alcohol*.

pH - Between 6.0 and 8.4, determined in a 10 percent w/v solution, Appendix.3.1.3

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

Heavy metals - Not more than 20 parts per million, determined by Method A. Appendix 2.3.3. on a solution prepared in the following manner: Dissolve 1 g in 10 ml of *water*, slowly add 5 ml of *dilute hydrochloric acid* and evaporate the mixture to dryness on a water-bath. Gently boil the residue with 15 ml of *water* for two minutes, and filter. Heat the filtrate to boiling, and add sufficient *bromine solution* to the hot filtrate to produce a clear solution and add a slight excess of *bromine solution*. Boil the solution to expel the *bromine* completely, cool to room temperature, then add a drop of *phenolphthalein solution* and *sodium hydroxide solution* until a slight pink colour is produced. Add 2 ml of dilute acetic acid and dilute with *water* to 25 ml.

Calcium - Dissolve 1 g in 20 ml of *water*, and add a few ml of *ammonium oxalate solution*; no turbidity is produced.

Chloride - Dissolve 0.25 g in 15 ml of 2 N *nitric acid* and boil gently for three to four minutes cool and filter; the filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate and Sulphite - Dissolve 0.25 g in 10 ml of water, to 3 ml of this solution add 2 ml of *iodine solution*, and gradually add more *iodine solution*, drop wise until a very faint-persistent yellow colour is produced; the resulting solution complies with the *limit test for sulphates*, Appendix 2.3.6

Sulphide - Dissolve 1 g in 10 ml water and 10 ml of a freshly prepared 5 percent w/v solution of *sodium nitroprusside*; the solution does not become violet.

Assay: Weigh accurately about 0.8 g and dissolve in 30 ml of water. Titrate with 0.1 N iodine, using 3 ml of *starch solution* as indicator as the end-point is approached. Each ml of 0.1 N iodine is equivalent to 0.02482 g of $Na_2S_2O_3$. $5H_2O$.

Storage - Store in tightly-closed containers.

Sodium Thiosulphate - 0.1 N; $Na_2 S_2O_3. 5H_2O$=248.17, 24.82 g in 1000 ml.

Dissolve about 26 g of *sodium thiosulphate* and 0.2 g of *Sodium Carbonate* in *carbon dioxide-free water* and dilute to 1000 ml with the same solvent. Standardize the solution as follows:

Dissolve 0.3 g of *potassium bromate* P.S. in sufficient *water* to produce 250 ml. To 50 ml of this solution, add 2 g of *potassium iodide* and 3 ml of 2 *N hydrochloric* acid and titrate with the *sodium-thiosulphate solution* using starch solution, added towards the end of the titration, as indicator until the blue colour is discharged. Each 0.002784 g of potassium bromate is equivalent to 1 ml of 0.1 *N Sodium thiosulphate*. Note-Re-standardize 0.1 *sodium thiosulphate* frequently.

Stannous Chloride - $SnCl_2, 2H_2O$=225.63

Contains not less than 97 percent of $SnCl_2, 2H_2O$.

Description - Colourless crystals.

Solubility - Soluble in *dilute hydrochloric acid.*

Arsenic - Dissolve 5 g in 10 ml of *hydrochloric acid*, heat to boiling and allow to stand for one hour; the solution shows no darkening when compared with a freshly prepared solution of 5 g in 10 ml of *hydrochloric acid.*

Sulphate - 5 g, with the addition of 2 ml of *dilute hydrochloric acid*, complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1 g and dissolve in 30 ml of *hydrochloric acid* in a stoppered flask. Add 20 ml of *water* and 5 ml of *chloroform* and titrate rapidly with 0.05 *M potassium iodate* until the chloroform layer is colourless. Each ml of 0.05 *M potassium iodate* is equivalent to 0.02256 g of $SnCl_2, 2H_2O$.

Stannous chloride solution - May be prepared by either of the two methods given below:

2 Dissolve 330 g of *stannous chloride* in 100 ml of *hydrochloric acid* and add sufficient *water* to produce 1000 ml.

3 Dilute 60 ml of *hydrochloric acid* with 20 ml of *water*, add 20 g of tin and heat gently until gas ceased to be evolved; add sufficient *water* to produce 100 ml allowing the undissolved tin to remain in the solution.

Starch Soluble - Starch which has been treated with *hydrochloric acid* until after being washed, it forms an almost clear liquid solution in hot water.

Description - Fine, white powder.

Solubility - Soluble in hot *water*, usually forming a slightly turbid *solution*.

Acidity or Alkalinity - Shake 2 g with 20 ml of *water* for three minutes and filter; the filtrate is not alkaline or more than faintly acid to litmus paper.

Sensitivity - Mix 1 g with a little cold *water* and add 200 ml of *boiling water*. Add 5 ml of this solution to 100 ml of *water* and add 0.05 ml of 0.1 *N iodine*. The deep blue colour is discharged by 0.05 ml of 0.1 *N sodium thiosulphate*.

Ash - Not more than 0.3 percent, Appendix 2.2.3.

Starch, Solution - Triturate 0.5 g of *soluble starch*, with 5 ml of *water*, and add this, with constant stirring to sufficient water to produce about 100 ml. Boil for a few minutes, cool and filter.

Solution of *starch* must be recently prepared.

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

Description: Reddish-brown powder.

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

Sulphamic Acid - NH_2SO_3H=97.09.

Contains not less than 98 percent of H_3NO_3S.

Description - White crystals or a white crystalline powder.

Solubility - Readily soluble in *water*.

Melting Rang - 203^0C to 205^0C, with decomposition, Appendix 3.1.4.

Sulphuric Acid - H_2SO_4=98.08

When no molarity is indicated use analytical reagent grade of commerce containing about 98 percent w/w of *sulphuric acid*. An oily, corrosive liquid weighing about 1.84 g per ml and about 18 M in strength.

When solutions of molarity xM are required, they should be prepared by carefully adding 54 x ml of sulphuric acid to an equal volume of water and diluting with water to 1000 ml.

Solution of sulphuric acid contain about 10 percent w/v of H_2SO_4.

Sulphuric Acid, Dilute: Contains approximately 10 percent w/w of H_2SO_4. Dilute 57 ml of *sulphuric acid* to 1000 ml with *water*.

Sulphuric Acid, Chlorine free - Sulphuric acid which complies with the following additional test:

Chloride -Mix 2 ml with 50 ml of *water* and add 1 ml of solution of *silver nitrate* no opalescence is produced.

Sulphuric Acid Nitrogen-free - Sulphuric acid which contains not less than 98 percent w/w of H_2SO_4 and compiles with the following additional test:

Nitrate - Mix 45 ml with 5 ml of *water*, cool and add 8 mg of *diphenyl benezidine*; the solution is colourless or not more than very pale blue.

Tartaric Acid - $(CHOH.COOH)_2$=150.1

Analytical reagent grade.

Thioglycollic Acid Mercapto Acetic Acid - HS. CH_2. COOH=92.11.

Contains not less than 89 percent w/w of $C_2H_4O_2S$, as determined by both parts of the Assay described below:

Description - Colourless or nearly colourless liquid, odour strong and unpleasant.

Iron - Mix 0.1 ml with 50 ml of *water* and render alkaline with *strong ammonia solution*; no pink colour is produced.

Assay - (1) Weigh accurately about 0.4 g and dissolve in 20 ml of water and titrate with 0.1 *N sodium hydroxide* using cresol *red solution* as indicator. Each ml of 0.1 *N sodium hydroxide* is equivalent to 0.009212 g of $C_2H_4O_2S$.

(2) To the above neutralized solution add 2 g of sodium bicarbonate and titrate with 0.1 *N iodine*. Each ml of 0.1 *N iodine* is equivalent to 0.009212 g of $C_2H_4O_2S$.

Thymol-2-Isoprophy-5-Methyl phenol; $C_{10}H_{14}O$=150.2

General reagent grade.

Colourless crystals with an aromatic odour; freezing point not below 49^0C.

ThymolBlue-6,6'-(3H-2,1Benzoxathil-3-ylidene)dithymolSS-dioxide; $C_{27}H_{30}O_5S$=466.6.

Gives a red colour in strongly acid solutions a yellow colour in weakly acid and weakly alkaline solutions, and a blue colour is more strongly alkaline solutions (pH range, 1.2 to 2.8 and 2.0 to 9.6).

Thymol Blue Solution - Warm 0.1 g of *thymol blue* with 4.3 ml or 0.05 M sodium hydroxide and 5 ml of *ethanol* (90 percent); after solution is effected add sufficient *ethanol* (20 percent) to produce 250 ml.

Complies with the following test:

Sensitivity - A mixture of 0.1 ml and 100 ml of Carbon dioxide-free water to which 0.2 ml of 0.02 *N sodium hydroxide* has been added is blue. Not more than 0.1 ml of 0.2 *N hydrochloric acid* is required to change the colour to yellow.

Titanous Chloride Solution - General reagent grade of commerce containing about 15 percent w/v $TiC1_3$.

Weight per ml, about 1.2 g.

Dull purplish liquid with a strongly acid reaction.

Titanous Chloride - 0.1N: $TiC1_3$=154.26; 15.43g in 1000 ml.

Add 103 ml of *titanous chloride solution* to 100 ml of *hydrochloric acid*, dilute to 1000 ml with recently boiled and cooled water, and mix, standardize, immediately before use, as follows:

Place an accurately measured volume of about 30 ml of standardized 0.1 *N ferric ammonium sulphate* in a flask and pass in a rapid stream of *carbon dioxide* until all the air has been removed. Add the *titanous chloride solution* from a burette and in an atmosphere of *carbon dioxide* until near the calculated endpoint then add 5 ml of ammonium thiocyanate solution, and continue the titration until the solution is colourless. Each ml of 0.1*N ferric ammonium sulphate* is equivalent to 0.01543 g of $TiC1_3$.

Water - See purified water.

Water Ammonia-free - Water which complies with the following additional test.

To 50 ml add 2 ml of *alkaline potassium mercuri-iodide solution* (Nessler's reagent); no colour is produced.

Water, Carbon Dioxide-free - Water which has been boiled vigorously for a few minutes and protected from the atmosphere during cooling and storage.

Xylenol orange - [3H-2, 1-Benzoxathiol-3-ylidene bis (6-hydroxy-5-methyl-m-phenylene) methyl-lenenitril] tetra acetic acid SS-dioxode ($C_{31}H_{32}O_2O_{13}S$) or its tetra sodium salt.

Gives a violet colour with mercury, lead zinc and contain other metal ions in acid solution. When metal ion are abscent, for example in the presence of an excess of disodium ethylene diamine tetraacetate, this solution is yellow.

Xylenol Orange Solution - Shake 0.1 g of *xylenol orange* with 100 ml of water and filter, if necessary.

Zinc, Granulated - Zn=65.38.

Analytical reagent grade of commerce.

Zinc Powder - Zn=65.38.

Analytical reagent grade of commerce.

Zinc Sulphate - $ZnSO_4$, $7H_2O$=287.6.

Analytical reagent grade of commerce.

APPENDIX – 5

5.1 GENERAL INFORMATION

5.1.1 Definition and Method of Preparing of Joshanda or Decoction

Joshanda is the decoction obtained by boiling Coarse powder of drugs in proportion of 4,8,16 times of water reduced to one fourth and strained in cloth.

5.1.2 Tasfia (Decontamination)

Tasfia is a process of decontamination with specified drugs for removal of impurities and potentiation of drugs. The process of Tasfia may be divided under the following processes:

1. Daq-wa-Sahaq;
2. Ghasl-e-Adviyah and
3. Tasweel-e-Adviyah.

1. Daq-Wa-Sahaq (Pounding and Grinding)

In the preparation of many compound formulations, single drugs are used in the form of coarse of fine powder. The process of powdering, by pounding or grinding, is called Daq-was-Sahaq (Kootna-aur-Peesna).

Drugs are generally powdered in a mortar and pestle, made of stone, iron, wood, porcelain or glass. Sometimes, they are rubbed on a sil-batta (flat grinding stone). Some drugs are pounded only in an iron or stone mortar. In large scale manufacture of drugs, pulverizing machines are now used.

(i) Powdering of hard drugs

Tough, hard or fibrous drugs are first dried in shade, Sun or over low fire to evaporate their moisture contents and pounded in an iron mortar. Initially, gentle pounding is employed to avoid drug pieces being scattered outside the mortar. When the drugs are initially broken into small pieces by gentlre pounding, vigorous pounding is then employed till they are finely powdered. The powder is sieved through sieves of the prescribed meshes. The coarse particles left in the sieve are again pounded and resieved. The remaining pieces of drugs which can no longer be pounded are ground on a sil-batta with a little water to form a fine paste which is then dried and ground to powder form in a porcelain or glass mortar.

(ii) Powdering of Nuts and Dry Fruits

Kernels of Nuts and Dry fruits are ground only on a sil-batta or in a Kharal. The powder of these drugs is not sieved.

(iii) Powdering of precious stones and minerals

Precious stones and minerals are first ground in an iron mortar or Kharal of hard stone and then sieved through sieves of 100 Mesh. The sieved powder is put in the same mortar or Kharal and ground with Arq-e-Gulab for three hours till the Arq is completely absorbed. The powder is then tested between the fingers for its fineness. If coarseness is still felt, more Arq-e-Gulab is added and ground till the coarseness disappears. The fine powder is then sieved through a piece of fine muslin cloth.

(iv) Powder of Mushk, Ambar, etc.

Drugs like Mushk, Ambar, Jund-e-Badastar, etc., are ground either dried or with a suitable Arq or Raughan and then used as required in the respective formula.

(v) Powdering of Zafran, Kafoor, etc.

Drugs like Zafran, Kafoor are ground only in a dry mortar (Kharal), with slow and light movements of the pestle to avoid sticking of the drug with the mortar. It is also ground with a few drops of alcohol. Lastly, these drugs are added to the powder of other drugs and mixed well in a mortar.

(vi) Powdering of Toxic Drugs

Poisonous or Toxic drugs are first purified or detoxicated (mudabbar) and then ground to fine powder. Kuchla (Nux-Vomica), besides being toxic (poisonous), is also very hard and difficult to powder. It is, therefore, ground immediately when it is soft. In case it gets hard on drying, it is powdered by frying in Raughan Zard or any other suitable oil by which the drug is cripsed.

(vii) Powdering of Abresham

Silk Cocoons (Abresham) are cut into small pieces and roasted in an iron pan over low fire, care being taken to ensure that they are not burnt. It is then ground in a mortar and pestle to fine powder form.

(viii) Powdering of moist and resinous drugs

Drugs like Afyun, Ushaq, Muqil, Anardana, Narjeel Daryaee, etc. are first dried over a low fire to evaporate the moisture content, care being taken to ensure that they are not burnt. They are then powdered.

(ix) Powdering of Khurma Khushk

In case of Khurma Khushk (Dry Date) the seeds are first removed and then dried over a low fire in a frying pan before powdering. In some formulations, dates (Khurma Khushk) are soaked in the prescribed liquids. In such cases they are ground on sil-batta, with a little water to form a fine paste and then mixed with other drugs coming in the respective formula.

(x) Powdering of Mastagi

Mastagi is powdered in a porcelain mortar by slow and light motion. It is also dissolved in any oil over a low fire and added to the other drugs in the formula.

(xi) Powdering of Abrak

The layers of Abrak are first separated by pounding in an iron mortar. The small pieces of Abrak are kept in a bag of thick cloth along with small pebbles, Cowrie shells, Data seeds or Dhan (Paddy) and tied. The bag is then dipped in hot water and rubbed vigorously with both hands. Small particles of Abrak are then squeezed out of the bag. The process of dipping the bag in hot water and rubbing is repeated till all the particles of Abrak are squeezed out of the bag. The particles of Abrak are allowed to settle down at the bottom of the vessel and the water is decanted. The Abrak particles are removed and then allowed to dry. The dry particles are called Abrak Mahloob.

(xii) Powdering of Tukhm-e-Imli

Tukhm-e-Imli is soaked in water for four to five days. The brownish outer covering (testa) of the seeds is removed and the seed are ground to powder. The outer covering can also be removed by roasting the seeds.

(xiii) Powdering of Sang-e-Surma

Sang-e-Surma is ground in a mortar and pestle (Kharal). The process of powdering is continued till the shine of the particles disappears and the powder is tested between the fingers for its fineness. If it is still coarse then the process is repeated till the highest degree of fineness is obtained. Similarly, all other drugs which are to be applied in the eyes are ground to the highest degree of fineness for which it is sieved through a piece of silk cloth to obtain the finest quality of Surma.

2. Ghasl-e-Adviyah (Cleaning of Drugs)

In order to prepare the drugs of moderate properties and action the drugs of plant, animal and mineral origin are washed with special method. This special method of washing is called Ghasl-e-Adviyah. The drugs which undergo this process are suffixed with the term Maghsool (washed) in respective formulae. A few of the drugs which are processed by this method are described below.

(i) Aahak (Choona)

Aahak (edible lime) is soaked in a large quantity of water, stirred well and allowed to settle down at the bottom. After settling down of the particles of Choona the water is decanted. Fresh water is again added to the sediment and stirred well. The process of addition of water to fine particles of Choona and decantation is repeated 7 to 8 times and the fine particles of the Choona are collected tin the end. The product thus obtained is called Choona Maghsool or Aahak Maghsool.

(ii) Hajriyat

Precious stones, like Shadjanj Adsi, Lajward, etc., are used after they are purified. The stone is ground to fine powder. Sufficient quantity of water is then added to be powder, stireed and allowed to settle down. The finer particles of the stone still suspended in the water will come out when decanted. The coarse particles will settle down at the bottom. These coarse particles are removed the ground till all the particles pass through the process of decantation. The decanted water is left undistrubed so that the finest particles are settled down at the botoom. Water is then removed and the particles when dried are finely powdered.

The drugs treated by the above method are called "Maghsool" viz. Shadnaj Adsi Maghsool, Sang-e-Surma Maghsool and Lajward Maghsool.

(iii) Raughan Zard or Ghee

Ghee is taken in a tin-coated metallic plate or Kansa (a metallic alloy) plate and water is poured over it. The Ghee is then rubbed with the hands for five minutes and the watery part is decanted. This process is repeated many times as indicated in the particular formula to obtain the Raughan Zard Maghsool.

(iv) Luk

First of all the visible impurities are removed from Luk. 30 gms. of Luk is finely powedered and ground in the decoction prepared by 15 gms. each of Rewand Chini and Izkhar Makki. The mixture is sieved through a piece of clean fine cloth, and when the fine particles of Luk settle down in the decoction, it is then decanted and the fine a particles of Luk are washed with water and dried to obtain the Luk Maghsool.

3. Tasweel-e-Adviyah (Sieving)

Sieves of different meshes are used in the process of powdering the drugs. Each sieve has a particular mesh number. The mesh number depends on the number of holes in the mesh in an area of 2.5 sq.cm. (1 square inch). If there are 20 holes, the mesh number is 40, if there are 30 holes, the mesh number is 60, for 50 holes the mesh number is 100. If coarse powder is required then sieve number 40 is used. For fine powders, sieves of highest number are used. Sieve of 100 mesh gives the finest powder. Powders are also sieved through a piece of muslin or thin silk cloth when the highest degree of fineness is required as in the case of preparation of Surma.

Joshandas (Decoctions) and Sharbats (Syrups) are filtered through a piece of clean thick cloth. Joshanda prepared for Sharbats are filtered through cotton pads to ensure a greater degree of homogenity and purity of the end product. Uniformly thick layers of cotton wool or double layered flannel cloth is spread over the sieve and the decoction is passed slowly through it. When a small quantity of fluid drug is required to be filtered, then a filter paper or a flannel cloth is used. The pulpy drugs like Maweez Munaqqa, Anjeer etc., are first cleaned by washing and then soaked in water and boiled till they become a soft mass. They are then removed from the water, allowed to cool, squeezed and the pulp is sieved through a metallic sieve or a piece of cloth.

Turanjabeen is first socked or boiled in water. When dissolved completely the solution is filtered through a piece of clean fine cloth and kept in a vessel to allow the impurities to settle down. The solution is then decanted into another container without disturbing the sediments.

5.1.3 Tadbir-e-Adviyah (Detoxification of Drugs)

Some of the plant, animal and mineral origin drugs are naturally toxic in their properties and actions. Therefore, these drugs before making the medicines are detoxicated or purified in order to enhance their therapeutic action and reduce their toxicity. The process of detoxification of the drug is called Tadbir-e-Adviyah and the drugs which undergo this process are suffixed with the term "Musaffa". Different processes of detoxification are employed for different drugs. Details of these processes for a few important drugs are described below. These should be referred along with the process prescribed in the original texts.

(i) Afyun

Dissolve Afyun in Arq-e-Gulab and filter it. The filtrate is heated till it became thick for making the Habb (Pills).

(ii) Sibr (Aloe)

Keep sibr in Apple or Bahi or Shalgham, cover it by the process of Kapoorti, heat it, till it turn brown. Now take out the elva, dry it and use.

(iii) Bhang

Soak the Bhang in Arq-e-Ajwain and dry it. Now keep it in an earthen pot, heat it to roast.

(iv) Zeera Siyah

Dip Zeera Siyah is sirka (the level of sirka should be 2 inch above the level of Zeera Siyah) for three days. After three days, Zeera Siyah is taken out and dry it to use.

(v) Rasaut

Rasaut is cut into small pieces and soaked in Araq-e-Gulab for 24 hours. It is then stirred well and sieved through a clean piece of fine cloth into a big cylindrical glass jar and the sediments are allowed to settle down. The liquid is then decanted into another vessel without disturbing the sediment and boiled till it becomes a thick mass. The purified Rasaut is called Rasaut Musaffa.

(vi) Anzaroot

Anzaroot powder is mixed with Mother's Milk or Donkey's milk to form a paste. The paste is smeared over a piece of Jhao wood (Tamarix wood) and dried directly over a charcoal fire.

(vii) Bhilawan

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

(viii) Habb-us-Salateen (Jamalgota)

25 grams of the kernels of Jamalgota is tied in a cloth bag and boiled in one litre of Cow's milk giving sufficient time till the milk becomes dense. When cooled, the kernels are taken out from the bag and the embryo part (pitta) of the seeds is removed to obtain jamalgota Mudabbar.

(ix) Chaksu

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

(x) Azaraqi

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

(xi) Kibreet (Gandhak)

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

(xii) Samm-ul-Far (Sankhiya)

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

(xiii) Shingraf

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

(xiv) Seemab

There are three following methods of purifying Seemab :

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

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

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

(xv) Khabs-ul-Hadeed

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

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

(xvi) Beesh (Bachnak or Meetha Telia)

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

(xvii) Hartal

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

(xviii) Sang-e-Surma

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

(i) A piece of Sang-e-Surma is covered with the goat's fat and kept on a low fire till all the fat is completely burnt into fumes. The pieces of Sang-e-Surma is then removed from the fire with a tongs and immersed in Araq-e-Gulab or ice water. The whole process is repeated three times.

(ii) A piece of Sang-e-Surma is immersed in Araq-e-Gulab or Araq-e-Badiyan and heated till the Araq evaporates. This process is repeated seven times.

(iii) Sang-e-Surma is immersed in Aab-e-Triphala and boiled for 12 hours.

(iv) Sang-e-Surma is kept immersed in rain water (Aab-e-Baran) for 21 days.

(xix) Ajwayin and Zeera

Either of the above drugs are soaked in Sirka Naishakar (Sugarcane Vinegar) for 72 hours. The level of sugarcane vinegar in the container should be 5 cms. above the level of the drug. The drug is then removed and allowed to dry and then roasted over a low fire before use. Besides purifying, Sirka naishakar (Sugarcane Vinegar) also enhances the efficacy of the drug.

5.1.4 Neem-Kob (Bruising)

Neem-Kob is the process by which hard and fibrous drugs (roots, stems, seeds etc.) are crushed to small pieces in an iron mortar and softened in order to obtain the maximum efficacy, when used in the preparation made by the process of decoction or infusions. The word "Neem Kofta" is suffixed to the name of the drug in the recipe/formula which has to undergo this process.

5.1.5 Tahmiz-o-Biryan-e-Adviyah (Roasting or Parching)

(a) Tahmiz (Roasting or Parching with a medium)

Tahmiz is a process in which the drugs like Chana (Gram), Jau (Barley) etc., are roasted with some medium e.g. when Chana or Jau is roasted with sand til they get swelled.

(b) Biryan (Roasting or Parching without medium)

In the process of Biryan, drugs are parched or roasted without medium e.g. drugs like Shibb-e-Yamani, Tankar, Tootiya-e-Sabz, etc. are directly put over fire in any vessel or frying pan and roasted.

5.1.6 Tarviq-e-Adviyah

In this process the juice of the fresh herb is poured in a tin-coated vessel and heated over low fire till a green froth appears on the surface. The juice is then slowly sieved through a piece of fine

cloth leaving behind the froth on the surface of the cloth. The watery juice thus obtained is called Aab-e-Murawwaq.

In case of dry herbs, a decoction is first made to which a small quantity of fresh Lemon or Alum powder is added. This will separate the green contents from the decoction. The aquous portion is decanted and stored.

WEIGHT AND MEASURE

METRIC EQUIVALENTS OF UNANI CLASSICAL WEIGHT

1 Chawal	=	15 mg
1 Ratti	=	125 mg
1 Dang	=	500 mg
1 Masha	=	1 g
1 Dirham	=	3.5 g
1 Misqal	=	4.5 g
1 Tola	=	12 g
1 Dam	=	21 g
1 Chhatank	=	60 g
1 Pao	=	240 g
1 Ser	=	960 g
1 Man Tabrizi	=	2 Kg 900 g
1 Oqia	=	32 g
1 Astar	=	1 Kg
1 Surkh	=	125 mg
1 Ratal Tibbi	=	420 g
1 Qeerat	=	250 mg

In case of liquid the metric equivalents would be the corresponding litre and millitre.

BIBLIOGRAPHY

S.NO.	NAME OF BOOK	AUTHOR	PUBLISHED BY
1.	National Formulary of Unani Medicine (English version) Vol. I	Department of Health Ministry of Health & F.W.	Government of India Publication, New Delhi.
2.	Kitabul Adviya	Hakim Kabiruddin	Daftar Al-Maseeh, Karol Bagh, N. Delhi.
3.	Muheet-e-Azam	Hakim Azam Khan	Matab Nizami,Kanpur (1303 H).
4.	Khazain-ul-Adviya	Hakim Najmul Ghani	Barqi Press, Lahore (1926)
5.	Makhzanul Adviya Ma Tohfatul Momineen	Mohammad Husain Shirazi	Matba Munshi-Nawal Kishore, Lucknow (1874).

*****