THE UNANI PHARMACOPOEIA OF INDIA

PART - I

VOLUME - I

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

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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. 235/-
Foreign – US $48

ISBN: 81-87748-00-X

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

FOREWORD

Unani System of Medicine is based on the drugs originated from plants, animals and minerals. The system is as old as humanity. In recent years, there has been a renewed interest in the indigenous/traditional system of medicine in both developing and affluent countries of the world, particularly because of the fact that these drugs have no major side-effects and accelerate the immunity of body resistance unlike modern medicine. Furthermore, Unani, Ayurveda and Siddha drugs are time-tested, centuries old, safe for use and cost effective. However, there is a need to maintain their purity, quality and safety by subjecting the finished products to rigorous scientific testing and to lay down pharmacopoeial standards for both Singh and Compound drugs to bring them within the purview of Drugs and Cosmetics Act, 1940, as amended in 1964. This necessitated the working out of the standards for each drug.

To fulfil the above objectives, The Government of India set up in 1964 the Pharmacopoeial Committee for Unani Medicine. Simultaneously, a Pharmacopoeial Laboratory of Indian Medicine was also established in the year 1970. This Laboratory was established mainly to work for evolving standards for Ayurveda, Unani and Siddha drugs. The Unani Pharmacopoeia Committee, as a result of extensive deliberations complied a National Formulary of Unani Medicine containing 441 formulations and this was published by the Ministry of Health and Family Welfare in 1981.

The Government of India have all along been concerned with the quality of drugs in various Indian Systems of Medicine and consequently, the work in this direction was taken up by the Laboratory concerned. I am glad to say that it has now been possible to bring out the first volume of pharmacopoeial standards entitled “UNANI PHARMACOPOEIA OF INDIA (PART-I)”. It comprises standards for 45 Single drugs of plant origin included in the National Formulary, Part-I, and work on which has been carried out at Pharmacopoeial Laboratory, Ghaziabad. This would set pace for evolving standards in Unani Medicine and help researchers, pharmaceutical houses and Government of India to enforce Drug control measures on these drugs in order to maintain their quality, purity and safety for human consumption.

With the setting up of a separate Department of ISM & H, we have focussed our attention on accelerating the pace of this work and currently, the work of laying down pharmacopoeial standards for more than 5000 drugs of Indian System of Medicines (ISM), of both plant and animal origin is in full swing. Government of India have identified 29 drugs testing laboratories across the country to take-up the work on single and compound formulations during the Ninth Five Year Plan, and to publish the subsequent volumes providing data on pharmacopoeial standards for various drug investigated.

I take this opportunity to express my sense of commendation to PLIM, Ghaziabad and the experts of Unani Pharmacopoeia Committee, along with the technical and administrative staff of the Department for their valuable contribution and help in accomplishing this task.

I also wish to state here that Government of India, Ministry of Health and Family Welfare is fully aware of the fact that being a first effort of its kind in the field of Unani System, there may always be room for further review and improvement. The suggestions and advise from the experts and scientists of this fields will, therefore, be welcome and most valuable in bringing out subsequent improved editions.

Sd/-
(SMT. SHANTA SHASTRY)
Secretary To Government of India
Ministry of Health & Family Welfare
Deptt. of Indian Systems of Medicine & Homoeopathy

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APPENDICES

LEGAL NOTICES

In Indian, there are laws dealing with certain drugs which are the subject of monogrphs which follow. These monographs should be read subject to the restrictions imposed by these laws wherever applicable.

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

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

Under the Drugs and Cosmetics Act, the Unani Pharmacopoeia of India (U.P.I.) Part-I Vol. I is the book of Standards for single drugs included therein and the standards prescribed is the Unani Pharmacopoeia of India Part-I Vol. I would be official. It considered necessary these standards can be amended and the Chairman of Unani Pharmacopoeia Commiittee is authorised to issue such amendments. Wherever such amendments are made, the Unani Pharmacopoeia of India Part-I, Vol. I would be deemed to have been amended accordingly.

GENERAL NOTICES

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

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

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

Other names: Other names of the drug appearing in each monograph in Arabic, Persian, English, Hindi, Urdu and other Indian regional languages have been mentioned as found in the classical texts, National Formulary of Unani Medicine Part-I and as procured from experts, scholars of Unani Medicine and officials working in the same field in different 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 of fractions of a gram (g) or milligram (mg).

Fluid measures are given in multiples or fractions of milliliter (ml).

When the term "drop" is used, the measurement is to be made by means of a tube which delivers in 20 drops, I gram of distilled water at 150C.

Metric measures are required by the Pharamacopoeia 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 the temperature.

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

The term "foreign matter" is used to designate any matter which does not form part of the drug as defined by the monograph. Vegetable drugs used as such or in formulations should be

duly identified and authenticated and be free from insects, pests, fungi, micro-organisms, pesticides and other animal matter including animal excreta and be with in the permitted and specified limits of lead, arsenic and heavy metals and not showing abnormal odour, colour, sliminess, mould or other evidence of deterioration.

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

The quantitavtive tests, e.g., total ash, acid soluble ash, water soluble ash, alcohol soluble extractive, water soluble extractive, other soluble extractive, moisture content, volatile oil content and assays are methods upon which the standards of Pharmacopeia depend. The methods for assays are described in their respective monographs and for others corresponding reference of appropriate appendix is given. The analyst is not precluded from employing on aternate method in any instance if he is satisfied that the instance, the methods of micro analysis of equivalent accuracy may be substituted. However, in the event of doubt or dispute, the methods of analysis of the Pharmacopoeia alone are authoritative.

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

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

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

Percentage of solutions: In defining standards, the expression per cent is used according to circumstances, with one of four meanings in order that the meaning to be attached to the expression in each instance may be clear, the following notations are used per cent w/w (Percentage weight in weight) expresses the number of grammes of active substance in 100 grammes of product.

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

Percentage of alcohol, all statements of alcohol (C_2H_5OH) refer to percentage by volume at 15.56^0C.

Temperature: Unless, otherwise specified all temperatures refer to the centigrade (Celsius) thermometric scale.

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

Reagents and Solutions: The chemicals and reagents required for the tests in Pharmacopoeia are described in appendices.

Solubility: When stating the solubilities of chemical substances, the term soluble is necessarily sometimes used in general sense irrespective of con-comittent chemical changes.

Statements of solubilities which are express as a precise relation of weights of dissolved substance ot 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.

Phamacopoeial chemicals when disssolved may show slight physical impurities, such as, fragment of filter papers, firbers and dust paritcles unless excluded by definits 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 I gramme of a solid or 1 milliliter liquid is soluble in that number of milliliters of the solvent represented by the stated number of parts.

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

The following table indicates the meaning of such terms:-

Descriptive terms	*Relative quantities of solvent for 1 part of solvent.*
Very soluble	less than 1 part
Freely soluble	From 1 to 10 parts
Soluble	From 10 to 30 parts
Sparingly soluble	From 30 to 100 parts

Slightly soluble	From 100 to 1000 parts
Very slightly soluble	From 1000 to 10,000 parts
Practically insoluble	More than 10,000 parts

Therapeutic uses and important formulation: Therapeutic uses and important formulations in this Pharmacopoeia are as provided in recognised unani classics and in the National Formulary of Unani Medicine (Part-I)

Doses: The does 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 does in metric and Unani System set forth in the text is of approximate quivalence. These quantities are for convenience of prescriber and sufficiently accurate for Pharmacopoeial purposes.

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

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

PREFACE

Our country having a unique distinction of veriety of geographical and climatic condition and rich in Flora and fauna many of which are used in the preparation of Poly pharmaceutical recipes of Unani Medicine and a few as home remidies in the country.

Unani system of Medicine has distinction of being a scientific system and its practitioners were 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.

During Colonical rule, the Unani system of Medicine got a set back as it was not patronised by the Government in power, was confined to the rural areas where it was protected and nurtured.

Urbanisation led to neglect of development and maintenace of forest and intern the availability of rich flora. Later because of better communication, transport and establishment of Agencies for supply of Crude drugs, let ot commercial manufacturing of Unani drugs on mass scale and many factories were established. In this set up the Unani practitioners could no longer processes and prepare their own medicines, but started depending on Pharmaceutical houses run commercially and on supplier of the crude durgs to the extent they needed. There was no any governmental control on the manufacturer/Pharmaceutical houses to ensure the quality of medicines marketed.

The Government of India constituted a committee under the Charimanship of Lt. Col. R .N. Chopra in 1946, which had gone into the question of need for proper identification of plants used in Indian System 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, there marketing and manufacturing was given a concrete shape.

In compliance with the recommendation of various committees constituted by Unani Government, the CCRIMH was established in 1969 by the Government of India for Research in all aspects including Drug Standardisation in Indian Medicine and Homoeopathy. In 1978, this Council was divided into four reserach councils and the research work in Unani system of Medicine was entrusted ot Central Council for Research in Unani Medicine.

The Pharmacopoeial Laboratory of Indian Medicine, Ghaziabad was established in 1970 for testing and standardisation 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. Inspite of repeated efforts by Unani Pharmacopoeia committee and individual Unani experts at various levels. The Central Council for Research in Unani Medicine have six survey units in different states and also established standardisation work of single and compound medicine at seven Drug Standardisation Research Units established by the Council.

The First Unani Pharamacopoia Committee was constitued in 1964 under the Chairmanship of Col. Sir Ram Nath Chopra The Committee was reconstituted in 1968, 1977, 1988 under the Chairmanship of Dr. Hussain Zaheer, Dr. Md. Yusufuddin Ahmed and Dr. A.U. Azmi respectively under taking the work of Unani Pharmacopoeia of India.

After the publication of First part of the National Formulary of Unani Medicine consisting of 441 formulations, the second part of National Formulary of Unani Medicine consisting of 202 formulations was prepared and submitted to the Ministry for publication. The third part of Formulary is under publication process. In this processes, a list of singel drugs which goes into the formulation emerged and the committee applied its minds to the task of collection of data from various sources such as PLIM / CCRUM where the experimental work has been carried out and data produced.

With the uniformity in the Educational pattern of Unani System of Medicine all over the country, the Government decided that there should be uniformity in the Unani Medicine marketed. In so far as their identity, strength and purity and concerned and to assure the quality of the medicine, throught proper drug control measures. To serve the pulic and the profession, the Government has published National Formulary of Unani Medicine Part - I and the Unani Pharmacopoeia Committee has completed the Unani Pharmacopoeia of India, Part-I for better quality assurance.

The Government of India have brought the Unani drugs under the perview of the Drugs and Cosmetics Act 1940. The publication of the National Formulary of Unani Medicine and the Unani Pharmacopoeia of India Part - I could help the Government, a base for enforcement of the Act in respect of the standard.

The Unani Pharmacopoeia Comittee has made a modest attempt to lay down norms of the single drugs, based on the experimantal data worked out at PLIM. Gahziabad and Drug Standardisation Resarch Units of Central Council for Research in Unani Medicine. The modern medicine in Western countries have also passed through this phase deccades ago. The Unani Pharmacopoeia Committee has made a beginning in this direction with regard to compilation of the Unani Pharmacopoeia of India Part - I. The Unani Pharmacopoeia of India Vol. I comprises 45 monograph of single drugs of plant origin which are used in one or more formulations enlisted in the National Formulary of Unani Medicine, Part -I. In compiling the monographs the title of each drug has been given as in the Unani literature. The definition

of the drug giving its identity is in scienctific 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 language. The monograph records the detailed gross and Microscopic description of the drug and its Mircroscopic tissue structures etc., having a Pharmacognostic value in identification especially when the drug in powder form.

The monograph also gives the details of chemical constituents physico-chemical standards and an assay, pH value, extractive valves and TLC behaviour of petroleum ether ($60\text{-}80^0$) extract.

In the efforts to compile pharcacopoeial mongraphs 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 ever though there is no specific established experimental method to quantify them is available for the time being.

The Legal Notics and General Notices have been included for the guidance of the analysts, manufacturers, research workers and pharmacies angaged in the field. Details about the equipments, reagents and solutions, tests, method of preparation of specimens for microsopical examination are given in appendices.

The Unani Pharmacopoeia Committee feels that with the publications of Unani Pharmacopoeia of India - Part - I comprising of 45 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 plant the research so that the out put of work could be accelerated.

The Unani Pharmacopoeia Committee request the Government of India to pass an Ordinance/Act for the adoption of the Unani Pharmacopoeia of India 1988 Volume I, and bring it under the preview of the Drug and Cosmetics Act, 1940.

On behalf of the Unani Phamacopopeia Committee, I feel it is my duty to place on records out sincere thanks and apreciation of the Government of India, PLIM, Ghaziabad, CCRUM, 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 Hakim (Mrs) Aliya Aman, Dy. Advisor(U) and Member Secretary - Unani Pharmacopoeia Committee, her collegues Hakim Shamsul Afaq, R.O. (U), Hakim Syed Ahmed Khan, A.R.O.(U), Hakim M. Jalees Subhani, R.A.(U), Sh. N. Padma Kumar, R.A. (Bot), Sh. Ashok Kumar, R.A. (Chem), Shri Ramesh Kumar, Asstt. Secretary APC, Unani Pharmacopoeia Committee and his staff.

Shri Rais Ahmed, Urdu typist and other office colleagues have done a good work in convening this meetings of the Unani Pharmacopoeia Committee and completing this work, deserves my thanks.

I also thank Dr. R. U. Ahmed, Director PLIM and their colleagues for their help in making the technical data available to the Unani Pharmacopoeia Committee.

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

PROF. HAKIM SYED KHALEEFATHULLAH
CHAIRMAN
UNANI PHARMACOPOEIA COMMITTEE

NEW DELHI
DATED: 20TH JUNE 1997

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 frim roots in India.

Unani System prefers treatment through single drugs and their combination in raw form, rather than compund formulations. In Unani System there is a freat emphasis on propers 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 practising physician was solely responsible for identification and collection of single drugs, the manufacturing process of compound formulation was done by the physician themselves. In the process he was free to substitute any drug and change fromulation. All this lead to a state of confusion and uncertainly about the identification of single drugs and also lack of uniformity in compound formulations.

Commercialisation 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 utlilise the existing law “The Drug & Cosmetci Act, 1940” to control the Unani, Ayurvedic & Siddha Drugs in a limited manner. The act was accordingly amended in 1964, namely

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

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

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

To achieve the desired effects of drugs on the patients, it is essential to procure the standard and authenticated single drugs, and subsequently the compound formulations. For this very purpose, there is an urgent need to develop the pharamcopoeial standards of Unani medicines, 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 commercialisation the Government of Indian 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 Pharmacopoeis 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 Standards Institution, Manak Bhawan, 9, Bahadur Shah Zafar Marg, New Delhi.	Member
4.	Hakim Syed Mohd. Shibli Seniour Lecturer, Nizamia Tibbi College, Hyderabad	Member
5.	Dr. S. Prasad Head of the Pharmaceutical Deptt. 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 Tibba College, Karol Bagh New Delhi	Member
10.	Hakim Shakeel Ahmed Shamsi Principal, Takml-ul-Tibba 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, Adviser om ISM, Ministry of Health New Delhi	Member Secretary

The Unani Pharmacopoeia Committee was reconstitued 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, Malika 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	
8.	Hakim Abdul Ahad Deputy Director Health, (Indian Medicine) Govt. of Bihar Patna	Member
9.	Dr. P.N.V. Kurup Adviser in Indian Systems of Medicines Department of Health & Urban Development, New Delhi	Member Secretary (ex officio)

10.	Hakim M.A. Razzack, Senior Research Officer (Unani) Department of Health & Urban Development, New Delhi.	Associate Secretary

On expiry of the tenure of three years in Office of the second committee, on 14th November, 1971, the Government of India extended its term by another three years, vide their notification no. F.62/72-APC dated 25th October 1972 with effect from 15th November 1971, Hakim Shakil Ahmed Shamsi, Hony, Secretary Takmil-ul-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 furter 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 Pharamacopoeia Committee was reconstituted by the Government of India vide their notification no.X. 19018/1/76-APC 10th February, 1977, under the Chairmanship of Dr. Mohd. Yusufuddin Ansari, Professor and Head 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 Buildings Delhi.	Member
3.	Hakim Shakeel Ahmed Shamsi Hakim Abdul Aziz Road Lucknow	Member
4.	Hakim S.M. Shibli, Hony. Director Central Research Institute for 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 Faiyaz Alam 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, Professor & 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	
13.	Hakim M.A. Razzack Deputy Adviser (Unani) Ministry of Health and Family Welfare, New Delhi.	Member Secretary

After completing the duration, the U.P.C., was again reconstituted in 1988 vide notification no. U. 20012/1/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. Saiffuddin Ahmed Hakeem, Mahmoodul Haq Road Meerut, U.P.	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 (N.P.)	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, (A.P.) - 500 001	Member

10.	Hk. Mohd. Qayamuddin Principal, Ajmal Khan Tibbia College A.M.U, Aligarh U.P. - 202 001	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 Nartional Bureau of Plant Genetic Resources, Pusa Road New Delhi	Member
13.	Dr. A.H. Israily Div. Manager, Hamdard (Wakf) Laboratory, Hamdard Marg, Lalkuan, Delhi - 110 006	Member
14.	Dy. Adviser (Unani) Ministry of Health & F.W New Delhi	Member Secretary

Keeping in view the vacancy in Dy. Adviser (U) in the Ministry of Health & F.W since 1984, the Govt. of India has decided that till such time and until further order, Ressearch Officer (Unani) shall function with immediate effect as Member Secretary of Unani Pharmacopoeia Committee reconstituted vide this Ministry's order no. U. 20012/1/87-APC dated 13/15-6-1988.

The present 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, Bharti Salai, Madras - 600 005.	Chairman

2.	Hakim Iqbal Ali 11-4-614/6-3, Bazar Guard Hyderabad, A.P. - 500 004.	Member
3.	Hakim Faiyaz Alam Director, Islahi Dawakhana, Fancy Mahal Mohd. Ali Road, Bomday - 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 Illmul Adviya, A.K. Tibbia College, A.M.U., Aligarh U.P. - 202 001.	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. M. Khalid Siddiqui Director, CCRUM, 61-65, Institutional Area, Janakpuri, New Delhi	Member
10.	Hakim M.A. Wajid, C.R.I.U.M Opp. E.S.I. Hospital Eragadda, Hyderabad, Andhra Pradesh.	Member
11.	Hakim (Mrs) Ummul Fazal Dy. Director, CCRUM, 61-65, Institutional Area Janakpuri, New Delhi.	Member
12.	Prof. M.S. Y. Khan Dept of Pharmaceutical Chemistry, Jamia Hamdard, Patiala, Punjab.	Member
13.	Dr. S.S. Handa Deptt. of Pharmaceutical Chemistry, Patiala Unversity, 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 U.P. - 202 001	Member

16. Hakim (Mrs) Aliya Aman — Member Secretary
Dy. Adviser (U)
Deptt. of ISM & H
Ministry of Health & F.W.
Red Cross Building Annexe,
NewDelhi.

2. The functions of the committee shall be as follows :-

(a) (I) To prepare official formulary of compound formulations/preparations which are frequently used in Unani Practice throughout the country, and

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

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

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

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

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

The 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 staff working in the Ministry of Health & Family Welfare, Department of Indian System of Medicine and Homoeopathy in bringing out this volume.

The Committee is also grateful to the Director Pharmacopoeial 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 prepared and published National Formulary in Unani Medicine-I consisting of 441 formulation. The Unani Pharmacopoeia Committee has also prepared National Formulary in Unani Medicine - II consisting 202 formulations which is ready for publication.

As far as the pharmacopoeial standards for Unani Medicine are concerned, the Pharmacopoeial Committee considered various aspects relating to the developing of pharmacopoeial standards. The laboratory work for the development of standards is being carried out by the Pharmacopoeial Laboratrory

of Indian Medicine. So far 45 monographs of single drugs of plants origin used in Nationl Fromulary of Unani Medicine - I has been finalised by the present Unani Pharmacopoeia Committee. The format adopted for laying down standards has been prepared more or less on the patten of different pharmacopoeial of Herbal medicines.

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

The Unani Pharmacopoeia Committee welcomes the efforts taken by the Department of Indian System of Medicine, Ministry of Health & Family Welfare in identifying 29 laboratories through out the country for carrying the pharmacopoeial work on single and compound drugs of Indian System of Medicine.

The Unani Pharmacopoeia Committee also has agreed to take up the work of standardisation (single drugs and compound formulations) already done by the units of Central Council for Research in Unani Medicine, Scrutinize them and approve them for inclusion in the Unani Pharmacopoeia of India.

MONOGRAPHS

PHARMACOPOEIAL STANDARDS OF SINGLE UNANI DRUGS

AAK

Drug Aak (Madar) consists of dried leaves of *Calotropis pocera* (Ait). R. Br. of Asclepiadaceae family. Drug yielding plant is found wild more or less throughout India.

OTHER NAMES:

Arabic	:	Ushr
Persian	:	Khark, Zaharnak
Assamese	:	Akand, Akan
Bengali	:	Akanda, Akone
English	:	Madar Tree, Gigantic-Swallow-Wort, Mudar.
Gujarati	:	Akado, Aakado, Akda, Myhara, Retoakah
Hindi	:	Aak, Madar
Kannada	:	Ekka, Ekkemale, Arkagida
Kashmiri	:	Aeka
Malayalam	:	Erikka, Erikku, Vallerikku
Marathi	:	Lalrui, Akanda, Lalakara
Oriya	:	Akondu, Bikkortono, Kotuki
Punjabi	:	Ak
Sanskrit	:	Surya Patra, Arka, Alarka, Mandara
Tamil	:	Erukku, Badabadam, Yercum
Telegu	:	Jilledu, Mandaramu, Ekke, Arkamu, Nallajilledu
Urdu	:	Madar, Aak:

DESCRIPTION:

a) **Macroscopic:** Subsessile, 6-15 cm by 4.5-8 cm. by Broadly ovate, ovate-oblong, elliptic or obovate acute, pubescent when young and glabrous on both sides on maturity.

b) **Microscopic :**

Midrib: Transverse section through midrib shows an upper and lower single layered epidermis externally covered with thick, striated cuticle, few epidermal cells on both surfaces of leaf elongated to form uni-seriate, 2-3 celled trichomes; epidermal cells cubical and radially elongated, epidermis of followed by 3-8 layered collenchyma on both lower and upper surfaces parenchymatous cells thin-walled, is odiametric to circular with intercellular spaces present in ground tissue; stele crescent shaped, composed of bicollateral open vascular bundle, xylem consists mostly of vessles and tracheids, a strip of cambium present between xylem and phloem tissues; laticifers also present in the phloem and parenchymatous zone.

Lamina: dorsiventral with mesophyll differentiated into a palisade and spongy tissue, upper andn lower epidermis covered externally with a thick, striated cuticle, below upper epidermis three rows of elongated, closely arranged palisade parenchyma present, spongy parenchyma tissues almost radially elongated with intercellular spaces, central, cells irregular is shape, laticifers and vascular bundles also present scattered in this region.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total Ash	:	Not more than 21 per cent
Acid-insoluble ash	:	Not more than 5 per cent
Alcohol-soluble extractive	:	Not less than 5 per cent
Water soluble extractive	:	Not less than 24 per cent
CONSTITUENTS	:	Glycoside (Calotropin)
ACTION	:	Mohallil-e-Warm, Munaffis-e-Balgham, Hazim, Jali, Qatil-e-Deedan-e-Ama.
THERAPEUTIC USE	:	Zeequn Nafas, Waj-ul-Mafasil, Bawaseer, Zaheer, Jiryan, Deedan-e-Ama
DOSE	:	(External Use)
IMPORTANT FORMULATIONS	:	Raughan-e-Haft Barg, Raughan-e-Chahar Barg

AAMLA

Drug Aamla consists of pericarp of dried mature fruits of *Emblica officianalis* Gaertn. Syn. *Phyllanthus emblica* Linn. of Euphorbiaceae family. Drug is mostly collected in winter season after ripening and in kashmiri in summer. Drug yielding plant is a small or medium sized tree, found both in natural state in mixed deciduous forests of the country ascending to 1300 m on hills, cultivated in gardesn, homeyards of grown as a road side tree.

OTHER NAMES:

Arabic	:	Amlaj
Persian	:	Aonla, Amla, Amuleh, Amial
Assamese	:	Amlaku, Amlakhu, Amluki, Ambali, Sohmyrlain.
Bengali	:	Amla, Dhatri, Amlaki, Amlati
English	:	Emblic Myrobelan, Indian Goosebery
Gujarati	:	Ambala, Amala
Hindi	:	Amla, Aonla, Amlika,
Kannada	:	Nallika, Nelli, Amalaka, Nellikkai
Kashmiri	:	Ambali, Amli Aonla
Malayalam	:	Nellikka, Nellikai, Nelli
Marathi	:	Anvala, Avolkathi, Avala, Arda, Bhuiawali, Aonli
Oriya	:	Gondhona, Amlaki, Ahalu
Punjabi	:	Amla, Ambli, Ambal
Sanskrit	:	Dharti-phala, Amraphalam, Amalku, Adiphala
Tamil	:	Nellikkai, Nelli, Topi Amalagam
Telegu	:	Usirikayi, Nelli, Amalekamu, Usiri, Triphalam Usirikai
Urdu	:	Aamla, Amlaj

DESCRIPTION:

(a) **Macroscopic:** Drug consists of curled pieces of pericarp of dried fruit occurring either as saperated single segment; 1-2 cm long or united as 3 or 4 segments; bulk colour grey to black, pieces showing a broad, highly shriveled and wrinkled external convex surface to somewhat concave, transversely wrinkled lateral surface, external surface shows a few whitish specks, occasionally some pieces show a portion of stony testa (which should be removed before processing); texture rough cartilaginous, tough; taste, sour and astringent.

(b) **Microscopic :** Transverse section of fruit epicarp consisting of a single layered epidermis, cell appearing tabular and polygonal in surface view; cuticle present, mesocarp cells tangentially elongated parenchymatous and crushed, differentiated roughly into a peripheral 8 or 9 layers of tangentially elongated smaller cells, rest consisting of mostly isodiametric large cells with walls showing irregular thickenings, ramified vascular elements occasionally present; stone cells present either isolated or in small groups towards endocarp; pitted vascular fibers, walls appearing serrated due to the pit canals leading into lumen.

Powder: Fine powder shows epidermis with uniformly thickened straight walled, isodiametric parenchyma cells with irregular thickened walls, occasionally short fibers and tracheids.

IDENTITY, PRURITY AND STRENGTH:

Foreign matter (including seed and seed coat)	:	Not more than 2 per cent
Total Ash	:	Not more than 7 per cent
Acid-insoluble Ash	:	Not more than 2 per cent
Alcohol-soluble extractive	:	Not less than 40 per cent
Water-soluble extractive	:	Not less than 50 per cent

CONSTITUENTS	**:**	Ascorbic acid and gallo tannins
ACTION	**:**	Muqawwi-e-Qalb, Qabiz, Musakkin, Muqawwi-e-Dimagh
THERAPEUTIC USE	**:**	Zof-e-Dimagh, Nisyan, Suda, Qarha-e-Meda, Humuzat-e-Meda, Ishal
DOSE	**:**	3 to 5 g.
IMPORTANT FORMULATION	**:**	Anoshdaru, Murabba-e-Amla, Majoon-e-Maqawwi-e-Rahem, Majoon-e-Mundi, Majoon-e-Lana, Majoon-e-Kundur, Qurs-e-Mulaiyin Jawarish-e-Aamla Sada, Sufoof-e-Hazim Kalan, Dawa-ul-Misk Motadil Sada, Itrifal, Zamani, Itrifal-e-Sagheer, Itrifal-e-Ustu-Khuddus, Sufoof-e-Aamla.

ASGAND

Drug Asgand consists of dried mature roots of *Withania somnifera* Dunal. of Solanaceae family; Drug yielding plant is perennial shrub, found in waste land, cultivated in fields and open grounds throughout India; widely cultivated in certain areas of Madhya Pradesh and and Rajashtan; roots collected in winter, washed and cut into short pieces.

OTHER NAMES:

Arabic	:	Kakanj Hindi
Persian	:	Asgandh Nagori, Kaknja-e-Hindi
Assamese	:	Asgvagandha
Bengali	:	Ashvagandha, Asvagandha
English	:	Winter cherry
Gujarati	:	Asgandha, Asundha, Asana, Ghodakun, Asoda, Asan
Hindi	:	Asgandh, Punir
Kannada	:	Angarberu, Hirenaddina-Hire-gadday, Hiremaddina-Gadday, Virenaddlinagadda
Kashmiri	:	Asgandha
Malayalam	:	Amukkram, Pevette
Marathi	:	Asagandha, Askagandha, Askandhatilli Askandha, Kanchuki
Oriya	:	Asugandha
Punjabi	:	Asgandh, Isgand, Asgandnagar, Aksan
Sanskrit	:	Ashvaganadha, Gandhrapatri, Palashaparni, Varahapatri
Tamil	:	Amukkaram kizargu Amukkuran, Kilangee, Amukkira, Ashuvagandhi
Telegu	:	Pennerugadda, Asvagandhi, Penneru, Penneroogadda
Urdu	:	Asgand Asgand Nagori

DESCRIPTION:

(a) **Macroscopic:** Roots straight, unbranched, thickness varying with age, roots bear fiber like secondary roots, outer surface buff to grey-yellow with longitudinal wrinkles; crown consists of 2-6 remains of stem base; stem bases variously thicked; nodes prominent only on the side from where petiole arises, cylindrical, green with longitudinal wrinkles fracture, short and uneven; odour characterstic; taste bitter and acrid.

(b) **Microscopic:** Transverse section of root shows cork exfoliated or crushed; when present isodiamatric and non-lignified; cork cambium of 2-4 diffused rows of cells; secondary cortex about twenty layers of compact parenchymatous cells; phloem consists of sieve tubes companion cells, phloem parenchyma; cambium 4-5 rows of tangentially elongated cells; secondary xylem hard forming a closed vascular ring separated by multiseriate medullary rays; a few xylem parenchyma.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 7 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol (25 per cent) Soluble extractive	:	Not less than 15 per cent

Assay: Asgand consists of not less than 0.2 per cent of total alkaloids, when assayed as follows:-

Take about 30g. accurately weighed of the powdered drug, cover with Alcohal (90 per cent) and allow to stand over night. Extract for 6 hours in wet apparatus and concentrate to syrup residue. Treat with 25, 20 and 10 ml. portions of 5 per cent Sulphuric Acid unitl complete extraction of alkaloid is affected.

To the combined acid extracts add an excess of Dragandorf's reagent. Filter under suction and dissolve the residue in Acetone. Shake the Acetone solution with freshly prepared suspension of 2g. Silver Carbonate in 10 ml. of water. Filter the solution and wash the precipitate with Acetone, Alcohol and Water in that order. Pass sufficient Hydrogen Sulphide through the filtrate. Boil the Solution for 10 minutes, filter and evaporate under vacuum in tared flask. Add to the residue 5ml. of Ethyl Alcohol, evaporate to dryness, the process once again and weight the residue to constant weight in a vacuum dessicator.

CONSTITUTENTS	:	Alkaloids and Winthanolides.
ACTION	:	Mohallil-e-Warm, Muqawwi-e-Aam, Muqawwi-e-Meda, Muwalli-d-e-Mani, Musammin-e-Badan, Musakkin-e-Asab, Munawwim.
THERAPEUTIC USE	:	Sailan-ur-Rahem, Jiryan, Riqqat-e-Mani, Waj-ul-Qutn, Waj-ul-Mafasil, Zof-e-Bah.
DOSE	:	5 to 10 g.
IMPORTANT FORMULATIONS	:	Majoon-e-Sohag, Sonth, Majoon-e-Salab, Zimad-e-Mohallil, Kushta-e-Gaodanti

ASL-US-SOOS

Drug Asl-ul-Soos consists of dried, unpeeled, stolon and root of *Glycyrrhiza glabra* Linn. of Leguminosae family. Drug yielding plant is a tall perennial herb, upto 2 m high found cultivated in Europe, Persia, Afghanistan and to little extent in some parts of India.

OTHER NAMES:

Arabic	:	Asl-us-Soos
Persian	:	Beikh-e-Mehak
Assamese	:	Jesthimadhu, Yeshtamadhu
Bengali	:	Jeshtimadhu, Jaishbomadhu
English	:	Liquorice root, Sweetwood
Gujarati	:	Jethimadha
Hindi	:	Mulethi, Mulathi, Muleti, Jethimadhu, Jethimadh, Mulhatti
Kannada	:	Yeshtimadhuka, Atimadhura
Kashmiri	:	Multhi
Malayalam	:	Irattimadhuram, Athimadhuram, Yeshtimadhuram
Marathi	:	Jeshthamadha
Oriya	:	Jatimadhu, Jastimadhu
Punjabi	:	Jethimadh, Mulathi
Sanskrit	:	Yashtimadhu, Madhuka
Tamil	:	Athimadhuram, Antimadhuram
Telegu	:	Atimadhuramu, Yashtimadhukam
Urdu	:	Mulethi, Asl-ul-Soos

DESCRIPTION:

(a) **Macroscopic:** Stolon consists of yellowish brown or dark brown outer layer, externally longitudinally wrinkled, with occasional small buds and encircling scale leaves, smoothed transversely cut surface shows a cambium ring about one-third of radius from outer surface and a small central pith; root similar without a path; fracture, coarsely fibrous in bark splintery in wood; odour, faint and characteristic; taste, sweetish.

(b) **Microscopic:**

Stolon: Transverse section of stolon shows cork of 10-20 or more layers of tabular cells, outer layers with reddish-brown amorphous contents, inner 3 or 4 rows having thicker, colourless walls; secondary cortex usually of 1-3 layers of radially arranged parenchymatous cells containing isolated prisms of calcium oxalate; secondary phloem a broad band, cells of innerpart cellulosic and outer lignified, radially arranged groups of about 10-50 fibers surrounded by a sheath of parenchyma cells, each usually containing a prism of calcium oxalate about 10-35m long;

cambium form tissue of 3 or more layers of cells; secondary xylem distinctly radiate with medullary rays, 3-5 cells wide, vessels about 80-200m in diameter with thick, yellow, pitted, recticulately thickened walls; groups of lignified fibers with crystal sheaths similar to those of phloem; xylem parenchyma of two kinds, those between the vessels having thick pitted walls without intercellular spaces, the remaining with thin walls; pith of parenchymatous cells in longitudinal rows, with inter-cellular spaces.

Root: Transverse section of root shows structure closely resembling that of stolon except that no medulla is present; xylem tetrarch; usually our principal medullary rays at right angles to each other; in peeled drug cork shows phelloderm and sometimes without secondary phloem; all parenchymatous tissues containing abundant, simple, oval or rounded starch grains, 2-20m in length.

IDENTITY, PURITY AND STRENGTH:

Total Ash	:	Not more than 10 per cent
Acid-insoluble ash	:	Not more than 2.5 per cent
Alcohol-soluble extractive	:	Not less than 10 per cent
Water-soluble extractive	:	Not less than 20 per cent
CONSTITUENTS	:	Glycyrrhizin, Glycyrrhizic acid, glycyrrhetinic acid, asparagine, sugar, resin and starch
ACTION	:	Munzij, Muqawwi-e-Asab, Mohallil-e-Waram, Munaffis-e-Balgham, Kasir-e-Riyah, Mudirr-e-Baul, Muddirr-e-Hazi.
THERAPEUTIC USE	**:**	Sual, Khushunat-e-Halaq, Bohat-us-Saut Haad, Zeequn Nafas, Hirqat-ul-Baul
DOSE	:	3 to 7g.
IMPORTANT FORMULATIONS	:	Habb-e-Ghariqoon, Habb-e-Surfa, Habb-e-Surfa Qawi, Qurs-e-Zarishk, Dayaqooza, Lauq-e-Hulba, Lauq-e-Khiyar Shmabar, Lauq-e-Nazli, Lauq-e-Sapistan Lauq-e-Shamoon Lauq-e-Zeequn Nafas, Majoon-e-Mundi, Qairooti-e-Aarad-e-Karsana, Raughan-e-Sanan, Sharbat-e-Sadar.

ATEES SHIREEN

Drug Atees consists of dried, tuberous roots of *Aconitum heterophyllum* Wall ex. Royle of Ranunculaceae family. Drug yielding plant is a perennial herb, native of western Himalayas and found in Garhwal, Kumaon and Kashmir at altitude between 2500-4000m.

OTHER NAMES:

Arabic	:	Atees
Persian	:	Atees, Vaj-e-Turki
Assamese	:	Aatieh
Bengali	:	Ataieha
English	:	Indian Atees
Gujarati	:	Ativishni Kali ativikhani Kali, Atvasa, Ativish, Atavishnikali
Hindi	:	Atis, Atvika
Kannada	:	Athivisha, Athibage
Kashmiri	:	Hongisafed, Mohandiguj Safed
Malayalam	:	Atividayam, Ativitayam
Marathi	:	Ativisha, Atavish
Oriya	:	Atushi
Punjabi	:	Atisa, Atees, Bonga, Chitijari Sukhihasi
Sanskrit	:	Ativisha, Sitashringi Bangura, Pankura
Tamil	:	Ativadayam, Atividyam
Telegu	:	Ativasa, Ativasu
Urdu	:	Atees

DESCRIPTION:

(a) **Macroscopic:** Roots, ovoid-conical, tapering downwards to a point, 2.0-7.5cm. Long, 0.4-1.6 cm or more thick at its upper extremity, gradually decreasing in thickness towards tapering end, externally light ash-grey, white or grey-brown, while internally starch white, external surface wrinkled marked with scars of fallen rootlet and with a rosette of scaly rudimentary leaves on top; fracture, short, starchy, showing uniform white surface marked towards centre by 4-7 concentrically arranged yellowish-brown dots, corresponding to end of fibrovascular bundles traversing root longitudinally; taste, with not tingling sensations.

(b) **Microscopic** : Transvers section of mature root shows, single layered epidermis consisting of light-brown tabular cells rupturing on formation of cork; cork consists of 5-10 rows of tangentially elongated, thin-walled cells; cork cambium single layered consisting of tangentially elongated, thin-walled cells; cortex much wider consisting of tangentially elongated or rounded, thin-walled parenchymatous cells with intercellular spaces, cells fully packed with both simple

as well as compound starch grains, compound starch grain composed of 2-4 components of spherical body; endodermis distinct composed of barrel-shaped cells; elements of vascular bundles poorly developed, vascular bundles, arranged in a ring; inter-fascicular cambium present in the form of a ring composed of few layered thin-walled cells; central core consisting of thin-walled parenchymatous cells, possessing starch grains similar to those found in cortical cells.

Powder: Ash coloured to light brown; under microscope shows abundant simple and compound starch grains and parenchymatous cells.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total Ash	:	Not more than 4 per cent
Acid-insoluble Ash	:	Not more than 1 per cent
Alcohol soluble extractive	:	Not less than 6 per cent
Water-soluble extractive	:	Not less than 24 per cent
CONSTITUETNS	:	Alkaloids (atisine, dehydroatisine, hetisine and heteratisine)
ACTION	:	Daf-e-Humma, Qabiz, Habis-ud-Dam, Muqawwi-e-Meda, Moharrik-e-Asab.
THERAPEUTIC USE	:	Zof-e-Meda, Qai, Ishal, Zaheer-e-Muzmin.
DOSE	:	2 to 3 g.
IMPORTANT FORMULATION	:	Majoon-e-Joqraj Gugal

BABCHI

Drug Babchi consists of dry ripe fruits of *Psoralea corylifolia* Linn. of Leguminosae family. Drug yielding plant is an erect, 0.3-1.8 m. high annual herb, distributed throughout India, found commonly in Uttar Pradesh, Bengal and Maharashtra.

OTHER NAMES:

Arabic	:	Babchi
Persian	:	Babchi
Assamese	:	Habucha, Babchi
Bengali	:	Hakuchi, Bavachi, Lata Kasturi
English	:	Babachi, Babchi seeds
Gujarati	:	Bavacha, Babchi, Bawachi, Bakchi, Bhavaj
Kannada	:	Bauchige, Bhavanti buja, Bhavanchigid, Baukuchi, Baranchigida, Karbekhiya
Kashmiri	:	Babchi
Malayalam	:	Karkokil, Karpokhari, Kamkoalan
Marathi	:	Babachi, Babchi, Bavachi
Oriya	:	Bakuchi
Punjabi	:	Babchi, Bavachi
Sanskrit	:	Somaraji, Bakuchi, Sugandha Kantak
Tamil	:	Karpokarishi, Karpurarishi, Karporgam
Telegu	:	Bavanchalu, Bhavanji, Karubogi, Baaranchalu, Bapurlen, Baranchalu
Urdu	:	Babchi

DESCRIPTION:

(a) **Macroscopic**: Fruits, dark chocolate to almost black with pericarp adhering to the seed-coat,3-4.5mm long, 2-3 mm broad, ovoid-oblong or bean shaped, somewhat compressed, glabrous rounded or mucronate, closely pitted; seeds campylotropous, non-endospermous, oily and free from starch; odourless, but when chewed smell of pungent essential oil felt; taste, bitter, unpleasant and acrid.

(b) **Microscopic**: Transverse section of fruit shows pericarp with prominent ridges and depressions, consisting of collapsed parenchyma and large secretory glands containing oleo-resinous matter; testa, an outer layer fo palisade epidermis, layer of bearer cells which are much thickened in the inner tangential and basal radial walls and 2-3 layers of parenchyma; cotyledons of polyhedral parenchyma and three layers of palisade cells on the adaxial side.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 8 per cent
Acid-insoluble ash	:	Not more than 2 per cent
Alcohol-soluble extractive	:	Not less than 13 per cent
Water-soluble extractive	:	Not less than 11 per cent
CONSTITUENTS	:	Essential oil, fixed oil, psoralen, psoralidin, isopsoralen and bakuchiol.
ACITON	:	Musaffi-e-Dam, Mohammir-e-Jild, Muqawwi-e-Meda, Qatil-e-Deedan-e-Ama, Mulaiyin
THERAPEUTIC USE	:	Fasad-ud-Dam, Juzam, Bars, Bahaq Abyza.
DOSE	:	3 to 5 g.
IMPORTANT FORMULATION	:	Sufoof-e-Bars

BADIYAN

Drug Badiyan consists of dried ripe fruits of *Feoniculum vulgare* Mill. of Umbelliferae family. Drug yielding plant is an erect glabrous aromatic herb, 1-2 m high, cultivated extensively thoughout India upto 1830 m and also sometimes found wild, fruits ripen in September; Stems cut with sickles and put up in loose sheaves to dry in sun; when dry, fruits are beaten out in a cloth in sun, cleaned by winnowing and collected.

OTHER NAMES:

Arabic	:	Raziyanaj
Persian	:	Badiyan Darazyana
Assamese	:	Guvamuri
Bengali	:	Mauri Panmouri
English	:	Fennel
Gujarati	:	Variyali, Variari, Warialli
Hindi	:	Saunf
Kannada	:	Badi-sepu, Badi-Sopu, Sabbasaige
Kashmiri	:	Saunf, Badanai
Malayalam	:	Kattusatakuppa, Parinjaeragum
Marathi	:	Badishep
Oriya	:	Panamadhuri
Punjabi	:	Saunf
Sanskrit	:	Misi, Mishreya, Madhurika
Tamil	:	Shombu, Sokirie
Telegu	:	Sopu
Urdu	:	Saunf

DESCRIPTION:

(a) **Macroscopic**: Fruits, usually entire with pedicel attached; mericarps, upto about 100mm long and 4mm broad, five sided with a wider commissural surface, tapering slightly towards base and apex, crowned with a conical stylopod, glabrous, greenish or yellowish-brown with five paler prominent primary ridges; endosperm; orthospermous.

(b) **Microscopic**: Transverse section of fruit shows pericarp with outer epidermis of quadrangular to polygonal cells with smooth cuticle and a few stomata; trichomes, absent; vittae, 4 dorsal and 2 commissural extending with length of each mericarp, intercostal, with an apithelium of brown cells and volatile oil in cavity; mesocarp, with much reticulate lignified parenchyma; costae, 5 in each mericarp, each with 1 vascular strand having 1 inner xylem strand and 2 lateral phloem strands separated by a bundle of fibers; inner epidermis of very narrow, thin-walled cells arranged parallel to one another in groups of 5-7 many of these groups with longer

axis of their cells at an angle with those of adjacent groups (Parquetry arrangement); endosperm consists of thick-walled, cellulosic parenchyma containing much fixed oil, microrosette crystals of calcium oxalate, and numberous aleurone grains upto 5 m in diameter; carpophore with very thick walled sclerenchyma in two strands, often unsplit with two strands very close to each other.

IDENITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 12 per cent
Acid-insoluble Ash	:	Not more than 15 per cent
Alcohol-soluble extractive	:	Not less 4 per cent
Water-soluble extractive	:	Not less 1 per cent
Volatile oil	:	Not less 1.4 per cent v/w
CONSTITUENTS	:	Essential oil and fixed oil.
ACTION	:	Mufatteh Sudad, Kasir-e-Riyah, Muqawwi-e-Meda, Muddirr-e-Baul, Mudirr-e-Haiz, Muqawwi-e-Basar.
THERAPEUTIC USE	:	Waj-ul-Meda, Nafkh-e-Shikam, Zof-e-Meda, Ethebas-e-Baul, Ethebas-e-Tams, Zof-e-Basarat.
DOSE	:	5 to 7g.
IMPORTANT FORMULATIONS	:	Habb-e-Ghariqoon, Qurs-e-Mulaiyin, Jawarish-e-Narmuskh, Jawarish Zarooni Sada, Majoon-e-Muqil, Majoon-e-Musaffi-e-Khoon, Majoon-e-Nankhwah, Raughan-e-Baladur, Araq-e- Badiyan, Araq-e-Juzam, Sikanjabeen Buzoori Motadil, Sharbat-e-Sadar, Sufoof-e-Hazim Kalan, Sufoof-e-Tabkheer.

BALELA

Drug Balela consists of pericarp of dried ripe fruits of *Terminalia belerica* Roxb of Combretaceae family. Drug yielding plant is a large deciduous tree, 10-12 m or more high, commonly found in plain and forests upto 900 m elevation; fruits ripen towards November.

OTHER NAMES:

Arabic	:	Balela
Persian	:	Balelaj
Assamese	:	Bhaira, Bauri, Bahera, Bahira
English	:	Belleric Myrobalan
Gujarati	:	Bahedan, Bahedamunjhad, Bahedo, Baheda, Bero, Sag.
Hindi	:	Bahera, Bhaira, Bhera, Buhura
Kannada	:	Tanrekai, Shantikayi, Shantimara
Kashmiri	:	Babelo, Balali
Malayalam	:	Tannikka, Thani, Tannikkai, Tanni, Tusham
Marathi	:	Bahera, Behera, Balra, Beda
Oriya	:	Bahada
Punjabi	:	Bahera, Birha, Balela, Bayrah
Sanskrit	:	Vibhita, Aksa, Akshka, Cibhitaka, Anilaghnaka, Vibhitaki
Tamil	:	Thanrikkai, Tani, Thani, Kathuelupay, Tanrikkay, Tankrikkai
Telegu	:	Thanikkikaya, Tani, Tandi, Tandikeya, Thandra, Vibhitakama, Thana Bhutavasanu, Tadi
Urdu	:	Bahera.

DESCRIPTION:

(a) **Macroscopic** : Fruit nearly spherical to ovoid, 2.5-4.0 cm. in diameter; fresh ripe fruits slightl silvery or with whitish shiny pubescent surface; mature fruits grey or grayish-brown with slightly wrinkled appearance; rind of fruit shows variation in thickness from 3-5 mm; tasta, astringent.

(b) **Microscopic** : Transverse section of fruit shows an outer epicarp consisting of a layer of epidermis, most of epidermal cells elongate to form hair like protuberance with swollen base; composed of a zone of parenchymatous cells, slightly tangentially elongated and irregularly arranged, intermingled with stone cells of varying shape and size, elongated stone cells found towards periphery and spherical in the inner zone of mesocarp in groups of 3-10; mesocarp traversed in various directions by numerous vascular strands; bundles collateral, endarch; simple starch grains and some stone cells found in most of mesocarp cells, few peripheral layers devoid of starch grains; rosettes of calcium oxalate and stone cells present in parenchymatous cells; endosperm composed of stone cells running longitudinally as well as transversely.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 7 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-soluble extractive	:	Not less than 8 per cent
Water-soluble extractive	:	Not less than 35 per cent
CONSTITUENTS	:	Gallic acid, tannic, acid and glycosides
ACTION	:	Muqawwi-e-Meda, Qabiz, Munaffis-e-Balgham, Muqawwi-e-Dimagh, Muqawwi-e-Basar
THERAPEUTIC USE	:	Zof-e-Meda, Zof-e-Ama, Is-hal, Zof-e-Basarat, Zof-e-Dimagh, Sual.
DOSE	:	5 to 7 g.
IMPORTANT FORMULATIONS	:	Majoon-e-Jograj Gugal, Itrifal-e-Muqil Itrifal-e-Saghir, Iitrifal-e-Ustukhudus, Majoon-e-Fanjnosh.

BAOBARANG

Drug Baobarang consists of dried mature fruits of *Embelia ribes* Burm.f. of Myrsinanceae family. Drug yielding plant is a large scandent shrub with long slender, flexible branches; distributed throughout hilly parts of India upto 1600 m.

OTHER NAMES:

Arabic	:	Biranj Kabuli, Baranj
Persian	:	Baranj Kabuli, Barang
Assamese	:	Silgilla
Bengali	:	Biranga
Gujarati	:	Vavading, Vayavadang
Hindi	:	Baberang
Kannada	:	Vayuvidanga, Vayuvilanga
Kashmiri	:	Babading
Malayalam	:	Vishalam, Tiruvittikanni
Marathi	:	Karkannie
Oriya	:	Bidongo
Punjabi	:	Babrug, Vavaring
Sanskrit	:	Jantughna, Kirmighna, Vidanga, Amogha, Vella
Tamil	:	Vayuvilangam, Vayuvidangam
Telegu	:	Vaividungalu
Urdu	:	Baobarang, Babrang

DESCRIPTION:

(a) **Macroscopic**: Fruit brownish-black globular, 2-4 mm in diameter, warty surface with a beak like projection at apex, often short, thin pedicel and persistant calyx with usually 3 or 5 seplas present; pericarp brittle enclosing a single seed covered by a thin memberane; entire seed, reddish and covered with yellowish spots (Chitra tandula); odour, slightly aromatic; taste, astringent.

(b) **Microscopic** : Transverse section fruit shows epicarp consisting of single row of tabular cells of epidermis, usually in surface view cells rounded with wrinkled cuticle; mesocarp consists of a number of layers of raddish-brown coloured cells and numerous fibrovascular bundles and rarely a few prismatic crystals of calcium oxalate; inner part of the mesocarp and endodermis composed of stone cells; endodermis consisting of single layered, thick-walled, large, palisade-like stone cells; seed coat composed of 2-3 layered raddish-brown coloured cells endosperm cells irregular in shape, thick-walled containing fixed oil and proteinous masses; embryo small when present otherwise most of the seeds sterile.

Powder: Reddish; under microscope shows reddish parenchyma and stone cells.

IDENTITY, PURITY AND STRENGTH:

Identification:

I. Shake 1g. of the powdered seeds with 20 ml of solvent Ether for five minutes and filter. To a portion of the filtrate add 5 per cent v/v solution of sodium Hydroxide; a deep violet colour is developed in the aqueous layer. To the other portion add-2 drops of Dilute Ammonia Solution; a bluish violet precipitate is obtained.

II. Boil 5 g. of the powdered seed with 25ml Alcohol and filter. Divide the deep red coloured filtrate into two portions. To one portion, add solution of Lead Acetate; a dirty green precipitate is produced. To the other portion add solution of Ferric Chloride a reddish-brown precipitate is produced.

Foreign matter	:	Not more than 2 per cent
Total Ash	:	Not more than 6 per cent
Acid-insoluble ash	:	Not more than 1.5 per cent
Alcohol-soluble extractive	:	Not less than 10 per cent
Water-soluble extractive	:	Not less than 9 per cent

Assay: Contains not less than 2 per cent w/w of embelin (limits 1.85 to 2.15) when assayed as follows:-

Weigh accurately about 10 g. of powder (40mesh) and transfer to a 500 ml. glass stoppered flask. Shake occasionally for thirty minutes with 150 ml. of Solvent Ether. Pack the whole mass in a percolator; allow to macerate for thirty minutes and extract with Solvent Ether till the ethereal solution ceases to give a pink colour with a drop of Dilute Ammonia Solution. Distil off the Ether, treat the residue with small quantity of light Petroleum (b.p 40 degree to 60 degree) cool in ice, filter through a Buchner funnel under suction and reject the filtrate. Wash the residue with further small quantities of cooled Ether (b.p 40^0 to 60^0). Transfer the residue to a tarred beaker with sufficient quantity of Solvent Ether, remove the Light Petroleum and dry the residue of embelin to constant weight at 80 degree. The melting range of the residue is 142 degree to 144 degree.

CONSTITUENTS	:	Benzoquinones, alkaloid (Christembine), Tannin And essential oil.
ACTION	:	Qatil-e-Deedan-e-Ama, Mushil
THERAPEUTIC USES	:	Deedan-e-Ama, Waj-ul-Mafasil.
DOSE	:	1 to 2 g.
IMPORTANT FORMULATIONS	:	Habb-e-Kibreet, Qurs-e-Deedan, Itrifal-e-Deedan Majoon-e-Jograj Gugal, Majoon-e-Kal-Kalanaj, Habb-e-Kabid Naushadri

BELGIRI

Drug Belgiri consists of pulp of entire, unripe or half ripe fruits of *Aegle marmelos* Corr. of Rutaceae family. Drug yielding plant is a tree, attaining a height of 12 m. growing wild and also cultivated throughout the country; rind of fruit is removed and pulp is bruised and dried.

OTHER NAMES:

Arabic	:	Safarjal Hindi
Persian	:	Safarjal Hindi, Shul
Assamese	:	Bel
Bengali	:	Bela, Vilva, Bel
English	:	Bengal Quince, Bael Fruit, Golden Apple Holy fruit, Stone Apple.
Gujarati	:	Bill, Bilvaphal, Billy, Bilinuphal
Hindi	:	Bela Sriphal, Bel, Billi, Siriphal, Bael Siripaal
Kannada	:	Bilva, Bilpatre, Belepatre
Kashmiri	:	Bel
Malayalam	:	Koovalam, Kuvalam, Vilvam, Mavilavu
Marathi	:	Bel, Baela
Oriya	:	Bela, Belo, Bilwa, Siripholo
Punjabi	:	Bil
Sanskrit	:	Bilva, Gandhapatra, Trishkhapatra, Mahaphala
Tamil	:	Vilvam, Aluvigam, Kuvilam, Villuvam.
Telegu	:	Maredu, Bilvamu, Maluramu, Sriphalamu,Bilvapandu
Urdu	:	Bel.

DESCRIPTION:

Macroscopic: Fruit, sub-globose, 5-10 cm. in diameter, externally greenish when young, yellowish-brown when ripe, rind about 1.5 mm-3 mm. thick, hard and woody, surface smooth or slightly granular bearing a circular scar at the point of attachment with peduncle; carpels, 10-15, central, each containing several hairy seeds embedded in yellowish brown, extremely stickly mucilage; seeds oblong, flat, woody and having white hair; fresh pulp of ripe fruit, brown, of sticky shreads; dried pulp hard and pale to dark red in colour, frequently breaks away from the rind during drying, leaving a thin layer attached to it; odour, faintly aromatic, taste, mucilaginous and slightly astringent.

IDENTITY, PURITY AND STRENGTH:

Total ash	:	Not more than 4 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-oluble extractive	:	Not less than 6 per cent
Water-soluble extractive	:	Not less than 50 per cent.
CONSTITUENTS	:	Marmalosin, tannins, mucilage, fatty oil and sugar
ACTION	:	Qabiz, Habis-ud-dam, Muqawwi-e-Meda, Daf-e-Human, Musakkin-e-Alam, Mufarreh.
THERAPEUTIC USE	:	Zaheer-e-Damvi, Ishal
DOSE	:	2 to 3 g.
IMPORTANT FORMULATIONS	:	Murabba-e-Belgiri, Jawarish-e-Zanjabeel

CHIRAITA

Drug Chiraita consists of whole plant of *Swertia chirata Buch*. Ham. of Gentianaceae family. Drug yielding plant is a small, erect, annual herb 0.6-1.25m. high, found in temperate Himalayas at an altitude between 1200-1300 m from Kashmir to Bhutan and Khasia Hills in Meghalaya; durg collected when flowering (July-October) and dried.

OTHER NAMES:

Arabic	:	Qasab-uz-zareerah
Persian	:	Qasab-uz-Zareerah
Assamese	:	Chirta
Bengali	:	Chirata, Mahatita
English	:	Chiretta
Gujarati	:	Kariyatu, Kariyatun, Charyatah, Chirayita
Hindi	:	Chirayata, Chirayatah, Kiryat, Charayatah
Kannada	:	Nalebevu, Chirata Kaddi, Chirayat, Nelabevu
Kashmiri	:	L se, Chiraita
Malyalam	:	Nilaveppu, Kirayattu, Nilamakanjiram, Kirlyattu
Marathi	:	Kiraita, Kaduchiraita, Chirayita
Oriya	:	Chiretia
Punjabi	:	Chiretta, Chiraita
Sanskrit	:	Kirata, Kirataka, Bunimba, Kiratiktaka, Chiratika, Anaryatikta.
Tamil	:	Nilavembu, Shirattakuchi
Telegu	:	Nelavemu, Neelaveru, Neelavemu, Nilavembu
Urdu	:	Chiraita.

DESCRIPTION:

(a) **Macroscopic**: Drug consists of whole plant, a peculiar shining yellowish tinge all over the herb in fresh sample; stem upto 1 m long and 6 mm in diameter, glabrous, yellowish-brown to purplish, slightly guadrangular above and cylindrical below; large, continuous, easily separable yellow pith, leaf, opposite, cauline, broad at base, ovate or lanceolate, entire, acuminate, glabrous, usually with 5-7 prominent lateral veins; branching from the axils of the leaves which ramify further into paniculate inflorescence; flower, tetramerous, 2-3 mm wide, ovoid, with two glandular depressions near the base of each of corolla lobes; ovary, superior, bicarpellary, unilocular, ovoid and pointed; fruit a capsule with numerous, minute reticulated seed, 0.25 mm long 0.16-0.45 mm broad irregularly ovoid.

(b) Microscopic :

Root : Transverse section of root shows, 2-4 layers of cork; secondary cortex represented by 4-12 layers of thick-walled, parenchymataous cells, some showing radial wall formation, tangentially elongated with sinuous walls; secondary phloem composed of thin-walled srrands of sieve tubes, companion cells and phloem parenchyma; secondary xylem composed of vessels, tracheids parenchyma and xylem fibers, all elements lignified and thick-walled; in older roots, centre of wood more or less spongy and hollow in most cases; outer woody ring remaining strongly lignified; vessels show scalariform thickening and also simple and bordered pits, tracheids similar in thickening as the vessels; fibers have simple pits; mucilage present in secondary cortical cells; minute acicular crystals present in abundance in secondary cortex and phloem region; resin also present as dark brown mass in secondary cortex cells.

Stem : Transverse Section of stem shows single layered epidermis, externally covered with a thick striated cuticle present in young stem, in older epidermis remains intact but cells flattened and tangentially elongated, four ribs also consists of an epidermis and parenchymatous cortical cells; endodermis distinct, showing anticlinal or periclinal walls, followed by single layered pericycle consisting of thin walled cells; stem possesses an amphiphloic siphonostele; external phloem represented by usual elements, cambium between external phloem and xylem composed of a thin strip of tangentially elongated cells, internal phloem similar in structure as that of external phloem excepting that sieve tube strand is more videly separated; xylem continuous and composed mostly of tracheids, a few xylem vessels present single or rarely in groups of two, while tracheids and fibers present in abundance; vessels and fiber tracheids have mostly simple and bordered pits and fibers with simple pits on the walls; medullary rays absent; central part of the stem occupied by a pith consisting of rounded and isodiametric cells with prominent interecellular spaces mucilage present in cortical cells; minute acicular crystals also present in abundance, cortical cells, in resin present as dark brown mass in some cortical cells alongwith oil droplets.

Leaf : Transverse section of leaf shows very little differentiation of mesophyll tissues; epidermis single layered covered with a thick, strated cuticle, more strongly developed on the upper surface than the lower; stomata of anisocytic type; palisade tissue single layered cells at places become wider and less elongated particularly in bigger veins; spongy messophyll represented by 4-7 layers of somewhat loosely arranged, tangentially elongated cells, some epidermal cells prominently arched outside at the margin; mucilage present in epidermal and mesophyll cell while minute acicular also present in abundance in mesophyll cells; in leaf parenchymas oil droplets also present.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 6 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol (60 per cent)	:	

Soluble extractive	:	Not less than 10 per cent
Water soluble extractive	:	Not less than 10 per cent

Absence of tannin: On addition of Ferric Chloride to aqueous or alcoholic extract no blue black colour develops.

Assay: Contains not less than 1.3 per cent, of the bitter principle as determined by the following method:

Mix 20 g. in powder (No. 60 sieve) with boiling water containing 0.5 g. of Calcium Corbonate and extract with boiling water till the last portion of the extract is devoid of bitterness; concentrate in vacuum and dissolve the residue in hot Alcohol. Filter while hot and wash the residue thrice on the filter with 10 ml. portions of hot Alcohol; remove the alcohol from the filtrate and take up the residue repeatedly with 25, 15, 15, 15 and 15 ml. of hot water. Shake the aqueous extract repeatedly with 25 20, 15, 15 and 10 ml. of Ethyl Acetate, collect the Ethyl Acetate extracts, evaporate, dry and weigh.

CONSTITUENTS	:	Xanthones, Xanthone glycoside and mangiferine (Flavonoid).
ACTION	:	Musaffi-e-Dam, Mohallil-e-Waram, Mudirr-e-Baul, Mulattif, Qabiz, Muqawwi-e-Meda, Kasir-e-Riyah, Mudirr-e-Haiz, Muqawwi-e-Kabid, Mushahhi.
THERAPEUTIC USE	:	Su-e-Hazm, Nafkh-e-Shikam, Fasad-ud-Dam, Istisqa-e-Ziqqi, Busoor, Taqteerul Baul, Zof-e- Ishteha.
DOSE	:	5 to 7 g.
IMPORTANT FORMULATIONS	:	Mojoon-e-Musaffi-e-Khoon, Majoon-e-Masikul-Baul, Araq-e-Juzam.

DARCHINI

Drug Darchini consists of the dried inner bark devoid of cork and cortex of stem of *Cinnamomum zeylanicum* Blume of Lauraceae family. Drug yielding plant is a moderate sized evergreen tree usually attaining a height of 6-7.5 m; cultivated on the Western Ghats and adjoing hills; bark collected during April-July and October-December.

OTHER NAMES:

Arabic	:	Darsini, Qirfa
Persian	:	Darchini
Assamese	:	Dalcheni, Dalchini
Bengali	:	Darchini, Daruchini
English	:	Cinnamon Bark, Chinese cassia
Gujarati	:	Dalchini, Taj
Hindi	:	Dalchini, Darchini, Qalmi Darchini
Kannada	:	Dalchini Chakke
Kashmiri	:	Dalchini Dalchin
Malayalam	:	Karuvapatta, Ilavarngathely, Ethunai lavangam
Marathi	:	Dalchini
Oriya	:	Dalochini, Gudotwako, Daruchini
Punjabi	:	Dalchini, Darrchini
Sanskrit	:	Darusita, Tvaka
Tamil	:	Lavangapatta, Karuvapattai
Telegu	:	Lavangapatta, Dalchinichekka
Urdu	:	Darchini

DESCRIPTION:

(a) **Macroscopic**: Bark pieces about 0.5 mm thick brittle, occurs as single or double, closely packed compound guills, upto a metre or more in length and upto about 1 cm in diameter; outer surface, dull yellowish-brown, marked with pale wavy longitudinal lines with occasional small scars or holes; inner surface darker in colour, striated with longitudinally elongated reticulation; fracture, splintery, free from all but traces of cork; odour, fragrant; taste; sweet; aromatic with sensation of warmth.

(b) **Microscopic**: Transverse section of bark (devoid of cork and cortex) shows except at certain places pericyclic sclerenchyma, 3 or 4 rows of is diametric cells, sometimes tangentially elongated, inner and radial walls often being thicker than the outer, some containing starch

grains; small groups of pericylic fibers embedded at intervals in the sclerenchyma; phloem of tangential bands of sieve tissue alternating with parenchyma, and containing axially elongated secreting cells containing volatile oil or mucilage; phloem fibers with very thick walls, upto 30m in diameter, isolated or in short tangential rows; sieve tubes narrow with transverse sieve plates, collapsed in outer periphery; medullary rays of isodiametric cells, mostly 2 cells wide; cortical parenchyma and medullary rays containing small starch grains mostly below 10 m in diameter; minute acicular crystals of calcium oxalate persent.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 3 per cent
Acid-insoluble ash	:	Not more than 2 per cent
Alcohol-soluble extractive	:	Not more than 2 per cent
Water-soluble extractive	:	Not more than 3 per cent
Volatile Oil	:	Not more than 1 per cent

CONSTITUENTS : Essential Oil,, tannin and mucilage

ACTION : Mulattif, Kasir-e-Riyah, Munaffis-e-Balgham, Muqawwi-e-Meda, Muqawwi-e-Kabid, Qabiz, Moharrik-e-Bah, Mudirr-e-Baul, Mudirr-e-Haiz

THERAPEUTIC USE : Bakhr-ul-Fam, Bahaq, Zof-e-Bah, Zeequn Nafas, Ehtebas-e-Baul

DOSE : 1 to 2 g.

IMPORTANT FORMULATIONS:

Habb-e-Ambar Momyaee, Qurs-e-Mukhaddir, Dawa-ul-Kurkum, Dawa-ul-Misk Motadil-Jawahar Wali, Dawa-ul-Misk Motadil Sada, Halwa-e-Baiza-e-Murgh, Halwa-e-Gazar, Jawarish-e-Bisbasa, Jawarish-e-Jalinoos, Jawarish-e-Kundur, Jawarish-e-Nar Muskh, Jawarish-e-Ood-Shireen, Jawarish-e-Ood-Tursh, Jawarish-e-Pudina, Jawarish-e-Shaha ryaran Jawarish-e-Utraj, Jawarish Zarooni Sada, Majoon-e-Dabeedulward, Majoon-e-Falasifa, Majoon-e-Fanjnosh, Majoon-e-Ispand sokhtani, Majoon-e-Jalali, Majoone-e-Jalinoos-Lului, Majoon-e-Khadar, Majoon-e-Lana, Majoon-e-Mughalliz, Majoon-e-Muluki, Majoon-e-Rahul Momineen, Majoon-e-Suparipak, Majoon-e-Ushba, Tiryaq-e-Samania, Raughan-e-Darchini Araq-e-Ambar, Araq-e-Chobchini, Iyarij-e-Faiqra, Sufoof-e-Kishneez, Sufoof-e-Qaranful.

FUFAL

Drug Fufal consists of dried ripe seeds of *Areca catechu* Linn. of Palmae family. Drug yielding plant is a graceful, slender, stemmed perennial palm, trunk reaching a height of about 25 m. cultivated in the coastal regions of Southern India, Bengal and Assam upto an altitude of 1000 m.

OTHER NAMES:

Arabic	:	Fufal, Fofal
Persian	:	Popal
Assamese	:	Tamol, Tambul
Bengali	:	Supari, Gua
English	:	Areca Nut, Betel Nut
Gujarati	:	Sopari
Hindi	:	Supari, Chaalia
Kannada	:	Adika
Kashmiri	:	Supari, Spari
Malayalam	:	Pakka, Atekka
Marathi	:	Supari, Pophali, Pung
Oriya	:	Gua, Pugo
Punjabi	:	Supari, Spari
Sanskrit	:	Kramuka, Ghonta
Tamil	:	Kamugu, Pakku, Pakkuppanai
Telegu	:	Vakka, Pugamu, Kolapoka
Urdu	:	Chalia, Supari

DESCRIPTION:

(a) **Macroscopic:** Ovoid, externally pale, reddish-brown to light yellowish-brown, marked with a net work of paler lines, frequently with adhering portions of silvery brittle endocarp and adhering fibers of mesocarp at base of seed, seed hard with ruminate endosperm of brownish tissue alternating with whitish tissue; odour, characteristic, astringent.

(b) **Microscopic:** Transverse section of seed shows a seed coat consisting of several rows of cells, tangentially elongated, with inner walls more or less thickened; whitish cells of endosperm tissue with thick porous walls containing oil globules and aleurone grains; brown perisperm tissue with thick-walled cells and delicate tracheae.

Powder: Reddish brown to light brown; under microscope shows fragments of endosperm tissue with porous walls, irregularly thickened and small stone cells of seed coat, a few aleurone grains and oil globules and a few delicate tracheae; starch absent.

IDENTITY PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 per cent
Total ash	:	Not more than 3 per cent
Acid-insoluble ash	:	Not more than 0.4 per cent
Alcohol-soluble extractive	:	Not less than 19 per cent
Water-soluble extractive	:	Not less than 10 per cent
CONSTITUENTS	:	Alkaloid (arecoline) tannins and fats.
ACTION	:	Qabiz, Mohallil-e-Waram, Rade, Habis.
THERAPEUTIC USE	:	Ishal, Sailan-ur-Rahem, Jiryan.
DOSE	:	3 to 5 g.
IMPORTANT FORMULATIONS	:	Habb-e-Hamal, Majoon-e-Muqawwi-e-Rahem, Majoon Supari Pak

GILO

Drug Gilo consists of dried, matured pieces of stem of *Tinospora cordifolia* (Willd) Miers. of Menispermaceae family. Drug yielding plant is a perennial climber found thoughout Tropical India; drug collected during summer preferably in the month of May; drug is used in fresh from also.

OTHER NAMES:

Arabic	:	Gilo
Persian	:	Gulbel
Assamese	:	Siddhilate, Amarlata
Bengali	:	Gulancha, Gilo, Gadancha, Guluncha, Ningilo, Golancha
English	:	Gulancha Tinospora
Gujarati	:	Galac, Garo, Gado, Galo, Gulo, Gulwel
Hindi	:	Giloe, Gurcha, Gurach, Gulancha
Kannada	:	Amrutoballi, Amrulballi, Madhuparne, Uganiballi
Kashmiri	:	Amrita, Gilo
Malayalam	:	Amrytu, Peyamarytam, Sittamrytu
Marathi	:	Gulvel, Ambarvel, Gharol, Giroli, Guloe
Oriya	:	Guluchi, Gulochi
Punjabi	:	Gilo, Batindu, Garham, Garum, Gilo, Gularish
Sanskrit	:	Amrita, Amritalata, Chakrangi, Dhira, Guluchi, Kundalli
Tamil	:	Seendal, Sindil Kodi, Amudam, Asasi, Kunali, Sadi, Silam
Telegu	:	Thippateega, Guduchi, Madhuka, Manpala, Somida
Urdu	:	Gilo

DESCRIPTION:

(a) **Macroscopic** : Drug occurs in pieces of varying thickness ranging from 0.6-5 cm. in diameter; young green with smooth surfaces and swelling at nodes, oldr ones show a light brown surface marked with warty protuberances due to circular lenticels; transversely smoothened surface shows a radial structure with conspicuous medullary rays traversing porous tissue; taste bitter.

(b) Microscopic : Transverse section of stem shows outer-most layer of cork, differentiating into outer zone of thick-walled brownish and compressed cells, inner zone of cork broken at some places due to opening of lanticels, followed by 5 or more rows of secondary cortex of which the cells of outer rows smaller than the inner one; just within the opening of lenticels, groups of sclereids consisting of 2-10 cells found in secondary cortex region, outer zone of cortex consists of 3-5 rows of irregularly arranged, tangentially elongated chlorenchymatous cells; cortical cells situated towards inner side, polygonal in shape and filled with plenty of starch

grains, simple ovoid, or irregulaity ovoid-elliptical occasionally compound of 2-4 components, several secretary cells; found scattered in the cortex; pericyclic fibers lignified with wide lumen and pointed ends, associated with a large number of crystal fibers containing a single prism in each chamber; vascular zone composed of 10-12 or more wedge-shaped strips of xylem, externally surrounded by semi-circular strips of phloem, alternating with wide medullary rays; phloem consists of sieve tube companion cells and phloem parenchyma of polygonal or tangentially elongated cells some of them contain crystels of calcium oxalate; cambium composed of one or two layers of tangentially elongated cells in each vascular bundle; xylem vessels comparatively narrow devoid of tyloses; secondary xylem elements thick-walled, lignified, vessels cylindrical in shape bearing boardered pits on their walls some large vessels possess several tyloses and often contain transverse septa; medullary rays 15-20 or more cells wide containing rounded, hemispherical, oblong, ovoid, with faintly marked concentric striations and central hillum appearing like a point, starch grains of 5.5 – 11.20 m in length; pith composed of large, thin-walled cells mostly containing starch grains.

IDENTITY, PURITY AND STRENGTH:

For dried drug	:	
Foreign Matter	:	Not more than 2 per cent
Total ash	:	Not more than 16 per cent
Acid-insoluble ash	:	Not more than 3 per cent
Alcohol-soluble extractive	:	Not less than 3 per cent
Water-soluble extractive	:	Not less than 11 per cent
For fresh drug:		
Foreign matter	:	Nil
Moisture content	:	75 per cent

CONSTITUENTS **:** Terepenoids and alkaloids

ACTION **:** Daf-e-Humma, Muqawwi-e-Meda, Qabiz, Qatil-e-Deedan-e-Ama, Mohallil-e-Waram, Muddir-e-Baul, Musaffi-e-Dam.

THERAPEUTIC USE **:** Humma, Ishal, Zaheer, Deedan-e-Ama.

DOSE **:** 5 to 10 g.

IMPORTANT FORMULATIONS **:** Sufoof-e-Satt-e-Gilo, Sufoof-e-Satt-e-Gilo-Sartani

HALELA ZARD

Drug Helela consists of the pericarp of mature fruits of *Terminalia chebula* Retz of Combretaceae family. Drug yielding plant is a moderate sized or large tree found throughout India, chiefly in deciduous forests and areas of light rainfall, but occasionally also in slightly moist forests, upto about 1500 m elevation, throughout India; flowers appear from April-August and fruits ripen from October-January.

OTHER NAMES:

Arabic	:	Halelaj
Persian	:	Halela Kabuli
Assamese	:	Helikha, Silikha, Hokikha
Bengali	:	Haritaki, Hora
English	:	Chebulic Myrobalan, Black Myrobalan
Gujarati	:	Hirdo, Himaja, Pilo-Harde, Kabuli-harda, Hardo
Hindi	:	Harra, Harad, Harar, Pile Har, Bal Har
Kannada	:	Alalikai, Kale Har, Zangli Har, Har, Harara
Kashmiri	:	Halela
Malayalam	:	Katukka, Kayastha, Kadukhai, Divya
Marathi	:	Harda, Hirda, Harba
Oriya	:	Haridra, Hirdar, Hirada, Horida
Punjabi	:	Halela, Haser, Harrar, Har Hush, Harar
Sanskrit	:	Abhaya, Kayastha, Siva, Pathya, Haritaki
Tamil	:	Kadukkai, Amagola, Arabi, Aridadi
Telegu	:	Karaka, Karakkaya, Haritaki Karaka, Sringitiga, Karakai
Urdu	:	Halela, Halela Kabuli, Halela Zard.

DESCRIPTION:

(a) **Macroscopic:** Intact fruit yellowish-brown, ovoid, 20-35 mm long, 13-25 mm wide, wrinkled and ribbed longitudinally; pericap fibrous, 3-4 mm thick, non-adherent to seed; taste, astringent.

(b) **Microscopic:** Transverse section of pericarp shows epicarp consisting of one layer of epidermal cells inner tangential and upper portions of radial wall thick; mesocarp, 2-3, layers of collenchyma, followed by broad zone of parenchyma in which fibers and sclerieds in group and vascular bundles scattered; fibers with peg like outgrowth and simple pitted walls; sclerieids of various shapes and sizes but mostly elongated tannins and raphides in parenchyma; endocarp consists of thick-walled sclereids of various shapes and sizes, mostly elongated epidermal surface view reveal, polygonal cells, uniformly thick-walled, several of them divided into two by a thin septa; starch grains simple rounded or oval in shape, measuring 2-7 m in diameter, founding plenty in almost all cells of mesocarp.

Powder : Brownish in colour; under microscope shows a few fibers, vessels with simple pits and groups of sclereids.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 per cent
Total ash	:	Not more than 5 per cent
Acid-insoluble ash	:	Not more than 5 per cent
Alcohol-soluble extractive	:	Not less than 40 per cent
Water-soluble extractive	:	Not less than 60 per cent
CONSTITUENTS	:	Tannins, anthraquinenes and polyphenolic compounds.
ACTION	:	Muqawwi-e-Basar, Muqawwi-e-Dimagh, Musakkin, Musawwi-e-Shar.
THERAPEUTIC USE	:	Zofe-e-Basarat, Zof-e-Dimagh, Zof-e-Meda, Zof-e-Ama,
DOSE	:	3 to 5 g.
IMPORTANT FORMULATION	:	Itrifal Kishneezi, Itrifal Zamani, Itrifal-e-Ustukhuddus, Itrifal-e-Shahtra, Itrifal-e-Sagheer, Itrifal Mulaiyin, Itrifal-e-Kabir,Majoon-e-Kundur, Majoon-e-Khabs-ul-Hadeed, Kohal-ul-Jawahir.

HEEL KHURD

Drug Heel Khurd consists seeds of dried fruits of *Elettaria cardamomum* (Linn.) Maton and its varieties of Zingiberaceae family. Drug yielding plant is a stout large perennial herb, growing naturally in moist forests of western ghats up to 1500 m, also cultivated in many other parts of south India at an elevation from 750-1500 m.

OTHER NAMES:

Arabic	:	Qaqla Sighar, Shamashar, Khairbua, Sho-Shmir
Persian	:	Khair Buwa, Hel Buwa
Assamese	:	Sarooplakchi
Bengali	:	Chota Elachi, Garate
English	:	Cardamom
Gujarati	:	Elchi, Elaochi, Elayachi
Hindi	:	Chhoti Ilayachi
Kannada	:	Elakki, Sanna yalakki
Malayalam	:	Elam, Chittelam, Elakka ya
Marathi	:	Velloda, Lahanveldoda, Velchi
Oriya	:	Gujarati Cholaa leicha, Olaicho, Ela
Punjabi	:	Illachi, Choti Ilachi
Sanskrit	:	Truti, Ela, Sukshmaila
Tamil	:	Elam, Elakaya; Ella-Kay
Telegu	:	Chinne Elakulu, Sanna Elakulu, Elakkaya, Pakkuln
Urdu	:	Heel Khurd

DESCRIPTION:

(a) Macroscopic:

Fruit: About 1-2 cm long, ovoid or oblong and more or less three sided with rounded angles, greenish to pale-buff or yellowish in colour; base rounded or with the remains of pedical; apex shortly beaked; surface almost smooth or with slight longitudinal striations; small trilocular fruit, each containing about 15-20 seeds in a row of doubles, adhering together to form compact mass.

Seed: Dark brown to black, about 4 mm long and 3 mm broad, irregulary angular, transversely wrinkled but not pitted; with a longitudinal channel containing raphe, enclosed in a colourless, membraneous aril; odour strongly aromatic; taste, characteristic.

(b) Microscopic : Transverse section of seed shows flattened, airl, thin-walled parenchymatous cells; testa with outer epidermis of thick-walled, narrow, elongated cells, followed by layer of

collapsed parenchyma, becoming 2 or 3 layered in the region of raphe, composed of large, thin-walled rectangular cells containing volatile oil, a band of 2 or 3 layers of parenchyma and an inner epidermis of thin walled flattened cells; inner integument 2 layered an outer palisade sclerenchyma with yellow to reddish-brown beaker shaped cells, 20 m long in radial direction and 12 m wide, thickened on inner and anticlinal walls, each cell with small bowl shaped lumen containing a warty nodule of silica and an inner epidermis of flattened cells; perisperm cells thin-walled packed with minute rounded polyhedral starch grains, about 1-2 to 4-6 m in diameter and containing 1-7 small prismatic crystals of calcium oxalate, about 10-20 m long; endosperm of thin-walled parenchyma containing protein as a granular hyaline mass in each cells; embryo, of small thin-walled cells containing aleurone grains; starch absent in endosperm and embryo; fibers sclerenchymatous; large vessels present in pericarp.

IDENITY, PURITY AND STRENGTH:

Foreign Matter	:	Not more than 2 per cent
Total Ash	:	Not more than 6 per cent
Acid-insolube ash	:	Not more than 4 per cent
Alcohol-soluble extractive	:	Not less than 2 per cent
Water-soluble extractive	:	Not less than 10 per cent
Volatile Oil	:	Not less than 4 per cent

CONSTITUENTS : Essential Oil

ACTION : Muqawwi-e-Meda, Mutayyib-e-Dahan, Kasir-e-Riyah, Muffarreh, Musakkin, Muqawwi-e-Qabl.

THERAPEUTIC USE : Bakhrul fam, Zof-e-Hazm, Nafkh-e-Shikam, Zof-e-Qalb, Khafqan, Qai, Ghisyan

DOSE : 0.5 to 1 g.

IMPORTANT FORMULATIONS:

Jawarish-e-Anarain, Jawarish-e-Bisbasa, Jawarish-e-Jalinoos, Jawarish-e-Narmuskh, Jawarish-e-Ood Tursh, Jawarish-e-Pudina, Jawarish Shahi, Jawarish-e-Shahreyaran, Jawarish-e-Tamar Hindi, Jawarish-e-Zanjabeel, Jawarish-e-Zarishk, Majoon-e-Azaraqi, Majoon-e-Dabeedul Ward, Majoon-e-Jalali, Majoon-e-Kalkalanaj, Majoon-e-Lana, Majoon-e-Mughalliz, Majoon-e-Kuluki, Majoon-e-Muqil, Majoon-e-Supari Pak, Majoon-e-Mufarreh Barid, Majoon-e-Mufarreh-e-Barid Jawahar Wali, Marham Raskapoor, Raughan-e-Babuna Qawi, Araq-e-Ambar, Araq-e-Heel Khurd, Araq-e-Juzam, Sufoof-e-Hazim-Kalan, Sufoof-e-Qaranful, Sufoof-e-Satt-e-Gilo, Sufoof-e-Satt Gilo Sartani, Sufoof-e-Suzak Qawi Sufoof-e-Tabkheer, Sunoon-e-Missi, Zuroor-e-Qula Abyaz, Zuroor-e-Kath, Zuroorj-e-Qula.

HILTEET

Drug Hilteet consists of oleo-gum-resin obtained from rhizomes and roots of *Ferula foetida* Regel Syn., *Ferula narthex*, Boiss, and other species of *Ferula* of Umbelliferae family. Drug yielding plant is a perennial herb, occurring in Persia and Afghanistan; resin collected after making incisions at the upper part of tap root of more than five year old plants by scrapping in March, April just before flowering, whole process repeated many times; after one or two days or after a few weeks when it gets hardened.

OTHER NAMES:

Arabic	:	Anjdan, Hilteet
Persian	:	Angoza, Angzoo
Assamese	:	Hin
Bengali	:	Hing, Hingra
English	:	Asafoetida
Gujarati	:	Hing, Vagharni
Hindi	:	Hingra, Hing
Kannada	:	Hingu, Ingu, Hing
Kashmiri	:	Yang
Malayalam	:	Kayam, Perungayam, Perugkayam
Marathi	:	Hing, Hira
Oriya	:	Hengu, Hingu
Punjabi	:	Hing
Sanskrit	:	Ramatta, Bhutnasan, Hingu, Sulanasan Bahleeka
Tamil	:	Perungayam, Perungkayam
Telegu	:	Ingura, Inguva, Ing.
Urdu	:	Hilteet, Hing

DESCRIPTION: Rounded, flattened or masses of agglutinated tears, grayish-white to dull yellow mostly 12-25 mm in diameter; freshly exposed surface, yellowish and translucent of milky white, opaque slowly becoming pink, red, finally reddish brown; odour, strong, characteristic and persistent; taste, bitter and acrid.

IDENTITY, PURITY AND STRENGTH:

Identification:

(I) Freshly broken surface when touched with sulphuric acid a bright red reddish brown colour is produced, changing to violet when acid washed off with water.

(II) Boil 0.2 g with 2 ml Hydrochloric acid for about 1 minute, dilute with an equal volume of water, and filter into 3 ml of dilute solution of Ammonia, fluorescence is produced.

Absence of colophony resin : Triturate 1 g with 10 ml of light Petroleum (b.p 40-60) for 2 minutes, filter into a test tube and add to the filtrate 10 ml of a fresh 0.5 per cent w/v aqueous solution of copper acetate; shake well allow the liquids to separate; pertroleum layer does not show any green colour, indicating absence of colophony resin.

Foreign matter	:	Not more than 2 per cent
Total Ash	:	Not more than 15 per cent
Acid-insoluble ash	:	Not more than 3 per cent
Alcohol (90 per cent) Soluble extractive	:	Not less than 50 per cent
Water-soluble extractive	:	Not less than 50 per cent

Assay : Place about 5 g accurately weighed, in a small beaker furnished with a glass rod, and tared; add 50 ml of Alcohol (90 per cent), and boil gently. Filter the hot solution through a tared filter paper and boil the residue with further quantities of Alcohol (90 per cent); until all soluble matter is removed, using the glass rod to disintegrate the soluble matter. Wash the filter paper with hot alcohol (90 per cent) transfer the paper to the beaker, dry at 100 degree and weigh. The residue weighs not more than 50 per cent of the original sample taken.

CONSTITUENTS	:	Essential oil, gum and resin
ACTION	:	Moharrik-e-Asab, Hazim, Kasir-e-Riyah, Daf-e-Taffun, Muddir-e-Baul, Mudirr-e-Haiz.
THERAPEUTIC USE	:	Nafkh-e-Shikam, Zof-e-Hazm, Zof-e-Meda, Nisyan, Qillat-e-Baul Falij, Laqwa.
DOSE	:	1 g.
IMPORTANT FORMULATIONS	:	Majoon-e-Antaki, Habb-e-Hilteet, Tila-e-Jund, Zimad-e-Khanazeer.

JAUZBUWA

Drug Jauzbuwa consists of the endosperm of dried seeds (kernels of fruits) of *Myristica fragrans* Houtt of Myristicaceae family. Drug yielding plant is dioecious or occasionally monoecious aromatic tree, about 10-20 m high, found mostly in Tamil Nadu and to some extent in Kerala, Andhra Pradesh and Assam.

OTHER NAMES:

Arabic	:	Jauzbuwa
Persian	:	Jauzut-teeb
Assamese	:	Jayphal, Kanivish
Bengali	:	Jayphala, Jaepatri
English	:	Nutmeg
Gujarati	:	Jaiphala, Javantri
Hindi	:	Jaiphal
Kannada	:	Jadikai, Jaykar, Jajakai
Kashmiri	:	Jafal
Malayalam	:	Jatika
Marathi	:	Jaiphal
Oriya	:	Jaipholo
Punjabi	:	Jaiphal
Sanskrit	:	Jatiphalam, Malathi-Phalam
Tamil	:	Sathkhai, Jathikkai, Jadikkay
Telegu	:	Jajikaya
Urdu	:	Jauzbuwa, Jaiphal

DESCRIPTION:

(a) **Microscopic**: Seed ellipsoid, 20-30 mm long and about 20 mm broad; externally greenish-brown sometimes marked with small irregular dark brown patches or minutes dark points and lines slightly furrowed reticulately; a small light-coloured area at one end indicating the position of the radicle; a groove running along the of perisperm with infoldings appearing as dark ruminations in the abundant grayish-brown endosperm; embryo, in an irregular cavity, small with two widely spreading crumpled cotyledons and a small radicle; odour, strong and aromatic; taste, pungent and aromatic.

(b) **Microscopic**: Transverse section of endosperm shows peripheral perisperm, of several layers of strongly, flattened polyhederal cells with brown contents or containing prismatic crystals; inner layer of perisperm of thin-walled parenchyma about 40 m thick, infolding into the tissue

of the endosperm to form the ruminations containing numerous, very large oil cells with brown cell walls, vascular strands; in the peripheral region, numerous small spiral vessels; large celled, endosperm, parenchymatous with occasional tannin idioblasts, with thin brown walls, containing numerous simple, rounded and compound starch grains, with upto about 10 components usually 2-8, individual grains, upto 20 m in diameter present, most of the cells with crystalline fat and often a large aleurone grain in each cell, containing a rhombic protein crystal upto 12 m and small aleurone grains with less regular crystalloids; embryo, of shriveled and collapsed parenchyma.

IDENTITY PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 per cent
Total Ash	:	Not more than 3 per cent
Acid-insoluble ash	:	Not more than 0.5 per cent
Alcohol-soluble extractive	:	Not less than 11 per cent
Water-soluble extractive	:	Not less than 7 per cent
Ether-soluble extractive	:	Not less than 25 per cent v/w
Volatile oil	:	Not less than 5 per cent v/w

CONSTITUENTS	:	Essential oil and fixed oil
ACTION	:	Mufarreh, Muqawwi-e-Bah, Mutayyib-e-Dahan, Muqawwi-e-Meda, Qabiz, Kasir-e-Riyah, Mukhaddir.
THERAPEUTIC USE	:	Zof-e-Bah, Qula, Falij, Laqwa, Zof-e-Basarat, Nafkh-e-Shikam
DOSE	:	1 to 2 g.
IMPORTANT FORMULATIONS	:	Laboob-e-Kabir, Jawarish-e-Ood Shireen, Habb-e-Mumsik-Waqi.

KABABCHINI

Drug Kababchini consists of mature, dried fruits of *Piper cubeba* Linn, of family Piperaceae. Drug yielding plant is woody, climbing, perennial with dioeceous flowers in spike, cultivated to a small extent in India, specially in the Karnataka state; fruits collected when mature but still unripe and carefully dried.

OTHER NAMES:

Arabic	:	Kababsh
Persian	:	Kababah
Assamese	:	Kakkol, Kababcheni
Bengali	:	Kababchini, Sitalachini
English	:	Cubebs, Tailed Pepper
Gujarati	:	Chanakabab, Chinikabab, Tadamiri, Kababchim
Hindi	:	Seetalchini
Kannada	:	Gandhamenasu, Balamenasu
Kashmiri	:	Kushfal, Kababchini
Malayalam	:	Cheenamulaku, Takkolam, Valmulaku
Marathi	:	Kankol Hinsimire, Kabachini, Kankola
Oriya	:	Kababchini
Punjabi	:	Kababchini, Sardchini
Sanskrit	:	Kankolika, Sugandhamuricha
Tamil	:	Vaali Milaku, Valmilaku
Telegu	:	Chalavamiriyalu, Tokamiriyalu
Urdu	:	Kababchini

DESCRIPTION:

(a) **Macroscopic**: Fruit wrinkled, rounded, 5-7 mm in diameter, light brown to dark brown about 7 mm long stalk attached; pericarp red to slightly brown, testa fused with pericarp; fruit hard and stony albumen white and oily; odour, aromatic and characteristic; taste, pungent and slightly bitter.

(b) **Microscopic** : Transverse section of fruit shows an outer layer of epidermis, externally covered with thick cuticle, a row of 2-5 small, crushed, brown and thick-walled cells below; mesocarp composed of large, thin-walled parenchymatous cells, oil cells and vascular bundles; endocarp of multi-layered sclereids heavily lignified with narrow lumen; testa and gegmen composed of elongated cells tegmen cells hyaline and kernel cells grayish in colour.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 8 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-soluble extractive	:	Not less than 14 per cent
Water-soluble extractive	:	Not less than 11 per cent
CONSTITUENTS	:	Essential oil (cubebin)
ACTION	:	Mulattif, Mufatteh-Sudad, Mutayyib-e-Dahan, Mohallil-e-Waram, Mudirr-e-Baul, Mudirr-e-Haiz.
THERAPEUTIC USE	:	Sual, Qurooh, Ehtebas-e-Baul.
DOSE	:	1 to 3 g.
IMPORTANT FORMULATION	:	Majoon-e-Antaki, Laboob-e-Sagheer, Sufoof-e-Indrijulab, Sunoon-e-Mujalli, Zuroor-e-Qula Abyaz, Zuroor-e-Kath.

KALONJI

Drug Kalonji consists of seeds of *Nigella sativa* Linn. of Ranunculaceae family. Drug yielding plant is a small herb. 45-60 cm high, mostly cultivated in Punjab, Himachal Pardesh, Bihar and Assam.

SYNONYNMS:

Arabic	:	Habb-ul-Sauda, Kamun Aswad
Persian	:	Shooneez
Bengali	:	Kalajira, Mungrela
English	:	Small Fennel Nigella Seed, Black Cumin
Gujarati	:	Kalonji, Jirum, Kalaunji
Hindi	:	Kalaunji, Mangaraila
Kannada	:	Karijirige
Kashmiri	:	Tukkum-e-Gandana
Marathi	:	Kalaunji-Jire, Kalerjire
Malyalam	:	Karinchirakam
Punjabi	:	Kalvanji
Sanskrit	:	Sthula Jiraka, Susavi, Krishna-Jiraka
Tamil	:	Karunjarakam, Karunjiragam
Telegu	:	Peeajila Karra, Nallajilakara
Urdu	:	Kalonji

DESCRIPTION:

(a) **Macroscopic** : Seeds flattened, oblong, angular, rugulose tubercular, small, funnel shaped, 0.2, cm long and 0.1 cm. wide black; odour slightly aromatic; taste, bitter.

(b) **Microscopic :** Transverse section of seed shows single layer of epidermis consisting of elliptical, thick-walled cells covered externally a papillose cuticle filled with reddish-brown content: epidermis followed by 2-3 layers of thick-walled, tangentially elongated, parenchymatous cells, followed by a pigmented with reddis-brown pigment; below pigmented layer; parenchyma composed of thick walled rectangular, radially elongated cells, present in a layer; endosperm consists of moderately thick-walled rectangular to polygonal cells, a few filled with oil blobules, embryo embedded in endosperm.

Powder: Black, oily to touch; under microscope shows groups; of parenchyma, endosperm cells and oil globules.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 6 per cent
Acid-insoluble Ash	:	Not more than 0.2 per cent
Alcohol-soluble extractive	:	Not less than 20 per cent.
Water-soluble extractive	:	Not less than 15 per cent.
CONSITITUENTS	:	Essential oil, fixed oil, resin, saponin and tannin
ACTION	:	Jali, Munaffis-e-algham, Muqawwi-e-Meda, Qatil-e-Deedan-e-Ama, Mudirr-e-Haiz, Musakkin, Mohallil-e-Waram
THERAPEUTIC USE	:	Bahaq, Bars, Quba, Shaqeeqa, Zeequn Nafas, Zof-e-Meda, Nafkh-e-Shikam, Qulanj, Yarqan, Waj-ul-Mafasil, Waja-ul-Qutn. Falij, Laqwa.
DOSE	:	1 to 2 g.
IMPORTANT FORMULATIONS	:	Majoon-e-kalkalanaj, Majoon-e-Fanjnosh, Majoon-e-Kundur.

KAMILA

Drug Kamila consists of glands and hairs of fruit of *Mallotus philippinensis* Muell. Arg. of Euphorbiaceae family. Drug yielding plant is a very common perennial shrub or small tree found is outer Himalayas ascending to 1500m; mature fruits collected in February- March; reddish brown powder collected in cloth by shaking and rubbing the fruits with hands.

OTHER NAMES:

Arabic	:	Qimbeel
Persian	:	Kamila, Kanbila
Assamese	:	Lochan, Jorat Losan, Gangai, Jaggaru, Paddum
Bengali	:	Kamalagundi, Kamala, Kamalaguri, Tung.
English	:	Indiankamala, Rottlera, Monkey face tree, Kamala Dye.
Gujarati	:	Kapila Kapil
Hindi	:	Kamala, Sindur Rohini, Kambila Rora, Kamela, Raini, Kumud
Kannada	:	Chandrahettu, kapila, kapilathettu, Kunkumadamara, Vasare Chanrahittu.
Kashmiri	:	Kaimbil
Malayalam	:	Kampippala, Kapila, Manjanan, Kuramadakku, Chenkolli Maunana, Poonagam, Punaats.
Marathi	:	Shendri, Kapila, Shindur.
Oriya	:	Kamalagundi, Sinduri, Kunkumo, Kapillogundi.
Punjabi	:	Kamila, kamla, Kambal, Kamela, Kumila, Reini, Reun, Rulya
Sanskrit	:	Kapila, Kambha, Rechandka, Bahupushpa, Chandra, Kasara, Punnaga, Nadivasa, Madhuka.
Tamil	:	Kamala, Kampila, Kapli Kungumam, Kurangumanjanatti, Avam, Kabilam, Kapilapali.
Telegu	:	Sinduri, Chendiranu, Kunkuma
Urdu	:	Kamila.

DESCRIPTION:

(a) **Macroscopic** : Fine, granular powder, dull-red or madder-red coloured, floating on water.

(b) **Microscopic** : Under microscope glands appear depressed and globular, containing deep-red coloured resin, secreted by many club shaped cell radiating from a common centre; a number of stellate trichomes present, trichomes thick-walled, branching lignified with smooth margins, yellow coloured, arranged in small radiating groups.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total Ash	:	Not more than 6 per cent
Acid-insoluble ash	:	Not more than 4 per cent.
Alcohol-soluble Extractive	:	Not less than 50 per cent.
Water soluble extractive	:	Not less than 1 per cent.
CONSTITUENTS	:	Resinous colouring matter (rottlerin)
ACTION	:	Qatil-e-Deedan-e-Ama, Mus-hil, Mujaffif, Daf-e-Taffun.
THERAPEUTIC USE	:	Bussor, Jarab, Hikka, Deedan-e-Ama,
IMPORTANT FORMULATIONS	:	Itrifal-e-Deedan, Marham Gulabi, Qurs Deedan

KANER

Drug Kaner consists of dried leaves of *Nerium indicum* Mill. Syn. *Nerium odorum* Soland of Apocynaceae family. Drug yielding plant is a large evergreen woody shrub with milk juice, found throughout the year in upper Gangetic plains, Himalayas, from Nepal to Kashmir upto 2000 m, Central and Southern India; also cultivated near temples and gardens.

OTHER NAMES:

Arabic	:	Difli, Summ-ul-Himar
Persian	:	Kharazahar Difil
Assamese	:	Karavi,
Bengali	:	Karavi, Karabi
English	:	Indian oleander Sweet Scented Oleander, Roseberry Spurge.
Gujarati	:	Kanera, Karena, Karen, Kagar.
Hindi	:	Kaner, Karber, Kuruvira, Karabera
Kannada	:	Kanagalu, Kanagile, Paddale, Karwira, Bil iganagile.
Kashmiri	:	Gandeela Gandula, Kaner, Karabera.
Malayalam	:	Kanaveram, Arali, Alari, Karavivam, Raktapushpam, Veluttarali
Marathi	:	Kanher Kaneri,
Oriya	:	Konero, Koneyoro, Koriviro.
Punjabi	:	Kaner, Ganera, Ganhira, Kanira
Sanskrit	:	ayamaraka, Karavira, Asvamaraka.
Tamil	:	Arali, Alari, Agam, Alarida
Telegu	:	Ettaganneru, Ganneru, Karaviram Kasturipatta.
Urdu	:	Kaner

DESCRIPTION:

(a) **Macroscopic:** Leaves exstipulate, linera, lanceolate 10-20 cm long and apto 2.5 cm wide, thick, dark green and shining above and dotted beneath, venation unicostate, reticulate with midrib being stout and the secondary veins arising in very large number, running parallel, stomata anomocytic.

(b) **Microscopic:**

Petiole: Transverse section of petiole shows a single layer of epidermis covered externally by thick cuticle, epidermal cells elongate to form unicellular, non-lignified and non-glandular hairs, a wide zone of cortex, composed of 4-7 layers of collenchymatous cells and a wide zone of parenchyama follows the epidermis; parenchymatous cells thin-walled, more or less isodiametric with interecellular spaces, some cells contain rosette crystals of calcium oxalate; petiole receives three vascular bundles from stem, central one large and crescent shaped while

other two much smaller and somewhat circular present one each side of central vascular bundle; phloem present on upper side and xylem on lower side with usual elements.

Lamina: Transverse section of lamina shows an isobilateral structure, upper epidermis composed of penta or hexagonal parenchymatous cells, externally covered with thick cuticle, below upper epidermis 2-3 layers of hypodermis present; palisade 3-4 layerred composed of elongated and compactly arranged cells; vascular strands also seen in between palisade and spongy parenchyma, spongy parenchyma filled with chlorophyll; towards lower surface 2-3 layered palisade, below which parenchyma and lower epidermis present lower epidermis also coated with the cuticle externally; in lower surface many pits possessing stomata, unicellular, non-glandular and non-lignified trichomes; rosette crystals of calcium oxalate present throughout lamian, average palisade ratio 4:1.

Midrib: Transverse section of midrip shows epidermis composed of a layer of cells, externally; covered with cuticle, some epidermal cells on upper and lower sides from unicellular hairs; between epidermis and parenchyma 2-4 rows of thick walled cells, more prominent towards lower side; some parnechymatous cells contain rosette crystals of calcium oxalate; laticifers found scattered singly or in groups of 2 in this region beneath the vascular bundle a strip of fibers present, vascular bundle "U" shaped, xylem being towards lower side and phloem towards the upper consists of tracheides, vessels and parenchyma; vessels with end-openings, rarely with side openings tracheids many with spiral, annular or reticulate thickenings on their walls.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 9 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-soluble extractive	:	Not less than 20 per cent
Water-soluble extractive	:	Not less than 20 per cent.

CONSTITUTENTS	:	Cardiace glucoside (Oleandrin).
ACTION	:	Muqawwi-e-Bah, Musaffi-e-Dam, Jali Mujaffif, Mohallil-e-Waram.
THERAPEUTIC USE	:	Juzam, Bars, Aatishak, Suzak, Qurooh, Zof-e-Bah, Fasad-ud-Dam.
DOSE	:	1 to 15 g.
IMPORTANT FORMULATION	:	Tila-e-Mumsik

KARANJ

Drug Karanj consists of seeds of *Pongamia Pinnata* (Linn) Merr, Syn. *Pongamia glabra* Vent of Leguminosae family. Drug yielding plant is a medium sized glabrous tree with a short bole and spreading crown and found almost through out India upto an altitude of 1200m.

OTHER NAMES:

Assamese	:	Korach, karchave
Bengali	:	Nata, Karnaja, Dahara, Karanja, Dahar-Karanja
English	:	Smooth leaved pongamia, Indian Beech.
Gujarati	:	Kanaji, Kanajo, Karanj, Karanajnu
Hindi	:	Dithouri, Karuanini, Karanj, Kanaja, Karanjaka, Kiramal.
Kannada	:	Honge, Hulagilu, Honge-Marq, Batti Karanaja.
Malayalam	:	Pungu, Pungamaram, Minnar Punnu.
Marathi	:	Karanja, Karanj, Ghanerakaranj
Oriya	:	Konja, Koranjo
Punjabi	:	Karanj, Sukhchain, Paphri,
Sanskrit	:	Naktamata, Karanja, Kalimara, Putikaranja,
Tamil	:	Pungan, Pongam, Pungammaram, Agirunadanm, Ileanji, Pungu, Ponga, Pongam,
Telegu	:	Lamiga, Kanuga, Kanuga-chettu, Kagu, Pungu, Gaanuga
Urdu	:	Karanj

DESCRIPTION:

(a) **Macroscopic** : Seed usually one and rarely two elliptic of remiform in shape, 1.7-2 cm long and 1.7-2.0 cm long and 1.2-1.8 cm broad, wrinkled with reddish leathery testa; micropylar end of cotyledons slightly depressed while other side semi-circular in shape.

(b) **Microscopic**: Transverse section of seed shows, testa composed of a layer of palisade like outer epidermis, filled with brown pigment, covered externally with a thick cuticle, a layer of large, thin walled, somewhat rectangular cells, 2-4 layers of thick-walled parenchyma cells, a few rows of cells with small intercellular spaces, 2-3 layers of thick-walled elongated cells; a few layers of spongy parenchyma having large inter-cellular spaces, a number of parenchyma cells containing brown pigment; cotyledons composed of outer layer of epidermis with cylindrical cells, externally covered with thin cuticlue; epidermis followed by rectangular to polygonal cells of mesophyll, filled with globules, also present scattered in this region.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 per cent
Total ash	:	Not more than 3 per cent
Acid-insoluble ash	:	Not more than 0.1 per cent.
Alcohol-soluble extractive	:	Not less than 23 per cent.
Water-Soluble extractive	:	Not less than 13 per cent
CONSTITUENTS	:	Fixed oil, flavones and traces of essential oil,
ACTION	:	Musaffi-e-Dam, Habis, Daf-e-Taffun
THERAPEUTIC USE	:	Hikka, Hirqat-ul-Baul, Surfa, Nafs-ud-dam
DOSE	:	1 to 2 g.
IMPORTANT FORMULATION	:	Qurs-e- Deedan

KATAN

Drug Katan consists of dried, ripe seeds of *Linum usitatissimum* Linn. of Linaceae family. Drug yielding plant is an erect annual herb, 0.6-1.2m high extensively cultivated throughout the plains of India upto an altitude of 800 m; capsule ripen by end of June, dried seeds separated from capsule by thrashing.

OTHER NAMES:

Arabic	:	Bazr-ul-Katan
Persian	:	Tukhm-e-Katan.
Assamese	:	Tisi, Tusi
Bengali	:	Masina, Alasi, Tisi
English	:	Linseed, Flax Plant Common flax
Gujarati	:	Alsi, Arasi
Hindi	:	Alsi, Tisi
Kannada	:	Agasebeeja, Semeegara, Agasi, Kain Atish, Agashi
Kashmiri	:	Alsi Alish, Kenu
Malayalam	:	Agastha, Cheruchanan-Vittinteuilta
Marathi	:	Alashi, Javas
Oriya	:	Atushi, Peso
Punjabi	:	Ali, Alish, Alsi, Tisi
Sanskrit	:	Atasi, Chanaka, Madagandha, Nilpushpika
Tamil	:	Ali, Virai, Alshi, Alshi Virai, alivirai
Telegu	:	Avisi, Atasi, Madanginjalu, Ullusulu
Urdu	:	Alsi Katan.

DESCRIPTION:

(a) **Macroscopic** : Seed small, brown, glossy with minutely pitted surface, about 4-6 mm long and 2-2.5 mm in maximum width, elongated-ovoid, flattened, rounded at one end and obliquely pointed at the other, near which on one edge, a light depression enclosing hilum and micropyle; embryo consisting of two yellowish-white, flattened planoconvex cotyledons and a radicle, nearly fills the seed and embryo oily; testa mucilaginous when soaked in water, odour, characteristic; taste, oily when chewed.

(b) **Microscopic** : Transverse section of seed shows testa consists of isodiametric cells with mucilaginous outer walls, collenchymatous cells of middle layer of seed coat cylindrical; single layered, yellowish brown, longitudinally elongated, about 120-190 long and 14-47 wide, thick, lignified and with pitted walls; single layer of flattened polygonal pigment cells with reddish-brown contents; aleurone grains in the cotyledons, upto 20 in dimeter, each with globoid and crystalloid; abundant globule of fixed oil and occasional starch grains present.

IDENTITY PURITY AND STRENGTH:

Foreign matter	:	Not more than 1 per cent
Total ash	:	Not more than 5 per cent
Acid-insoluble ash	:	Not more than 2 per cent
Alcohol-soluble extractive	:	Not less than 30 per cent
Water-soluble extractive	:	Not less than 15 per cent
Fixed oil	:	Not less than 25 per cent

CONSTITUENTS : Fixed oil, mucilage and protein.

ACTION : Mohallil-e-Waram, Munzij, Jali, Musakkin-e-sual, Munaffis-e-Balgham.

THERAPEUTIC USE : Sual, Zeequn Nafas, Zat-ul-Janb, Zat-ur-Riya, Humuzat-e-Meda, Zaheer, Waj-ul-Mafasil, Haraq.

DOSE : 5 to 10 g.

IMPORTANT FORMULATIONS : Qairooti Bazr-e-Katan, Qairroti-e-Mohallil, Laooq-e-Katan, Zamad-e-Khanazeer, Marham-e-Dakhilyun.

KHAR-E-KHASAK KHURD

Drug Khar-e-Khasak consists of dried entire fruits of *Tribulus terrestris* Linn. of family Zygopyllaceae. Drug yielding plant is an annual, rarely perennial common weed of the pasture lands, road sides and other waste places, chiefly in hot, dry and sandy regions; grows throughout India as prostrate herb and utpo 3,000 m in Kashmir.

OTHER NAMES:

Arabic	:	Akhwas-ul-juz, Khasak
Persian	:	Khar-e-Khasak
Assamese	:	Gokshura Gokhuvkata
Bengali	:	Gokshura, Gokhri, Gokhru, Gokhura, Gokhshra
English	:	Caltrops fruits Calthrops, Small Caltrops
Gujarati	:	Nahannagokharu, Mithagokhru, Betagokhru.
Hindi	:	Gokhru, Gokshri, Burragokhur
Kannada	:	Sannaneggilu, Neggilamullu, Neggilu, Negalu
Kashmiri	:	Michirkand, Pakhda
Malayalam	:	Nerinjil, Nerinnil, Nerungil, Nerinji
Marathi	:	Sarate, Gokharu, Lahanagokharu, Sarala, Sharatte, Lahangokhru
Oriya	:	Gukhuru, Gokhyura, Gokshra, Gokhura
Punjabi	:	Bhakhra, Gokhru, Bhukri, Gokhrudesi, Kurkundai
Sanskrit	:	Shvadanstra, Traikantaka, Gokshura, Bahukantaka.
Tamil	:	Nerinjil, Nerunjil, Nerunji, Sirunerinji, Nerinji.
Telegu	:	Pellerukayaru, Paaerru, Chirupalleru, Pallerumul lal Nirunji, Chinnipalleru, Pallerukayalu.
Urdu	:	Gokharu.

DESCRIPTION:

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

(b) **Microscopic**: Transverse section of fruit shows small epidermal cells of each coccus rectangular; unicellular trochees in abundance; mesocarp 6-10 layers of large parenchymatous cells, rosette of calcium oxalate crystals abundantly present; mescoarp followed by 3-4 compact layers of small cells containing prismatic crystals of calcium of oxalate.

IDENTITY PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 15 per cent
Acid-insoluble ash	:	Not more than 2 per cent
Alcohol-soluble extractive	:	Not less than 6 per cent
Water-soluble extractive	:	Not less than 10 per cent
CONSTITUENTS	:	Potassium nitrate sterols, sapogenin with Pyroketone ring (diosgenin), gitogenin and hecogenins.
ACTION	:	Mudirr-e-Baul, Mudirr-e-Haiz Mufattit-e-Hasat.
THERAPEUTIC USE	:	Hasat-e-Masana, Hirqat-ul-Baul, Ehtebas-e-Haiz, Surat-e-Inzal, Jiryan.
DOSE	:	5 to 7 g.
IMPORTANT FORMULATIONS	:	Sharbat-e-Buzoori Motadil, Sufoof-e-Ziabetus Qawi.

KHIYAR SHAMBAR

Drug Khiyar shambar consists of pulp obtained from fruits (devoid of seeds, septa and pieces of pericarp) of *Cassia fistula* Linn. of leguminosae family. Drug yielding plant is moderate sized deciduous tree, common throughout India as wild or cultivated plant; fruits collected when ripe.

OTHER NAMES:

Arabic	:	Khiyar Shambar
Persian	:	Khiyar Shambar
Assamese	:	Sonaroo, Sonaru
Bengali	:	Sonalu, Soondali, Bundarlati, Amultas
English	:	Indian Laburnum, Purging Cassia, Pudding Pipe tree, Cassia, Golden shower
Gujarati	:	Garmala, Garmalu, Balla, Girmala
Hindi	:	Amaltas, Sonhali, Girimalah
Kannada	:	Aragnadha, Kakke,-Gidda, Kakkemera, Kakkedia, Kakkaemara, Rajataru, Kakke
Kashmiri	:	Kriyangal Phali
Malayalam	:	Konna, Kritamalam, Svarannakam, Saturangul
Marathi	:	Bahava, Garamala, Amaltas, Bawa
Oriya	:	Sunari
Punjabi	:	Amaltas, Alash, Ali
Sanskrit	:	Krtamala, Vyadhiantaku, Sampaka Nirpachruma, Aragbhada, Arakvadam, Suwarnaka, Rajataru
Tamil	:	Sarakkonai, Savakkondi, Sharakkanra, Konai, Konarai, Konaraikkai, Konnei
Telegu	:	Rela, Kondrakayi, Raelachettu, Argvadhamu, Relagujju
Urdu	:	Amaltas

DESCRIPTION:

Macroscopic: Fruit, a many celled, indehiscent pod, 35-60 cm long and 18-25 mm in diameter, nearly straight and subcylindrical, chocolate-brown to almost black in colour; pod surface smooth to naked eye, but under lens showing minute transverse fissures; both dorsal and ventral suture evident, but not prominent; short stalk attached to base of fruit and rounded distal end mucronate; pericarp thin, hard and woody; fruit initially divided by transverse septa about 5 mm, apart, each containing single seed attached to ventral suture by a long dark, thread-like funicle about 8-12 by 6-8 mm, circular to oval, flattened, reddish-brown smooth, extremely hard and with a distinct dark brown line extending from

micropyle to base; seed initially embedded in a black viscid pulp consisting of black, thin, shining, circular disc like masses having central depression of seed on both surfaces or as broken pieces adhered with each other; when dipped in water, makes yellow solution which darkness to brownish-yellow to dark brown, on keeping; pulp fills the cell but shrinks on drying and adheres to both sides of testa; seeds often lie loose in their segments; Odour faint, sickly; taste sweet.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 6 per cent
Acid-insoluble ash	**:**	Not more than 1 per cent
Alcohol-soluble extractive	**:**	Not less than 15 per cent
Water-soluble extractive	**:**	Not less than 46 per cent

CONSTITUTENTS **:** Sugar, mucilage, pectin and anthraquinone.

ACTION **:** Mus-hil, Mulaiyin, Mohallil-e-Waram, Mudirr-e-Haiz.

THERAPEUTIC USE **:** Qabz, Sual, Waram-e-lauzatain

DOSE **:** 20 to 40 g.

IMPORTANT FORMULATION **:** Laooq-e-Khiyar Shambar.

KISHNEEZ

Drug Kishneez consists of dried ripe fruits of *Coriandrum sativum* Linn. of family Umbelliferae. Drug yielding plant is a selender, glabrous, branched, annual her, cultivated all over India, 30-90 cm high, giving characteristic aroma when rubbed, crop matures in 2-3 months after sowing, herb is pulled out with roots, after drying, fruits thrashed out and dried in sun, winnowed, and stored in bags.

OTHER NAMES:

Arabic	:	Kazbra Yabisa
Persian	:	Kishneez
Assamese	:	Dhaniya
Bengali	:	Dhana, Dhania, Bhoti
Gujarati	:	Dhana Kenphir, Dhanis
Hindi	:	Dhaniya, Dhania, Kottmir
Kannada	:	Havija, Kothambaribija, Kothambri
Kashmiri	:	Dhaniwal Dhannawal
Malayalam	:	Malli, Kottampalari, Kothamalli
Marathi	:	Dhana Kothimbir, Dhanya, Khotbir, Kothmir.
Oriya	:	Dhania
Punjabi	:	Dhania
Sanskrit	:	Shanika, Dhanya, Vitunnaka, Kustumburi Dhaniyaka, Ababika
Tamil	:	Kottamali, Virai, Dhaniya, Kotamalli
Telegu	:	Dhaniyalu
Urdu	:	Dhania

DESCRIPTION:

(a) **Macroscopic:** Fruit globular, mericarps usually united by their margins forming a cremocarp about 2-4 mm in diameter, uniformly brownish-yellow or brown, glabrous, sometimes crowned by the remains of sepals and styles, primary ridges 10, wavy and slightly inconspicuous secondary ridges 8, straight, and more prominent; endosperm coelospermous; Odour aromatic; taste spicy and characteristic.

(b) **Microscopic** : Transverse section of fruit shows pericarp with outer epidermis, when present with slightly thickened anticlinal wall; a few stomata, many cells with small prisms of calcium Oxalate; trichomes absent; Outer layer of mesocarp parenchymatous with inner cells in wavy longitudinal rows and degenerated vittae as gangentially flattened cavities; middle layer of mesocarp sclerenchymatous forming a thick layer of fusiform, pitted cells in very sinuous tows, layers often crossing at the right angles with definit longitudinal strands in the secondary ridges; sinuous primary costae with some spiral vessel; inner cells of mecocarp, large, hexagonal

with rather thin, lignified walls; inner epidermis of very narrow thin-walled cells slightly sinous anticlinal wall thowing parquetry arrangement; two or rarely more, normal vittae occurring on commissural side of each mesocarp containing volatile oil; endosperm of thick-walled cellulosic parenchyma containing much fixed oil numerous- aleurone grains, about 4-8 in diameter containing micro-rosettes of calcium oxalate split carpohore passing at apex of each mericarp into raphe adjacent to which a large cavity and on inner side of this a flattened vascular strand; carpohore consisting of fibre surrounded by spiral vessels.

Powder: Fawn to brown epidermal cells of pericarp when present, slightly thick-walled and many containing small prism of calcium oxalate; parenchymatous cells of mesocarp without reticulate thickening; masses of sclerenchymatous cells of mesocarp in sinuous rows, often crossing at right angle large bubular hexagonal rather thin-walled sclerenchymatous cells of endocarp; cells of inner epidermis with slightly sinuous anticlinal walls; thick-walled polygonal parenchymatous cells of endosperm, containing fixed oil and numberous small alerurone grains, micro-rosettes of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 6 per cent
Acid-insoluble ash	:	Not more 1.5 per cent
Alcohol-soluble extractive	:	Not less than 10 per cent
Water-soluble extractive	:	Not less than 19 per cent
Volatile oil	:	Not less than 0.3 per cent v/w
CONSTITUENTS	:	Essential oil (coriandroal)
ACTION	:	Musakkin, Mohallil-e-Waram, Muqawwi-e-Qalb, Muqawwi-e-Dimagh, Muqawwi-e-Meda, Kasir-e-Riyah, Qabiz
THERAPEUTIC USE	:	Suda, Dawar, Zof-e-Qalb, Zof-e-Meda, Nafkh-e-Shikam, Zof-e-Dimagh
DOSE	:	5 to 7g.
IMPORTANT FORMULATIONS	:	Khamira Gao Zaban Sada, Khamira Gao Zaban Ambari Jwahar Wala, Jawarish-e-Shahi, Itrifal-e-Kishneezi, Dawa-ul-Misk Motadil Sada, Qurs-e-Ziabetus Sada, Arq-e-Musaffi-e-Khoon Qawi.

KULTHI

Drug Kulthi consists of dry seeds of *Vigna unquiculata* (Linn). walp syn,. *Dolichos biflorus* Linn. of Leguminosae family. Drug yielding plant is an annual branched, sub-erect of twining, downy or glabrescent, herb; cultivated allover India.

OTHER NAMES:

Arabic	:	Habb-ul-Quilt
Persian	:	Sang-e-Sikan
Assamese	:	
Bengali	:	Kulattha, Kalaya, Kurti-Kalai Kulti
English	:	Horse gram
Gujarati	:	Kalathi, Kulthi
Hindi	:	Kulathi, Kurathi, Kulthi
Kannada	:	Huruli, Hurali
Malayalam	:	Mutira, Muthera
Marathi	:	Kulitha
Oriya	:	Khalva, Vardhipatraka. Kulashta, Kulatha
Sanskrit	:	Khalva, Vardhipatraka, Kulastha, Kulatha
Tamil	:	Kollu, Keanam
Telegu	:	Ulavalu
Urdu	:	Kulthi

DESCRIPTION:

(a) **Macroscopic:** Seeds, hard, surface, smooth, ellipsoid, flattened, grayish to reddish brown; 4-6 mm long and 4 mm wide; microphyle prominent; tasta, somewhat astringent.

(b) **Microscopic:** Transverse section of seed shows testa consisting of a single layer of columnar, thin-walled parenchymatous, palisade like cells covered with a thin cuticle followed by single layer of rectangular to square bearer cells and 3-4 layers of thin-walled rectangular parenchymatous cells more wide at micropyler region; cotyledon consisting of single layer of upper and lower epidermis covered with a thin cuticle; epidermal cells thin-walled rectangular and parenchymatous followed by mesophyll, consisting of angular parenchymatous cells, filled with numberous simple grains and protein bodies also present.

Powder : Whitish in colour: under microscope shows broken pieces of testa, parenchymatous cells and startch.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 5 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-soluble extractive	:	Not less than 3 per cent
Water-soluble extractive	:	Not less than 12 per cent
CONSTITUENTS	:	An enzyme (urease) and oil.
ACTION	:	Mufattit-e-Hasat, Mudirr-e-Baul, Muddir-e-Haiz, Jali, Mufatteh Sudad, Mulaiyin.
THERAPEUTIC USE	:	Hasaat-e-Kulya, Hasat-e-Masana, Ehtebas-e-Baul, Ehtebas-e-Haiz.
DOSE	:	3 to 5 g.
IMPORTANT FORMULATION	:	Kushta-e-Hajrul Yahood.

LODH PATHANI

Drug Lodh pathani consists of dried stem bark of *Symplocos racemosa* Roxb. of Symplocaceae family. Drug yielding plant is an evergreen tree, 6-8.5 m tall, found abundantly in plains and lower hills throughout India.

OTHER NAMES:

Assamese	:	Mugam, Bhomroti
Bengali	:	Lodha, Lochra
English	:	Symplocos bark, Lodh tree
Gujarati	:	Lodhar, Lodar
Hindi	:	Lodhara,
Kannada	:	Lodhra, Pachettu
Malayalam	:	Pachotti
Marathi	:	Lodha, Lodhra
Oriya	:	Ludhu, Nidhu
Punjabi	:	Lodhar
Sanskrit	:	Rodhra, Pattika Lodhra, Sabara Lodhra, Tirita.
Tamil	:	Vellilathi, Vellilothram
Telegu	:	Lodhuga
Urdu	:	Lodh, Lodh Pathani

DESCRIPTION:

(a) **Macroscopic** : Mature stem bark occurs in channeled or curved pieces, few flat pieces also occur in thickness upto 1 cm, outer surface uneven and rough due to fissures and cracks; grayish-brown to grey externally, pale to whitish-brown internally; fracture short and granular in cortical region and somewhat fibrous in inner region; taste, astringent and feebly bitter.

(b) **Microscopic:** Transverse section of mature bark shows a wide cork of thin-walled, rectangular cells arranged in radial rows; cork cambium 1-3 layered; secondary cortex consists of thin-walled; oval and tangentially elongated parenchymaetous cells towards outer side and rounded cells towards inner side; a number of stone cells in singles or in groups present, scattered throughout the region having highly thickened walls with distinct pits; prismatic and cluster crystals of calcium oxalate, and starch grains mostly simple present in number of cortical cells; secondary phloem wide consisting of sieve elements, phloem parenchyma, phloem fibers and stone cells; phloem parenchyma, thin-walled, oval to rectangular, containing prismatic crystals of calcium Oxalate scattered in phloem parenchyma; phloem fibers lignified and present in singles or in groups, crystals not present in fibers; isolated fibers spindle shaped with pointed ends; groups of stone cells as rounded patches distributed throughout phloem region; medullary rays uni to multiseriate consisting of rectangular cells having brown colouring matter in some

cells, broader medullary rays dialating towards outer phloem region; a number of phloem cells also contains starch grains, mostly arranged in groups rarely solitary, simple and rounded.

Powder : Greyish-brown; under microscope shows fragments of cork, stone cells fibers, prismatic and cluster crystals of calcium oxalate and starch grains.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Nil
Total ash	:	Not more than 12 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-soluble extractive	:	Not less than 9 per cent
Water-soluble extractive	:	Not less than 15 per cent
CONSTITUENTS	:	Alkaloids, (loturine and collaturine) and red Colouring matter.
ACTION	:	Mughalliz-e-Mani, Habis
THERAPEUTIC USE	:	Ramad, Kasrat-e-Tams, Ishal, Bawaseer, Sailan-ur-Rahem, Jiyan, Zof-e-Bah, Zof-e-Rahem, Taqteer-ul-Baul.
DOSE	:	1 to 3 g.
IMPORTANT FORMULATION	:	Zimad-e-Asfar

MAINPHAL

Drug Mainphal consists of dried fruit of *Xeromphis spinosa* (Thunb) Keay, Syn. *Randia dumetorum* Lam. of Rubiaceae family. Drug yielding plant is a deciduous thorny shrub or a small tree, reaching a height upto 9 m and girth about a metre, branches numerous, thick and horizontal, found in sub-Himalayan tracts extending eastwards in Sikkim upto 1200 m and southwards to Peninsular India.

OTHER NAMES:

Arabic	:	Jauz-ul-Qai
Persion	:	Jauz-ul-Qai
Assamese	:	Meen, Gurol
Bengali	:	Mainaphal, Mayanaphal, Menphal
English	:	Emetic nut
Gujarati	:	Mindhala, Mindhol, Mindhar
Hindi	:	Mainphal
Kannada	:	Managarikai, Karigidda, Madanaphala, Maggrekai, Kare, Maggre Kayi.
Kashmiri	:	Madanfal, Kirkla, Kokoa
Malayalam	:	Malankara, Malamkarakka, Kara
Marathi	:	Gal, Galphala, Giephala, Madanphala
Oriya	:	Meena, Madana, Patova
Punjabi	:	Mindhal, Arara, Manphal
Sanskrit	:	Madana
Tamil	:	Marukkarai
Telegu	:	Maranga, Kaya, Monga Kaya, Manga
Urdu	:	Mainphal.

DESCRIPTION:

(a) **Macroscopic**: Fruit, 1.8-4.5-cm long, globose or broadly ovoid, longitudinally ribbed or smooth yellowish- brown, crowned with persistent calyx-limb; fruit, contains numerous seeds, 0.4-0.6 cm long compressed, smooth, brown and very hard.

(b) **Microscopic**:

Fruit: Transverse section shows epicarp consisting of single layered epidermis, sometimes obliterated in surface view; epidermal cells thin-walled and polygonal; mesocarp, broad zone consisting of thin-walled, parenchymatous cells, some cells contain reddish-brown content; a number of vascular bundles found embedded in this zone, endocarp stony consisting of light yellow polygonal, sclerenchymatous cells of variable shape and size.

Seed: Transverse section shows a seed coat, consisting of single layered, rounded to oval edipermal cells, a few layers of yellowish-brown pigmented cells; endosperm forms bulk of seed consisting of large oval and irregular shaped parenchymatous cells; albumen horny, translucent, cells of outermost layer smaller in size.

Powder: Reddish-brown; under microscope shows numerous, large, irregular, reddish brown cells sclereids of variable shape and size; pieces of xylem vessels with reticulate thickenings; thin-walled, crushed parenchymatous cells and yellow-orange pieces of seed coat.

IDENTITY, PUTRITY AND STRENGTH:

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 6 per cent
Acid-insoluble ash	**:**	Not more than 0.25 per cent
Alcohol-soluble extractive	**:**	Not less than 19 per cent
Water-soluble extractive	**:**	Not less than 16 per cent
CONSTITUENTS	**:**	Essential oil, Tannin saponins and resin.
ACTION	**:**	Mohallil-e-Waram, Munaffis-e-Balgham
THERAPEUTIC USE	**:**	Falji, Laqwa, Sual, Zeequn-Nafas, Busoor, Nafkh-e-Shikam.
DOSE	**:**	3 to 6g.
IMPORTANT FORMULATION	**:**	Raughan -e-Baladur.

MUQIL

Drug Muqil consists of exudate of *Commiphora wightii* (Arn.) Bhand; Syn. *Balsamodendron mukul* Hook, ex Stocks (*commiphora mukul Engl.)* of Burseraceae family drug yielding plant is a small perennial tree or shrub upto 1.2-1.8m high, occuring in rocky tracts of Rajasthan, Gujarati exudate is collected during winter season by making incisions in the bark or in summer falling from the bark itself.

OTHER NAMES:

Arabic	:	Muqil-e-Arzaq
Persion	:	Boo-e-Jahoodan
Assamese	:	Guggul
Bengali	:	Guggula, Guggul, Mukul
English	:	Gum guga, Indian Bedlellium
Gujarati	:	Gugal, Guggal, Gugar, Gugara, Guggul
Hindi	:	Guggal
Kannada	:	Kanthagana Guggala, Mahishaksha-Guggu,
Kashmiri	:	Guggal, Dhoop, Kanth Gan
Malayalam	:	Gulguu, Guggulu
Marathi	:	Guggul, Mahishaksh, Gugala, Guggule,
Oriya	:	Guggulu
Panjabi	:	Guggal
Sanskrit	:	Pura, Mahisaksa, Kaushikah, Palankas, Guggula, Guggulu, Kanshikaha
Tamil	:	Mahisakasi, guggulu, gukkulu, Gukkal, Maisatchi, Kungiliyam
Urdu	:	Muquil

DESCRIPTION :

Drug occurs in vermicular of stalactitic pieces of pale yellow or brown coloured mass, makes milky emulsion in hot water and readily burns; when fresh viscid and golden coloured; odour, aromatic; taste, bitter and astringent.

IDENTITY PURITY AND STRENGTH:

Foreign matter	**:**	Not more than 4 per cent
Total ash	**:**	Not more than 5 per cent
Acid-insoluble ash	**:**	Not more than 1 per cent
Alcohol-soluble extractive	**:**	Not less than 27 per cent
Water soluble extractive	**:**	Not less than 53 per cent
Volatile oil	**:**	Not less than 1 per cent v/w

CONSITITUENTS	**:**	Essential oil, gum, resin steroids
ACTION	**:**	Mohallil-e-Waram, Muqawwi-e-Asab, Mufatteh-Sudab, Kasir-e Riyah.
THERAPEUTIC USE	**:**	Bawaseer Amya, Qabz, Nafkh-e-Shikam, Waj-ul-Mafasil, Waram-e-Mafasil.
DOSE	**:**	1 to 15g.
IMPORTANT FORMULATIONS	**:**	Habb-e-Muqil, Zimad-e-Kibreet, Zimad-e-Mohallil, Mojoon-e-Muqil, Majoon-e-Jograj Gugal, Itrifal-e-Muqil Mulaiyin , Habb-e-Shabyar, Iyarij-e-Loghaziya.

PAMBADANA

Drug, Pambadana consists of seeds (devoid of lint) of *Gossypium herbaceum* Linn. of Malvaceae family. Drug yielding plant is an annual of perenneal shrub, 0.6-2.4 m high, extensively cultivated in India.

OTHER NAMES:

Arabic	:	Habb-ul-Qutn
Persian	:	Pambadana
Assamese	:	Kirpasa, Tula
Bengali	:	Kapas, Tula, Kapastula
English	:	Bona, Kapasia, Common cotton, Indian cotton
Gujarati	:	Vona, Ru, Kapas
Hindi	:	Kapasa, Binaula, Kapas, Kupas, Rui
Kannada	:	Hati, Arale, Ambara, Arali, Karpasa.
Malayalam	:	Karpasi, Panji, Karpasam, Parutti, Karppasam
Marathi	:	Sarki
Oriya	:	Karpasu, Kopa, Korpasu
Panjabi	:	Rui
Sanskrit	:	Tundakesi, Karpas, Anagnika, Chvya, Karpasasarini
Tamil	:	Paruthi, Kkoottam, Iladamoarutti,
Telegu	:	Pattiginga, Paththi, Badar, karpasamu, Patt, Pilya
Urdu	:	Pambadana, Habb-ul-Qutn

DESCRIPTION:

(a) **Macroscopic:** Seed, dark brown, ovoid, 0.3-0.6 cm in diameter; minute, shallow, longitudinal grooves arise from funicular region of seed; taste, slightly bitter.

(b) **Microscopic:** Transverse section of mature seed shows, two integuments forming seed coat; outer integument defferentiated into epidermis, a wide zone of parenchyma and a hyaline layer; epidermis single layered; some trichomes arise from epidermis and form lint and fuzz hairs; lint hairs elongated with thin wall and wide lumen; fuzz hairs thick-walled with narrow lumen parenchymatous zone consists of 4-8 layers of reddish-brown cells; a few vascular bundles embedded in this zone; hyaline layer consisting of 2-3 layers of tangentially elongated, cubical, thick-walled cell; inner integument composed of palisade and parenchyma; palisade cells compactly arranged and colourless; parenchyma many layered of tangentially elongated cells with deep reddish-brown contents cotyledons thin, large and folded; followed by 1 or 2 layered palisade like cells of mesophyll; beneath this zone, mesophyll cells show elongated to rounded structure without inter-cellular spaces lower epidermis single layered cubical or oval, covered with cuticle; some lysigenous glands filled with yellowish-brown contents also found scattered in mesophyll region, starch and calcium oxalate crystals absent.

Powder: Brown; under microscope shows palisade cells, thin-walled mesophyll cell, deep brown contents and hairs, pieces of testa and fuz intact.

IDENTITY, PURITY AND STRENGHT:

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 5 per cent
Acid-insoluble ash	**:**	Not more than 0.1 per cent
Alcohol-soluble extractives	**:**	Not less than 14 per cent
Water-soluble extractives	**:**	Not less than 8 per cent
CONSTITUENTS	**:**	Fixed oil, resin and sterols.
ACTION	**:**	Musammin-e-Badan, Muqawwi-e-Bah, Muwallied-e-Mani, Munaffis-e-Balgham, Jali.
THERAPEUTIC USE	**:**	Zof-e-Aam, Qillat-e-Mani
DOSE	**:**	3 to 7 g.
IMPORTANT FORMULATIONS	**:**	Majoon-e-Arad Khurma, Majoon Pambadana.

POST-E-GULAR

Drug Post-e-Gular consist of dried bark of *Ficus racemosa* Linn. Syn. *Ficus glomerata* Roxb. of Moraceae family. Drug yielding plant is a large deciduous tree distributed all over India, found throughout the year, grows in evergreen forests moist localities and bank of streams to the elevation of 1800 m. often cultivated in villages for shade and its edible fruits.

OTHER NAMES:

Arabic	:	Post-e-Humiz
Persian	:	Post-e-Anjeer Adam
Assamese	:	Jangedumuru, Yagyadimru
Bengali	:	Jagyadmur, Jagnadmur, Dumur
English	:	Cluste Fig., Country Fig.
Gujarati	:	Umbro, Umerdo, Umardo, Umarado, Umar
Hindi	:	Gulara, Gular, Lelka, Dimere, Paroa, Umar
Kannada	:	Attihannianamara, Qudumbaria, Athimara, Attigida, Athi.
Kashmiri	:	Rumbal
Malayalam	:	Athi
Marathi	:	Atti, Gular, Umbar
Oriya	:	Dimiri, Udumboro, Jognondumuro
Punjabi	:	Kathgular, Gular, Batbar, Dadhuri
Sanskrit	:	Sadaphala, Udumbara
Tamil	:	Atti, Ara, Koli
Telegu	:	Atti, Medi, Bodda
Urdu	:	Post-e-Gular

DESCRIPTION:

(a) **Macroscopic:** Bark greyish-green, surface soft and uneven, 0.5-1.8 cm thick; on rubbing white papery flakes come out from outer surface, inner surface light brown; fracture fibrous; taste, mucilaginous without any characteristic odour.

(b) **Microscopic:** Transverse section of bark shows cork, 3-6 layers of thin-walled cells filled with brownish content; cork Cambium single layered; secondary cortex 6-12 layered, composed of thin-walled, rectangular cells arranged regularly, a number of secondary cortex cells contains starch grains and some contain rhomboidal crystals of calcium oxalate, most of the cells filled with chloroplast giving green appearance; cortex a fairly wide zone composed of circular to oblong, thin-walled cels, containing orange-brown content, most of the cells filled with simple and compound starch grains, a number of cells also contain cubical and rhomboidal crystals

of calcium oxalate, some cortical cells get lignified with pitted walls found scattered singly or in large groups throughout cortical region; secondary phloem a very wide zone composed of parenchyma with patches of sieve tubes, companion cells by medullary ray; phloem parenchyma circular to oval and thin-walled; phloem fibres much elongated, lignified, very heavily thickened and possess a very narrow lumen; medullary rays uni to pentaseriate, widen towards peripheral region; a number or ray cells also get lignified and show pitted wall as described above; laticiferous cells also found starch grains and rhomboidal crystals of calcium oxalate also found in most of phloem parenchyma and ray cells; cambium, when present, 2-3 layered, of tangentially elongated thin-walled cells.

IDENTITY, PURITY AND STRENGHT:

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 14 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-soluble extractive	:	Not more than 7 per cent
Water-soluble extractive	:	Not less than 9 per cent
CONSTITUENTS	:	Tannins
ACTION	:	Mufarreh, Mulaiyin, Munaffis-e-Balgham, Habis-ud-Dam Mudirr-e-Baul
THERAPEUTIC USE	:	Qabz, Zeequm Nafas, Sual, Zof-e-Aam
DOSE	:	5 to 7 g.
IMPORTANT FORMULATIONS	:	Sufoof-e-Ziabetus Dulabi, Arq-e-Musaffi-e-Khoon Qawi.

QURANFUL

Drug Qaranful is the dried flower bud of *Syzygium aromaticum* (Linn). Merr. & L.M. Perry Syn. *Eugenia aromatica* Kuntze, *Eugenia Caryophyllata* Thunb of Myrtaceae family. Drug yielding plant is a tree cultivated in many parts of the world and also to a considerable extent in South India, flower buds collected twice a year in the months of October and February when they change colour from geen to crimson, dried carefully and separated form their peduncles.

OTHER NAMES :

Arabic	:	Qaranful
Persian	:	Qaranful
Assamese	:	Lavang, Lan, Long
Bengali	:	Lavang
English	:	Clove
Gujarati	:	Lavang, Laving
Hindi	:	Lavanga, Laung
Kannada	:	Lavanga
Kashmiri	:	Rung
Malayalam	:	Karayanpu, Krambu
Marathi	:	Lavang, Laung
Oriya	:	Labanga
Punjabi	:	Laung
Sanskrit	:	Devapuspa, Lavangaha, Devakusuman
Tamil	:	Kirambum, Lavangam
Telegu	:	Lavangamulu, Lavangamuchettu
Urdu	:	Qaranful, Laung.

DESCRIPTION :

(a) **Macroscopic:** Flower bud measuring 10-17.5 mm. in length, dark brown or dusty red, consisting of a sub-cylindrical, slightly flattended, four sided hypanthium readily exuding oil when pressed hypanthium containing in its upper portion a two celled inferior ovary with numerous ovules attached to an axile placenta, surmounted by four thick, divergent sepals and covered by unopened corolla consisting of four membranous imbricate petals, frequently detached, enclosing numerous incurved stamens and one erect-style; odour, strongly aromatic; taste, pungent, aromatic followed by slight tingling of the tongue.

(b) **Microscopic**: Transverse section of hypanthium shows epidermis and calyx teeth composed of straight walled cells, with thick cuticle having large anomocytic stomata, hypanthium tissue spongy, clusters of calcium oxalate crystals varying in size from 6-20 m in diameter, small number of sotne cells and prismatic crystals of calcium oxalate present in stalk; stamens, each

with an oil gland in the apex of the connective, traingularly centricular pollen grains, 15-20 m in diameter anther walls showing a typical fibrous layer, schizolysigenous glands found in all parts of clove; occasional isolate pericyclic firbres present.

Powder: Dark Brown; fragments of parenchyma showing large oval, schizolysigenous oil cavities, spiral tracheids and a few rather thick-walled, spindle shaped fibres, calcium oxalate crystals in rosette aggregates, 10-15 m in diameter, fragments of anther walls with chracteristic reticulated cells, pollen grains numerous, tetrahedral, 15-20 in diameter.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 7 per cent
Acid-insolauble ash	:	Not more 1 per cent
Alcohol-soluble extractive	:	Not less 3 per cent
Water-soluble extractive	:	Not less than 9 per cent
Volatile oil	:	Not less than 15 per cent.

CONSTITUENTS : Essential oil (Eugenalcetate and caryophyllene).

ACTION : Mohallil-e-Waram, Daf-e-Taffum, Mufarreh, Musakkin-e-Alam, Maqawwi-e-Qalab, Muqawwi-e-Dimagh, Munaffis-e-Balgham, Daf-e-Tashannnuj, Muqawwi-e-Meda, Muqawwi-e-kabid, Muqawwi-e-Ama.

THERAPEUTIC USE : Bakhrul Fam, Waj-ul-Asnam, Zof-e-Meda, Zof-e-Kabid, Sue-Hazm, Nafkh-e-Shikam Qulanj.

DOSE : 0.5 to 1 g.

IMPORTANT FORMULATIONS :

Habb-e-Ambar, Habb-e-Ambar Momyaee, Habb-e-tursh Mushtahi, Qurs-e-Tutiya-e-Kabir, Kohal-e-Roshnai, Itrifal Ghudadi, Jawarish-e-Jalinoos, Jawarish-e-Narmushk, Jawarish Zarooni sada, Jawarish-e-Bisbasa, Majoon-e-Kundur, Jawarish-e-Oad Tursh, Jawarish-e-Utraj, Khamira-e-Abresham Arshadwala, Mojoon-e-Dabeedul Ward, Majoon-e-Fanjosh, Majoon-e-Khadar, Majoon-e-lana, Majoon-e-Muluki, Majoon-e-Seer Alwi Khani, Majoon-e-Suparipak, Raughan-e-Qaranful, Raughan-e-Surkh, Araq-e-Ambar, Araq-e-Chobchini, Sunoon-e-Mujalli, Majoon-e-Jalali, Majoon-e-Kalkalanaj, Habb-e-Munaish.

QINNAB

Drug Qinnab consists of dried leaves of cultivated or wild pants of *Cannabis sativa* Linn. of Cannabinacae family. Drug yielding plant is an annula erect, dioecious herb, one to two m. hig, found almost throughout the year; practically maturalised in the sub-Himalayan tracts in India and abundantly found in waste lands from Punjab eastwards to Bengal and extending southwards.

OTHER NAMES :

Arabic	:	Qinnab
Persian	:	Warq-ul-Khiyal,
Assamese	:	Bhan, Bhang
Bengali	:	Bhang, Sidhi
English	:	Indian Hemp
Gujarati	:	Bhang
Hindi	:	Bhaang, Bhanga,
Kannada	:	Bhangigida, Ganjagida, Bangi
Kashmiri	:	Bangi
Malayalam	:	Cherukanchava, ginjilachilachi
Marathi	:	Bhang, Ganja
Oriya	:	Bhang, Ganjai
Punjabi	:	Bhang, Bengi
Sanskrit	:	Bhang, Vijaya
Tamil	:	Ganja, Bhangi, Kalpam.
Telegu	:	Ganzayi
Urdu	:	Qinnab, Bhang.

DESCRIPTION :

(a) **Macroscopic:** Leaves palmately compound, leaftles linear, laneceolate with serrate margin, 5-20 cm. long, pointed, narrow at base, upper surface dark green and rough, lower pale, downy; leaves of female plants longer than the male, odour, strong an characteristic; taste, slightly acrid.

(b) **Microscopic:** Transverse section of leaves anf bracts shows dorsiventral surface; upper epidermis with unicellular; pointed, curved, conial trchomes with enlarged bases containing cystoliths of calcium carbonate; mesophyll contains cluster of calcium oxalate crystals in many cells consisting of usually one layer of palisade cell and spngy tissue; trichomes on lower epidermis conical, longer, 340-500 but without cysloliths, numerous glandular trichomes sessile or with a multicellular stalk and a head of about eight radiating, club-shaped cells secreting oleo-resim, present in the lower epidermis especially on mid-rib; bracteoles with undifferentiated mesopyll and on lower surfae bear numerous glandular trichomes.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 percent
Total ash	:	Not more than 15 percent
Acid-insoluble ash	:	Not more than 5 percent
Alcohol (90 Per cent) Soluble extactive	:	Not less than 13 percent
Water-soluble extractive	:	Not less than 13 percent
CONSTITUENTS	:	Resin (Cannabinols, particulary tetrahydrocannabinol)
ACTION	:	Qabiz, Muqawwi-e-Meda, Mushahhi, Mufarreh, Muqawwi-e-Bah, Mumsik, Mujaffif, Musakkin-e-Alam, Munawwim, Daf-e-Tashannuj.
THERAEUTIC USE	:	Ishal, Kasrat-e-Tams, Bawaseer, Sual, Waj-ul-Kabid, Qulanj.
DOSE	:	1g.
IMPORTANT FORMULATIONS	:	Majoon-e-Falaksair, Kushta-e-Qalai, Araq-e-Aswad Barid.

QUST

Drug Qust consists of dried roots of *Saussurea lappa* C.B. Clarke of Compositate family. Drug yielding plant is a tall, robust, perennial herb with thick roots; found in Kashmir at altitude of 2500-3600 m; roots collected in September, October.

OTHER NAMES :

Arabic	:	Qust
Persian	:	Qust
Assamese	:	Kud, kur
Bengali	:	Kudo, Pachak, Kur, Kut
English	:	Costus root
Gujarati	:	Upaleta, Kath, Kur
Hindi	:	Kot, Kur, Kut, Kust, Pachak
Kannada	:	Changal, Koshtha
Kashmiri	:	Kuth, Chob-i-Kud, Post khai
Malayalam	:	Kottam, Sepuddy
Marathi	:	Upleta, Kushtha
Oriya	:	Kudha
Punjabi	:	Kuth
Sanskrit	:	Kushta, Kashmirja, Utpalam
Tamil	:	Goshtam, Kostam, Kottam
Telegu	:	Changala, Kustam
Urdu	:	Qust

DESCRIPTION :

(a) **Macroscopic:** Drug greish to dull brown, thick stout, susiform to cylindrical, 7-15 cm. Long, 1.0-5.5 cm broad, thicker roots with collapsed centre, occasinally ridged, wringles longitudinal and anastomosd.; rotlests rarely present; cut surface shows two regions, outer periderm ring thin, inner porous woody portion lighter in colour showing fine radial striations and oftern the central portion collapsed; fracture, short, horny; odour, strong, characteristically aromatic, taste, slightly bitter.

(b) **Microscopic:** Tranverse section of thin root shows thin periderm, followed by broad zone of phloem and still broader zpne of xylem traversed by wide medullary rays; cork. 3-5 layered wide, secondary cortical cells polygonal, mostly elongated, secondary phloem consists of mostly stroage parenchyma, small groups of sieve tubes and comapnion cells and often phloem fibres, bast fibres thick-walled, lignified, upto 350 m in length, with many simple pits associated

with fibre, tracheids and parenchyma; wood fibres smaller than bast fibres; with wider lumen and obtusely tapering ends, medullary rays mutiseriate and wider in phloem region; resin canals found throughout as large cavities; some roots possess a central cylinder of sclerenchyma while others have parenchymatous centre with scattered xylem elements; in older roots, wood parenchyma collapses and takes a spongy apperance in the centre of root; inulin present in storage parenchyma.

Powder: Deep brown or rusty; under microscope irregular bits of yellow, brown or orage-red fragments of resins and oils associated with thin-walled parenchymatous cells, broken bits of xylem vessels with scalariform, reticulate thickening and horizontal end walls.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	:	Not more than 2 per cent
Total ash	:	Not more than 4 per cent
Acid-insoluble ash	:	Not more than 1 per cent
Alcohol-soluble exratctive	:	Not less than 12 per cent
Water-soluble extractive	:	Not less than 20 per cent

CONSTITIUENTS **:** Essential oil, Alkaloid (Saussurine) and bitter resin.

ACTION **:** Jali, Mohallil-e-Waram, Mujaffif, Muqawwi-e-Asab, Munaffis-e-Balgham, Musakkin-e-Alam, Kasir-e-Riyah, Qatil-e-Deedan-e-Ama, Mudirr-e-Baul, Mudirr-e-Haiz.

THERAPEUTIC USE **:** Falij, Laqwa, Rasha, Waj-e-Mafasil, Niqras, Waram-e-Tehal, Deedan-e-ama, Ehtebas-e-Tams, Daf-e-Taffun.

DOSE **:** 2 to 3g.

IMPORTANT FORMULATIONS **:** Jawarish-e-Jalinoos, Dawa-ul-Kurkum, Majoon-e-Dabeedul Ward, Majoon-e-Juntiyana, Majoon-e-Khadar, Tiryaq-e-Samania, Zimad-e-Khanazeer, Sabadaritoos, Anqaruya-e-Kabir.

SANA

Drug Sana consists of dried leaves of *Cassia angustifolia* Vahl. of Leguminosae family. Drug yielding plant is a small shrub, 60-70 cm high found throughout the year, cultivated largely in Southern India, especially in districts of Tinnevelly, Madurai and Tiruchirapally an has also been introduced in Mysore; fully grown, thick bluish colour leaves stripped off by hand, collected and dried in shade for 7-10 days, till assume a yellowish-green colour; graded and then packed into large bales.

OTHER NAMES :

Arabic	:	Sana Makki
Persian	:	Sana
Assamese	:	Sonamukhi
Bengalu	:	Svarnamukhi, Sonpat, Sannamakki
English	:	Indian Senna, Tinnevelly Senna
Gujarat	:	Mindhiaval, Senamakhi, Nat-ki-Sana
Hindi	:	Sanaya, Hindisana
Kannada	:	Nelavarika, Nilavaka, Chinnukki, Adapatiyan
Marathi	:	Sonamakhi
Oriya	:	Shonamukhi
Punjabi	:	Sanapati, Sarnapatta, Sannamakhi
Sanskrit	:	Svarnapatri, Bhumiari, Bhupadama.
Tamil	:	Nilpponnai, Avarai, Nilavirai, Nilavagai,
Telgu	:	Sunamukhi, Nelaponna, Nelatengedyu.
Urdu	:	Sena, Barg-e-Sana

DESCRIPTION :

(a) **Macroscopic:** Leaflets, 2.5-6 cm long 7-15 mm wide at centre, pale yellowish-green, elongated lanceolate, slightly asymmetric at base; margins entire, flat, apex acute with sharp spine, both surfaces smooth with sparce trichomes; odour, faint but distinctive; taste mucilaginous and disagreeable but not distinctly bitter.

(b) **Microscopic:** Transverse section of leaflet through midrib shows an isobilateral sturcture, epidermal cells, straight walled, containing mucilage; both surfaces bear scattered, unicellular hair, often conical, curved near base, thick-walled, non-lignified; warty cuticle, stomata, paracytic, numerous on both surfaces; mesophyll consists of upper cuticle, stomata, paracytic, numerous on both surfaces; mesophyll consists of upper and lower palisade layers with spongy layer in betwee,; palisade cells of upper surface longer than those of lower surface, the latter having wavy anticlinal walls, prismatic crystals of calcium oxalate present on larger veins, and clusters

of calcium oxalate crystals distributed throughout the palisade and spongy tissues, midrib biconvex; bundles of midrib and larger veins, incompletely surrounded by a zone of pericyclic fibres and a crystal sheath of parenchymatous cells, containing prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	**:**	Not more than 1 per cent
Total ash	**:**	Not more than 14 per cent
Acid-insoluble ash	**:**	Not more than 2 per cent
Alcohol-soluble extractive	**:**	Not more than 3 per cent
Water-soluble extactive	**:**	Not more than 25 per cent
CONSTITUENTS	**:**	Anthraquinone, Glucoside, Flavonoids, Steroids and Resin
ACTION	**:**	Mushim, Munaqqi-e-Dimagh, Jali, Mufatteh Sudad, Mukhrij-e-Deedan-e-Ama, Musaffi-e-Dam, Daf-e-Qai
THERAPEUTIC USE	**:**	Waj-ul-Mafsil, Waj-ul-Qntn, Waj-ul-Warik, Irq-un-Nisa, Niqras, Zeeq-un-Nafas, Jarab, Busoor, Qulanj
DOSE	**:**	5 to 10g.
IMPORTANT FORMULATIONS	**:**	Habb-e-Shabyar, Majoon-e-Musaffi-e-Khoon, Majoon-e-Ushba, Sufoof-e-Chobchini, Sufoof-e-Lajward, Itrifal Ghudadi, Itrifal-e-Shahatra, Sufoof-e-Mulaiyin, Sufoof-e-Mus-hil.

SAZAJ HINDI

Drug Sazaj Hindi consists of dried mature leaves of *Cinnamomum tamala* (Buch. Ham.) Nees and Eberm of Lauraceae family, Drug yielding plant is a small evergreen tree upto 7.5 m, hign and occurs in tropical, sub-tropical Himalayas between 900-2300 m, often raised from seeds; sown in nursery; leaves collection in dry weather from about ten years old plant during October March.

OTHER NAMES :

Arabic	:	Sazaj
Persian	:	Sazaj
Assamese	:	Tejpat, Mahpat, Doptti
Bengali	:	Tejpatra, Tejpata
English	:	Indian Cinnamon, Cassia Cinnamon
Gujarati	:	Tamala Patra, Develee, Taj
Hindi	:	Tejpatra, Tejpat, Darchini
Kannada	:	Tamalapatra, Dalchini Ele
Kashmiri	:	Dalchini pan, Tajpatra
Malayalam	:	Karuvapatta Patram, Karuva Ela, Karuntoli
Marathi	:	Tamalpatra, Dalchinitiki, Sambharpana
Oriya	:	Tejpatra
Punjabi	:	Tajpater
Sanskrit	:	Tejpartra, Varanga Coca, Tamalaka
Tamil	:	Lavangapatri, Talishapattiri
Telgu	:	Akupatri, Talisapatri
Urdu	:	Tejpat

DESCRIPTION :

(a) **Macroscopic:**

Leaves: 12.5 -20 cm long, 5-7 .5 cm wide at the centre, 3 converging nerves from base to apex young leaves pink; petiole 7.5 -13 mm long; margin entire, apex acute or accuminate, taste, slightly sweet, mucilaginous and aromatic.

(b) **Microscopic:**

Petiole and Midrib: Transverse section of petiole and midrib shows epidermis externally covered with cuticle, uniseriate, multicellular (1 to3 cells), trichomes present, oil cells single or in group, isolated large stone cells, much lignified showing striations found scattered, most

of the parenchymatous cells of cortex with reddish-brown contents; pericyle represented by a few layers of sclerenchymatous cells, stele more or less planoconvex as in the midrib of leaf; xylem on upper and phloem on lower side consisiting of usual elements, present.

Lamina: Transverse sections of lamina show dorsiventral structure, represented by palisade tissue on upper and spongy parenchyma on lower side; epidermis same as in midrib, externally covered with cuticle; below upper epidermis single row of closely packed palisade layer folloed by multilayered, irregular, thin-walled cells of spongy parenchyma without intercellular spaces; idioblasts containing oil globules present in mesophyll and also in palisade; lower epidermis covered externally with cuticle; lamina inteervened by several small veinlets; vascular bundles covered with thick-walled fibres on both side.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 5 per cent
Acid-insoluble ash	**:**	Not more than 1 per cent
Alcohol-soluble extractive	**:**	Not less than 6 per cent
Alcohol-soluble extractive	**:**	Not less than 9 per cent
Volatile Oil	**:**	Not less than 1 per cent v/w

CONSTITUENTS	**:**	Essential oils (Phellandrene and eugenol)
ACTION	**:**	Muqawwi-e-aam, Kasir-e-Riyah, Qabiz, Mudirr-e-Haiz, Munaffis-e-Balgham, Mohallil-e-Waram
THERAPEUTIC USE	**:**	Zof-e-Meda, Bakhrulfam Zof-e-Kabid, Ishal, Sual, Nazla, Zukam.
DOSE	**:**	1 to 3g.
IMPORTANT FORMULATIONS	**:**	Jawarish-e-shahreyaran, Jawarish-e-Zarishk, Jawarish-e-Tamar Hindi, Khamira-e-Abresham Arshadwals, Kohal-e-Roshnai, Jawarish-e-Narmushk, Majoon-e-Juntiyana, Majoon Kalkalanaj, Majoon-e-Muqil, Majoon-e-Khadar, Majoon-e-Sohag Sonth, Araq-e-Ambar, Araq-e-Juzam, Sufoof-e-Ziabetus Qawi.

SHEETRAJ (HINDI)

Drug Sheetraj consists of dried mature root of *Plumbago zeylanica* Linn. of Plumbaginaceae family. Drug yielding plant is a large perennial sub-scandent shrub, found througout India in wild state and occasionally cultivated in garderns.

OTHER NAMES :

Arabci	:	Sheetraj, Shitraj
Persian	:	Shitrak, Shitrah
Assamese	:	Agiyachit, Agnachit
Bengali	:	Chita, Sufaid, Chitruke, Chitarak, Chitra
English	:	Lead Wor, Ceylon Lead Wort, White Flowered Lead Wort, White Lead Wort.
Gujarati	:	Chitrakmula, Chitaro, Chitrak
Hindi	:	Chira, Chitra, Chita, Chitarak, Chiti
Kannada	:	Chitramula, Vahni, Bilichitramoola, Bilary Chitramula
Kashmiri	:	Chitra, Shatrajna
Malayalam	:	Vellakoduveli, Tumbakoduveli, Tumpukotrochi, Vellakotuveri
Marathi	:	Chitraka, Chiramula
Oriya	:	Chitamula, Chitaparu, Chitramula, Krisanu.
Punjab	:	Chitra, Chitrak
Sanskrit	:	Agnimata, Chitraka
Tamil	:	Chitramulam, Kodiveli, Adigarvadi, Angodiveli, Koduveli, Chittira.
Telgu	:	Chitramulam, Agnimata, Chitramulamu
Urdu	:	Sheetraj Hindi, Cheetah, Chitalakri

DESCRIPTION :

(a) **Macroscopic:** Roots 30 cm or more in length, 6 mm or more in diameter as also as short stout pieces, including root stocks reddish to deep brown, scars, of rootles present; bark thin and brown, internal structure striated; odour, disagreeable; taste, acrid.

(b) **Microscopic:** Transverse section of root shows outer most tissue of cork consisting of 5-7 rows of cubical to rectangular dark brown cells; secondary cortex consists of 2-3 rows of thin-walled, rectangular, light brown cells, most of the cortex cell contain starch grains; secondary cortex followed by a wide zone of cortex, composed of large polygonal to tangentially elongated parenchymatous cells, varying in size and shape, containing starch grains and some cells with yellow contents; fibres scattered singly or in groups of 2-6; phoem a narrow zone of polygonal, thin-walled cell, consisting of usual elements and phloem fibre; simlar ot cortical zone, phloem

fibres usually in groups of 2-5 or more but occasionally occuring singly, lignified with pointed ends and narrow lumen, similar in shape and size to those of secondary cortx; cambium indistinct; xylem light yellow to whitish; vessels radially arranged with pitted thickenings; medullary rays straight, 1-6 seriate, cells radially elongated and filled with starch grains; stone cells absent.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 3 per cent
Acid-insoluble ash	**:**	Not more than 1 per cent
Alcohol-soluble extractive	**:**	Not less than 12 per cent
Water-soluble extractive	**:**	Not less than 12 per cent

CONSTITUENTS **:** Plumbagin

ACTION **:** Moharrik-e-Asab, Mohallil-e-Waram

THERAPEUTIC USE **:** Waj-ul-Mafasil, Falij, Laqwa, Zof-e-Asab.

DOSE **:** 1.5 to 3 g.

IMPORTANT FORMULATIONS **:** Majoon-e-Flasifa, Itrifal-e-Kabir, Majoon-e-Jograj Gugal, Raughan-e-Baladur, Jawarish-e-Narmushk, Jawarish-e-Fanjnosh.

SIBR

Drug Sibr consists of dried juice of leaves of *Aloe Barbadensis* Mill. Syn. *Aloe vera* Tourn. *ex* Linn; *Aloe indica* Royle of Liliacease family. Drug yielding plant is a shrub planted in many Indian gardens and found growing throughout India.

OTHER NAMES :

Arabic	:	Sibr
Persian	:	Sibr
Assamese	:	Musabhar, Machamber
Bengali	:	ghritakalmi, Ghrit-Kumari, Musabhar, Kanya
English	:	Indian Aloe
Gujarati	:	Eliyo, Eariy, Kunvar, Kumarpathy
Hindi	:	Musabhar, Elva, Ghikanvar, Kumari
Kannada	:	Karilola, Lobasara, Satra, Boralsara Molisara, Kolesara, Kathaligida, Komarika
Kashmiri	:	Musabbar, Siber
Malayalam	:	Chenninayakam, Kattavaza, Kumari
Marathi	:	Korphad, Korkand
Oriya	:	Musaboro, Kumari
Punjabi	:	Kalasohaga, Mussabar, Alua, Elwa
Sanskrit	:	Kumarirasasambhava, Sahasara, Ghritra Kumari, Kanya
Tamil	:	Kattalai, Sotthukkatal Bhottu, Katrazhae, Kottaalai.
Telegu	:	Musambaramu, Kalabanda
Urdu	:	Musabbar, Ailva, sibr, Ghikwar.

DESCRIPTION :

(a) **Macroscopic:** Dark chocolate brown, to black, compact, irregular masses; surface dull, opaque with slightly vitreous appearance; odour, characteristic; taste, nauseous and bitter.

(b) **Microscopic:** Powder when mounted in glycerin or lactophenol and examined under the microscope show innumerable crystalline, yellowish-brown to chocolate coloured particles of varying size and shape.

IDENTITY, PURITY AND STRENGHT :

Identification: Mix 0.5 g with 50 ml of water, boil until nearly dissolved, cool, and 0.5 g of Kieselguhr, and filter, to the filtrate apply the following tests.

(i) Heat 5 ml of filtrate with 0.2 g of Borax until dissolved, add a few drops of this solution to a test-tube nearly filled with water, a green gluorescence is produced.

(ii) Mix 2 ml of filtrate with 2 ml of a freshly prepared sloution of Bromine, a pale yellow precipitate is produced.

Foreign matter	**:**	Not more than 2 per cent
Totol ash	**:**	Not more than 5 per cent
Acid-insoluble ash	**:**	Not more than 2 per cent
Alcohol-soluble extractive	**:**	Not more than 80 per cent
Water-soluble extractive	**:**	Not more than 60 per cent
Moisure Content	**:**	Not more than 10 per cent of its weight when dried to constant weight at 105^0
CONSTITUENTS	**:**	Anthraquinone, Glycoside
ACTION	**:**	Mushil, Mudirr-e-Haiz, Mohallil-e-Waram, Moharrik-e-Kabid.
THERAPEUTIC USE	**:**	Qabz, Deedan-e-Ama, Waram-e-Kabid, Wajul-Mafasil, Izm-e-Tehal, Ethebas-e-Tams.
DOSE	**:**	1 to 4 g.
IMPORTANT FORMULATIONS	**:**	Zimad-e-Jalinoos, Majoon-e-Antaki, Kohal-e-Bayaz, Habb-e-Muntin Akbar, Habb-e-Mudirr, Habb-e-Ghafis, Iyarji-e-Loghaziya.

SUMBUL-UT-TEEB

OTHER NAMES:

Arabic	:	Sumbul-ut-teeb
Persian	:	Sumbul-uttib
Assamese	:	Jatamansi, Jatamanshi
Bengali	:	Jatamansi
English	:	Muskroot, Indian Spikenard, Spikenard
Gujarati	:	Baalchad, kalichad, Jatamasi, Kalichhad, Jatamasi
Hindi	:	Balchhar, Balchir, Jatamansi
Kannada	:	Jatamamshi, Jatamansi
Kashmiri	:	Bhut-jaat, Bhutijatt, Kukilipot
Malayalam	:	Jatamanchi, Jetamanshi, Jatamamshi
Oriya	:	Jatamansi
Punjabi	:	Billilotan, Balchhar, Chharguddi
Sanskrit	:	Mansi, Jati, Jatila Jatamansi, Janani, Jatamansi, Sukshmapatri, Bhutajata, Japaswini
Tamil	:	Jatamanji, Jatamanshi
Telegu	:	Jatamanji, Jatamanshi, Jatamsi
Urdu	:	Sumbul-ul-teeb, Balchar.

DESCRIPTION:

(a) **Macroscopic:** Dried rhizome dark brown, 2.5-7.5 cm long, cylindrical, covered with reddish-brown fibres forming a net work, which are skeletonsof sheathing leaf bases; fracture, brittle; internal colour reddis-brown, colour, strongly aromatic, taste, acrid, slightly bitter.

(b) **Microscopic:** Transverse section of rhizome shows cork consisting of 2-5 layers of cells filled with iol globules; cortex characterised by tthe presence of schizogenous canals; phloem in form of patches of small cells; cambium ring distinct and continuous; xylem consists of vessels, scattered individually or in rows of two or three vessels, with scalariform thickening; older rhizomes show one or more stellate shaped rings of interxylary and medullary cork, completely or incompletely separating the rhizome into four to nine vascular strands by joining outer cork; each separated strand encircled by a few layers of cork cell consisting of an outer cortex zone followed by two or more functional vascular bundles, tissues in between the strads usually non functional except for the cork cells which act as storage organ for oil globule.

IDENTITY, PURITY AND STRENGTH:

Identification: Shake about 2 g of the powder with 5 ml of Alcohol (80 per cent) for ten minutes and filter. Place one drop of the filtrate on a filter paper, dry and examine under ultra-violet light, a bright, bluish white fluorescene is visible.

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 9 per cent
Acid-insoluble ash	**:**	Not more than 5 per cent
Alcohol-soluble extractive	**:**	Not more than 2 per cent
Water-soluble extractive	**:**	Not more than 5 per cent
Volatile oil	**:**	Not more less than 0.1 per cent v/w.
CONSTITUENTS	**:**	Essential oil and resinous matter.
ACTION	**:**	Mohallil-e-Waram, Musakkin, Jali, Mutayyib-e-Dahan, Mujaffif, Kasir-e-Riyah, Muqawwi-e-Qalb, Muqawwi-e-Dimag, Mudirr-e-Baul.
THRERAPEUTIC USE	**:**	Suda, Nafkh-e-Shikam, Istisqa, Yarqan, Waram-e-Kabid, Waram-e-Rahem, Waram-e-Masana.
DOSE	**:**	3 to 5 g.
IMPORTANT FORMULATIONS	**:**	Jawarish-e-Fanjnosh, Barshasha, Anoshdaru, Anoshdaru Lulvi, Kohal-e-Roshnai, Sufoof-e-Mohazzil, Iyarij-e-Faiqra, Raughan-e-Babuna Qawi, Zimad-e-Sumbul-ut-teeb.

TAGAR

Drug Tagar consists of predominantly dried rhizome, stolon and small portioon of root of *Valeriana wallichii* DC of Valerianaceae family. Drug yielding plant is a hairy perennial herb growing in temperate Himalayas from Kashmir to Bhutan and Khasia Hill upto an altitude of 3,000 m; rhizomes dug in autumn, well washed with water and dried.

OTHER NAMES:

Arabic	:	Asarun
Assamese	:	Tagar
Bengali	:	Tagar Paduka, Mushkbala, Shumeo
English	:	Indian Valerian
Gujarati	:	Tagar Ganthoda, Tagar Gantho, Ghodawaj.
Hindi	:	Mushkbala, Sugandhabala, Tagar Balatagra
Kannada	:	Mandibattal, Mandyavanthu, Mandibattalu, Tagar
Kashmiri	:	Bala, Mushkbala, Chhalgudi
Malayalam	:	Thakaram
Marathi	:	Tagar, Ganthode
Oriya	:	Tagarapaduka, Jalashiuli
Punjabi	:	Mushkabala, Sugandhbala, Chargodar, Balamushkwali
Sankrit	:	Kalanusariva, Kalanusaraka, Nata, Chakra
Tamil	:	Tagarai
Telegu	:	Grandhi Tagaramu
Urdu	:	Tagar.

DESCRIPTION:

(a) **Macroscopic:** Rhizome, of about 4-8 cm long and 4-10 mm thick pieces, dull yellowish-brown sub cylindrical and dorsiventrally somewhat flattened, rough, slightly curved and unbranched, upper surface marked with raised encircling leaf scars; under surface bearing numerous, small, circular prominent, root scars and a few stout rootlets; crown bearing remains of aerial stems with scale leaves; fracture short and horny; stolon connecting rhizomes stout, 1-5 mm, long and 2-4 mm, long and 2-4 mm thick, yellowish-grey in colour, longitudinally wrinkled, usually with nodes and internodes and bearing adventitious roots, occasionally thin stolons 1-2 mm thick; root, yellowish-brown, 3-5 cm long and 1 mm thick; odour, strong and reminiscent of iso-valeric acid; taste, bitter and somewhat camphoraceous.

(b) **Microscopic :**

Rhizome: Transverse section of rhizome shows cork, consisting of 4-14 layers of lignified, cells occasionlly containing oil globules; cortex parenchymatous containing numerous starch

grains oil globules and yellowish-brown substance; outer 2 or 3 layers of cortex, collenchymatous occasional root traces appear as paler strands; endodermis single layered; pericycle, parenchymatous and within it 12-18 collateral vascular bundles, separated by dark medullary rays present; pith large, parenchumatous, lacunar, containing starch grains; starch occurs as single or occasional compound grains of two components, individual grains being 7-30 m mostly 10-25 m in diameter: calcium oxalate crystals absent.

Stolon: Transverse section of stolon shows cork, consisting of 2-5 layers; cortex upto 25 layers, parenchymatous, followed by 20 collateral vascular bundles, which in young stolons separated by cellulosic parenchymatous medullary rays and in older stolons become lignified; pith wide and lacunar; root traces absent.

Roots: Transverse section of root shows small, central parenchymatous pith, surrounded by tetrarch to polyarch xylem and a wide parenchymatous bark.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 12 per cent
Acid-insoluble ash	**:**	Not more than 10 per cent
Alcohol (60 per cent) soluble extractive	**:**	Not less than 30 per cent
Water-soluble extractive	**:**	Not more than 19 per cent

CONSTITUENTS **:** Essential Oil

ACTION **:** Mufatteh Sudad, Mohallil-e-Waram, Muqawwi-e-Dimagh, Muqawwi-e-Asab, Mudirr-e-Baul, Mudirr-e-Haiz.

THERAPEUTIC USE **:** Sara, Falij, Laqwa, Istirkha, Khadar, Nisyan, Yarqan-e-Suddi, Istisqa, Waram-e-Kabid, Salabat-e-Tehal, Waj-ul-Mafasil, Irqum-Nisa, Niqras, Waj-ul-Warik, Zof-e-Bah, Ehtebas-e-Baul, Ehtebas-e-Haiz.

DOSE **:** 2 to 5 g.

IMPORTANT FORMULATION **:** Sufoof-e-Qaranful

ZANJABEEL

Drug Zanjabeel consists of dried rhizome of *zingiber officinale* Rosc. of Zingiberaceae family. Drug yielding plant is widely cultivated in India, rhizomesh dug in January-February, buds and roots removed, soaked overnight in water, decorticated, and some times treated with lime and dried.

OTHER NAMES:

Arabic	:	Zanjabeel
Persian	:	Sahangrez, Zanjabil
Assamese	:	Ada
Bengali	:	Ada, saunth
English	:	Gringer
Gujarati	:	Sunth, Sundh
Hindi	:	Sonth, Ada
Kannada	:	Shunthi, Hasisunti
Kashmiri	:	Sho-ont
Malayalam	:	Andrakam, Inchi
Marathi	:	Ale
Oriya	:	Oda, Sunthi
Punjabi	:	Adrak, Sonth
Sanskrit	:	Ausadha, Mahausadha, Naara, Visva, Visvabhesaja, Srngavera, Visva, Visvausadha
Tamil	:	Sukkh, Chukku, Allam, Inji
Telegu	:	Sonthi, Sonthi, Allamu
Urdu	:	Sonth, Zanjabeel

DESCRIPTION:

(a) **Macroscopic:** Rhizome, laterally compressed bearing shor, flattish, ovate, oblique, branches on upper side each having at its apex a depressed scar, pieces about 5-15 cm long, 1.5-6.5 cm wide (usually 3-4 cm) and 1-1.5 cm thick; externally buff coloured showing longitudinal striations and occasional loose fibres; fracture short, smooth, transverse surface exhibiting narrow cortex (about one-third of radius); a well-marked endodermis and a wide stele showing numerous scattered fibro-vascular bundles and yellow secreting cells; odour; agreeable and aromatic; taste; agreeable and pungent.

(b) **Microscopic:** Transverse section of rhizome shows cortex of isodiametric thin-walled parenchyma with scattered vascular strands and numerous isodiametric idioblasts, about 40-80 m in diameter containing a yellowish to reddish-brown oleo-resin; endodermis slightly thick walled, free from starch; immediately inside endodermis a row of nearly continuous collateral bundles usually without fibres stele of thin walled, parenchyma cells, arranged radially around numerous scattered, collateral vascular bundles, each consisting of a few unlignified, reticulate or spiral vessels upto about 70 m in diameter; a group of phloem cells, unlignified, thin-walled;

septate fibres upto about 30 m wide and 600 m long with small oblique, slit, like pits, present; numerous scattered idioblasts, similar those of cortex, and associated with vascular bundles, also present; idioblasts about 8-20 m wide and upto 130 m long with dark reddish-brown contents; in single or in axial rows, adjacent to vessels, present; parenchyma of cortex and stele packed with flattened, rectangular, ovate; starch grains, mostly 5-15 m , 30-60 m long about 25 m wide and 7 m thick, marked by five transverse striations.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	**:**	Not more than 1 per cent
Total ash	**:**	Not more than 6 per cent
Water-soluble ash	**:**	Not more than 1.5 per cent
Alcohol (90 per cent)-soluble extractive	**:**	Not less than 3 per cent
Water-soluble extractive	**:**	Not less than 10 per cent

CONSTITUENTS **:** Essential oil, pungent constituents (gingerol and shogaol), resinous matter and starch.

ACTION **:** Kasir-e-Riyah, Hazim, Munaffis-e-Blagham, Jali

THERAPEUTIC USE **:** Nafkh-e-Shikam, Waj-ul-Meda, Zof-e-Ishteha, Waj-ul-Mafasil, Waj-ul-Qutn, Sual, Zeequm-Nafas, Sailan-ur-Rahem.

DOSE **:** 1 to 2 g.

IMPORTANT FORMULATIONS:

Habb-e-Ambar Momyaee, Habb-e-Hilteet, Habb-e-Hindi Mohallil, Habb-e-Hindi Zeeql, Habb-e-Pachlona, Habb-e-Kabid Naushadri, Habb-e-Miskeen Nawaz, Habb-e-Mushil-Dimaghi, Habb-e-Papita Desi, Habb-e-Papita Wilayati, Habb-e-Shifa, Habb-e-Tursh Mushtahi, Kohal-ul-Jawhir, Kohal-e-Roshnai, Halwa-e-Gazar, Jawarish-e-Bisbasa, Jawarish-e-Falafali, Jawarish-e-Fanjnosh, Jawarish-e-Jalinoos, Jawarish-e-Kamooni, Jawarish-e-Narmushk, Jawarish-e-Safarjali, Qabiz, Jawarish-e-Shahreyaran, Jawarish-e-Utraj, Jawarish-e-Zanjabeel, Luboob-e-Kabir, Luboob-e-Saghir, Majoon-e-Aqrab, Majoon-e-Baladur, Majoon-e-Bandkushad, Majoon-e-Flasifa, Majoon-e-Fanjnosh, Majoon-e-Baladur, Majoon-e-Bandkushad, Majoon-e-Flasifa, Majoon-e-Fanjnosh, Majoon-e-Jograj Gugal, Majoon-e-Kallalanaj, Majoon-e-Lana, Majoon-e-Muluki, Majoon-e-Muquil, Majoon-e-Nankhwah, Majoon-e-Piyaz, Majoon-e-Salab, Majoon-e-Seer Alvi Khani, Majoon-e-Suhag Sonth, Majoon-e-Suparipak, Majoon-e-Suranjan, Murabba-e-Zanjabeel, Raughan-e-Ispand, Raughan-e-Jauzmasil, Iyarij-e-Loghazia, Sufoor-e-Hazim Kalan, Sufoof-e-Mushil, Sufoof-e-Qaranful.

ZARD CHOB

Drug Zard Chob consists of the dried rhizomes of *Curcuma longa* Linn. of zingiberaceae family. drug yielding plant is a perennial herb extensively cultivated in all parts of the country; crop is harvested after 9-10 months, when lower leaves turn yellow rhizomes carefully dug up with hand-picks between October-April and cured by boiling and dried.

OTHER NAMES:

Arabic	:	Uroof-ul-Asfar
Persian	:	Zard Chob
Assamese	:	Haldhi, Haladhi
Bengali	:	Haldhi, Haldi, Halalda, Pitras
English	:	Turmeric
Gujarati	:	Haldar, Haldi, Halalsa, Halder
Hindi	:	Haldi, Hardi, Halada
Kannada	:	Arishina, Haldi
Kashmiri	:	Ledar, Ladhir, Lidar
Malayalam	:	Manjal, Mannal, Marinallu
Marathi	:	Halad, Haldi, Halada, Halede
Oriya	:	Haladi
Punjab	:	Rajani, Haldar, Halija
Sanskrit	:	Rajani, Nisa, Nisi, Ratti, Khanada, Dosa, Gauri, Varnavat, Haridra, Nisha, Aneshta, Haladi, Harita, Jagent, Mangalya, Manjal.
Tamil	:	Mangal
Telegu	:	Pasupu, Haridra, Pampi
Urdu	:	Haldi

DESCRIPTION:

(a) **Macroscopic:** Rhizomes ovate, oblong or pyriform (round turmeric) or cylindreical, often short brached (long turmeric), former about half as broad as long, latter 2-5 cm long and about 1-1.8 cm thick, externally yellowish to yellowish-brown with root scars and annulations of leaf bases; fracture horny, fractured surface orange to reddish brown; central cylinder twice as broad as cortex; odour and taste characteristic.

(b) **Microscopic:** Transverse section of rhizome shows epidermis with thick-walled, cubical cells of various dimensions; cortex characterised by the presence of mostly thin-walled, rounded parenchyma cells scattered collateral vascular bundles; a few layers of cork developed under eipdermis of 4-6 layers of thin walled, brick-shapped parenchyma; cells of ground tissue

contain starch grains of 4-15 in diameter; oil cells with suberised walls containing either orange-yellow globules of volatile oil or amorphous resionus mater, vessels mainly spirally thickened, a few reticulate and annular.

IDEBTITY, PURITY ABND STRENGTH:

Identification:

(1) On the addition of Concentrated Sulphuric acid or a mixture of concentrated sulplhuric acid and alochol to the powdered drug, a deep crimson colour is produced.

(2) A piece of filter paper is impregnated with an alcoholic extract of the powder, dried, and then moistened with a solution of Boric acid slightly acidified with Hydrochloric acid, again, the filter paper assumes a pink of brownish red colour which becomes deep blue of greenish-black on the addition of alkali.

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 9 er cent
Acid-insoluble ash	**:**	Not more than 1 per cent
Alcohol-soluble extractive	**:**	Not less than 8 per cent
Water-soluble extractive	**:**	Not less than 12 per cent
Volatile oil	**:**	Not less than 4 per cent v/w
CONSTITUENTS	**:**	Essential oil and a colouring matter (Curcumin)
ACTION	**:**	Mohallil-e-Waram, Musakkin, Jali, Mujaffif, Daf-e-Tashannuj.
THERAPEUTIC USE	**:**	Qurooh, Waj-ul-Mafasil, Ramad, Zof-e-Basarat, Hikka, zeeq-un-Nafas, Nazla, Zukam, Kharish.
DOSE	**:**	5 to 7 g.
IMPORTANT FORMULATIONS	**:**	Marham-e-Jadwar, Raughan-e-Sanan, Sufoof-e-Tehal, Sunoon-e-Zard.

ZEERA SIYAH

Drug Zeera Siyah consists of dried ripe fruts of *Carum carvi* Linn. of Umbelliferae family. Drug yielding plant is a biennial herb, 30-90 cm high, cultivated as a cold season crop in plains of India and as summer crop in hilly areas of Kashmir, Kumaon, Garhwal and Chamba.

OTHER NAMES:

Arabic	:	Karoya
Persian	:	Kumoon, Karoya
Assamese	:	Krisnjeera, Kalajira, Kalira
Bengali	:	Kalajira, Jira
English	:	Black Caraway, Caraway, Common Caraway
Gujarati	:	Shahijirum, Shjiru
Hindi	:	Kalajira, Shiajira, Zira
Kannada	:	Kari Jeerige, Sahajeerige
Kashmiri	:	Krihunzur, Gunyan, Gunyun
Malayalam	:	Karunjirka, Karinjeerakam
Marathi	:	Shahira, Shahajira, Shahajire
Oriya	:	Kalajira
Punjabi	:	Zira Siyah, Kalajira
Sanskrit	:	Asitajiraka, Bahugandha, Hridya, Bhedanika, Sushavi, Jarana, Krishna, Nila, sugandha.
Tamil	:	Karamjiragam, Shimaishembu, Kekkuvirai, Shimayi-Shembu, Shimayi-Shombu
Telegu	:	Nalla Jeerakarra, Shimaisapu
Urdu	:	Zira Siyah, Kala Zeera.

DESCRIPTION:

(a) **Macroscopic:** Fruit, greenish-brown, slightly curved, elongated; mericarps, usually separate, free form the pedical; carbophores upto 7 mm long 2 mm broad almost equally five sided, narrow, tapering to each end, arcuate, glabrous, brown with five very narrow, yellowish primary ridges; endosperm, orthospermous; odour and taste, aromatic and characteristic.

(b) **Microscopic:** Transverse section of fruit show pericarp with outer epidermis of polygonal tabular cells with a thick outer wall and striated cuticle; trichomes, absent; vittae four dorsal, intercostal and two commissural extending the length of each mericarp, with and epithelium of brown cells and volatile oil in the cavity; mesocarp parenchymatous without reticulate thickening; costae five in each mericarp with vascular strand consisting of an inner group of

small vessels and fibres and arched, outer group of pitted sclerenchyma with a small group of phloem on each lateral surface; on the outer margin of each vascular strand a small schizogenous canal extending into both stylopod and pedicel; inner epidermis of thin-walled, subrectangular cells, elongated tangentially, each about 8-12 μ wide and 40-100 μ long, arranged paralled with one another; endosperm of thick-walled, celluslosic parenchyma, containing much fixed oil and numerous small aleurone grains upto 10 μ in diameter, each containing one of sometimes two micro-rosette crystals of calcium oxalate; carpohore, when present, passing at the apex to a raphe in rach mericarp, and with a small strand of sclerenchyma, the sclereids of which continue into the styleopod.

Powder: Colour fawn to brown; epidermal cells of pericarp with striated cuticle; fragments of brown endothelium of vitae, parenchyatous cells of the mesocarp without reticulate thickening rectangular, finely pitted sclereids of mesocarp, thick-walked polygonal parenchymatous cells of endosperm containing much fixed oil; numerous small aleurone grains containing microrosette crystals of calcium oxalate; trichomes; starch and parquetry layer absent; it contains no less than 2.5 per cent of volatile oil.

IDENTITY, PURITY AND STRENGTH :

Foreign matter	**:**	Not more than 2 per cent
Total ash	**:**	Not more than 9 per cent
Acid-insoluble ash	**:**	Not more than 1.5 per cent
Alcohol-soluble extractive	**:**	Not less than 2 per cent
Water-soluble extractive	**:**	Not less than 12 per cent
Volatile oil	**:**	Not less than 3.5 per cent v/w

CONSTITUENTS **:** Essential oil (Carvone and Carvacrol)

ACTION **:** Hazim, Kasir-e-Riyah, Muqawwi-e-Meda

THERAPEUTIC USE **:** Zof-e-Meda, Nafkh-e-Shikam, Su-e-Hazm,

DOSE **:** 3 to 5 g.

IMPORTANT FORMULATION **:** Jawarish Kamooni, Majoon-e-Kalkatanaj, Majoon-e-Jograj, Gugal, Habb-e-Pachlona, Habb-e-Jund, Sufoof-e-Muqliyasa, Sufoof-e-Habb-ur-Rumman, Sufoof-e-Moya.

APPENDICES

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.

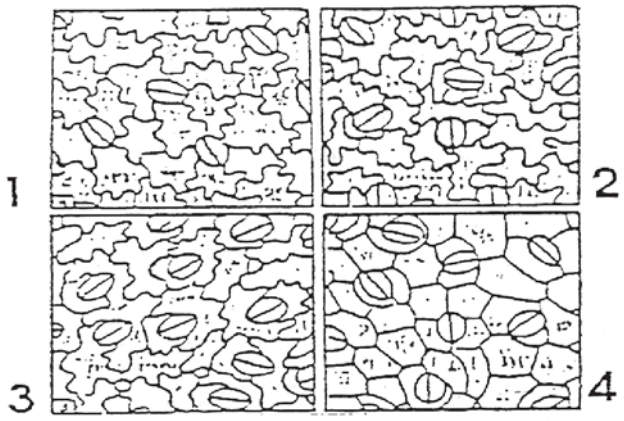

Fig. 1. Various types of stomata

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.

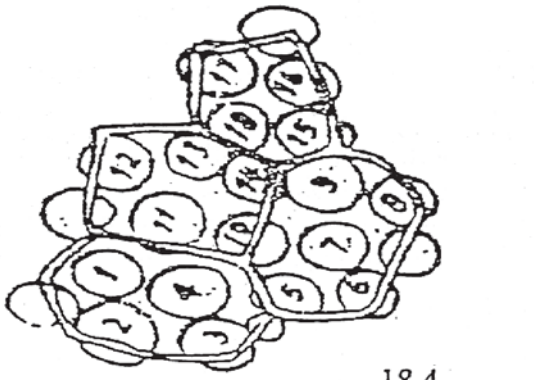

Figure 2

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

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

The *optical rotation*, unless otherwise specified, is measured at the wavelength of the D line of sodium (λ =589.3 μm) at 25°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

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

3.1.7 Refractive Index

The refractive index (n) of a substance with reference to air is the ratio of the sine of the angle of incidence to the sine of the angle of refraction of a beam of light passing from air into the substance. It varies with wavelength of the light used in its measurement.

Unless otherwise prescribed, the refractive index is measured at 25° ($\pm$ 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.

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