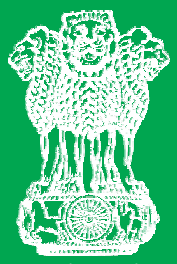
THE UNANI PHARMACOPOEIA OF INDIA

PART - I

VOLUME - VI



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

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DEPARTMENT OF AYURVEDA, YOGA & NATUROPATHY,
UNANI, SIDDHA AND HOMOEOPATHY (AYUSH)
NEW DELHI

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आयुर्वेद, योग व प्राकृतिक चिकित्सा,
यूनानी, सिद्ध एवं होम्योपैथी (आयुष) विभाग
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FOREWORD

The Unani System of Medicine has a long tradition of service in India. This system, though originated in Greece around 2500 years ago, was developed to great heights in Arab and Persian lands during the eighth and thirteenth century. Unani Medical System got enriched by imbibing what was best in the contemporary systems of traditional medicines in Egypt, Syria, Iraq, Persia, India, China and other Middle East countries.

2. In India, Unani System of Medicine was introduced by Arabs and soon it took firm roots. The Indian medical scholars developed it to greater heights. In post-independence era, Unani Medicine was not only recognized by Government of India as an Indian system of medicine but also got and continues to receive increasing governmental support and funds for its multidimensional and scientific development. At present the system forms an integral part of the country's national health care delivery system.

3. In recent years there has been increased worldwide interest in Unani Medicine. Similarly demand for Unani drugs is also growing internationally. In view of this trend, the Government of India have been making concerted efforts to validate the system on scientific foundations and ensure quality, efficacy and safety of the Unani drugs. The manufacture of Unani drugs is being regulated by Drugs and Cosmetics Act, 1940. To control the quality of these drugs the Government has made it mandatory for the manufacturers to adopt Good Manufacturing Practices (GMPs).

4. With the setting up of a separate Department of ISM & H, now known as Department of AYUSH, increasing attention is being paid to evolving pharmacopoeial standards for Unani drugs. The pace of the work has also been accelerated. And currently, the work of laying down pharmacopoeial standards for more than 5000 drugs of Indian Systems 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 drugs and formulations during the Eleventh Five Year Plan, and to publish the subsequent volumes providing data on pharmacopoeial standards for various drugs investigated.

5. In fact the Government of India has been quite conscious of developing and maintaining quality standards for Unani drugs as well as those used in other traditional medical systems. A Pharmacopoeial Laboratory of Indian Medicine (PLIM) was also established at Ghaziabad (Uttar Pradesh) in the year 1970 mainly to work for evolving standards for Ayurveda, Unani and Siddha drugs. To prepare a *National Formulary of Unani Medicine* (NFUM) and a *Unani Pharmacopoeia of India* (UPI), the Government of India in the Ministry of Health and Family Welfare established in 1964, a Unani Pharmacopoeia Committee (UPC) comprising experts of Unani Medicine, Chemists, Pharmacognocists, Botanists and Pharmacologists.

6. The Unani Pharmacopoeia Committee has so far published five parts of the *National Formulary of Unani Medicine*. The first part was published in 1981, the second in 1999, and the third in 2001. The fourth- and the fifth part have been published in 2007 and 2008, respectively.

7. The Central Council for Research in Unani Medicine (CCRUM) is the Secretariat for the UPC. The Council through its various Drug Standardization Research Units (DSRUs) has been engaged in generating data with regard to standardization of Unani drugs. So far, five volumes of the first part of the *Unani Pharmacopoeia of India* containing 45, 50, 53, 50 and 52 drugs, respectively have been published. The present sixth volume contains pharmacopoeial standards for 48 other Unani single drugs. It is hope that these volumes would benefit the manufacturers of Unani drugs as well as the researchers of Unani Medicine and would also help the Government to enforce quality control measures.

8. I would like to put on record my appreciation for the scientific staff of the Department of AYUSH, the CCRUM and all the experts associated with the UPC for their valuable contribution and help in bringing out these volumes of the *Unani Pharmacopoeia of India*. Suggestions and advice are welcome for further improving the quality of the pharmacopoeial work.

(S. Jalaja)

New Delhi
June 08, 2009.

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Dr. G. N. Qazi
Vice Chancellor

PREFACE

In order to maintain uniformity of standards for the Unani medicines produced by various manufacturers in the country, Ministry of Health & Family Welfare has already published five volumes of the *Unani Pharmacopoeia of India* containing 198 monographs of single plant drugs. These plant components are used stand alone or in combination with other standardized plant parts. In continuation to this task undertaken by CCRUM, I am pleased to know that yet another volume, Volume VI of the *Unani Pharmacopoeia of India* containing 48 single drugs standardized and compiled has been cleared by the Unani Pharmacopoeia Committee for publication. The single components of the plant origin are based on various parts of the plant including seeds, roots, leaves, heart wood, gum, stem bark, flowers, etc. which are widely being used in combinations for various drugs based on Unani Medicine. I acknowledge the hard work put in by the Central Council for Research in Unani Medicine and Unani Pharmacopoeia Committee in identifying these drugs for publication in this volume. All efforts have been made to give the correct information and Pharmacognosy details of the single component. The vernacular names in various regional languages for each such plant part has also been recorded in order to make it easy for people to identify the actual component in a drug. The dosage forms and the marker compounds identified from the literature have also been included as per the requirement.

I do hope that the publication of Volume VI of the *Unani Pharmacopoeia of India* will go a long way to help the Unani drug manufacturing industry in maintaining the minimum standards prescribed in the Drugs and Cosmetics Act of 1940 and that required in the good manufacturing practices (GNP) as a mandatory requirement for these drugs.

G.N. QAZI

INTRODUCTION

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

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

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

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

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

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

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

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

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

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

For the development of Unani pharmacy on modern lines and to enable the Unani medicine to withstand commercialization the Government of India has accepted the recommendations of the Unani Advisory Committee. The Govt. in their letter no.F.25/2/63-RISM dated 2nd March, 1964 constituted the first Unani Pharmacopoeia Committee consisting of the following experts for a period of three years with effect from the date of its first meeting:-

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

Principal,
Jamia Tibbia College,
Qasimjan Street,
Delhi.

9. Hakim Gurdit Singh Alag, Member.
Senior Lecturer,
Ayurvedic and Unani Tibbia College,
Karol Bagh,
New Delhi.

10. Hakim Shakeel Ahmad Shamsi, Member.
Principal,
Takmil-ut-Tibb College,
Lucknow.

11. Hakim M.A. Razzack, Member.
Medical Superintendent,
Hamdard Clinic,
Hamdard Building,
Delhi.

12. Dr. A.R. Kidwai, Member.
Head of the Department of Chemistry,
Aligarh Muslim University,
Aligarh.

13. Dr. C. Dwarkanath, Member-Secretary.
Advisor in ISM,
Ministry of Health
New Delhi.

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

1. Dr. Hussain Zaheer Chairman.
6-3-250, Banjara Hills,
Hyderabad.

2. Dr. Sadgopal, Member.
7, Malka Ganj,
Delhi.

3. Dr. P.N. Saxena, Member.

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

On expiry of the tenure of three years in Office of the second committee, on 14th November, 1971, the Government of India extended its term for another three years, vide their notification no.F.62/72-APC dated 25th October 1972. With effect from 15th November 1971, Hakim Shakil

Ahmed Shamsi, Hony. Secretary Takmil-ut-Tibb College, Lucknow was nominated as Member of the Committee in place of Late Shifa-ul Mulk Hakim Abdul Latif. After the completion of the extended period of three years the Govt. of India further extended the term of the Second Committee for one year more, vide notification no.F.6-2/72-APC dated 19th November, 1974 which expired on 14th November, 1975.

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

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

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

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

1.	Hk. Dr. A.U. Azmi, D-59, Abdul Fazl Enclave, Jamia Nagar, New Delhi-110 025.	Chairman.
2.	Hk. Syed Khaleefathullah,	Member.

	49, Bharati Salai, Madras-600 005.	
3.	Hk. Saifuddin Ahmed, Hakeem Mahmoodul Haq Road, Meerut (UP).	Member.
4.	Hk. Qamaruzzaman, Director (ISM), Govt. of Bihar, Patna-800 004.	Member.
5.	Hk. Madan Swaroop Gupta, D-3/15, Model Town, Delhi-110 009.	Member.
6.	Dr. A.M. Ansari, Director, CCRUM, 5, Panchsheel Shopping Centre, New Delhi-110 017.	Member.
7.	Hk. Malik Inamul Haq, Superintendent, Govt. Unani Pharmacy, Bhopal.	Member.
8.	Prof. Hkm. M. Arshad Sheikh, Principal, Tibbia College & Hospital, Nagpada, Bombay-400 008.	Member.
9.	Hk. Syed Mehmood Najmi, Regional Dy. Director, Deptt. of ISM & H, Hyderabad - 500 001 (AP).	Member.
10.	Hk. Mohd. Qayamuddin, Principal, Ajmal Khan Tibbia College, A.M.U., Aligarh-202 001 (UP).	Member.
11.	Hk. R.L. Verma, Deptt. of Anatomy and	Member.

History of Medicine,
All India Institute of Medical Sciences,
Ansari Nagar,
New Delhi-110 029.

12. Dr. Rajendra Gupta, — Member.
Project Co-ordinator,
National Bureau of Plant
Genetic Resources,
Pusa Road,
New Delhi.

13. Dr. A.H. Israily, — Member.
Div. Manager,
Hamdard (Wakf) Laboratories,
Hamdard Marg,
Lalkuan,
Delhi-110 006.

14. Dy. Advisor (Unani), — Member Secretary.
Ministry of Health & F.W.,
New Delhi.

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

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

1. Prof. Hakim Syed Khaleefathullah, — Chairman.
49, Bharati Salai,
Madras-600 005.

2. Hakim Iqbal Ali, — Member.
11-4-614/6-3,
Bazar Guard,
Hyderabad-500 004 (AP).

3. Hakim Faiyaz Alam, — Member.
Director,
Islahi Dawakhana,

	Fancy Mahal, Mohd. Ali Road, Bombay-400 003.	
4.	Hakim Jameel Ahmed, Dean, Faculty of Medicine, Jamia Hamdard, Hamdard Nagar, New Delhi.	Member.
5.	Prof. Hakim S. Zilur Rahaman, Head, P.G. Department of Ilmul Adviya, A.K. Tibbia College, A.M.U., Aligarh-202 001 (UP).	Member.
6.	Hakim Ved Prakash Sharma, Bassi Pathanan, Distt. Fatehgarh, Patiala, Punjab.	Member.
7.	Hakim Syed M. Ghayasuddin Ahmed, Regional Research Institute of Unani Medicine, 1, West Mada Church Street, Royapuram, Madras-400 006.	Member.
8.	Prof. Hakim S. Shaji Haider, Principal, Govt. Unani Medical College, Red Cross Building, Race Course Road, Bangalore (Karnataka).	Member.
9.	Hakim Mohd. Khalid Siddiqui, Director, CCRUM, 61-65, Institutional Area, Janakpuri, New Delhi-110 058.	Member.
10.	Hakim M.A. Wajid, C.R.I.U.M., Opp. E.S.I. Hospital, Eragadda, Hyderabad (AP).	Member.

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

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

1.	Dr. Sajid Hussain, Hyderabad	Chairman
2.	Prof. Hkm. S. Zillur Rehman, Aligarh	Member
3.	Prof. Hkm. M.A. Jafry, Bangalore	Member
4.	Hkm. S. Jaleel Hussain Hyderbad	Member

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

The functions of the committee shall be as follows:-

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

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

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

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

1.	Dr. G.N.Qazi, The Director, RRL Jammu,Canal Road,J ammu Tawi	Chaiman
2.	Drug Controller General of India DGHS, Nirman Bhawan, New Delhi	Member (Ex-Officio)
3.	The Director, Pharmacopoeial laboratory of Indian MedicineCGO Complex, Kamla Nehru Nagar Ghaziabad -201002	Member (Ex-Officio)
4.	The Director Central Council for Research in Unani Medicine, New Delhi.	Member-Secretary
5.	The Director, National Institute of Unani Medicine Kottigetalya, Magadimainain Road Vishwaneedom post, Bangalore	Member (Ex-Officio)
6.	Adviser (Unani)/ Deputy Adviser (Unani) Deptt. Of AYUSH, New Delhi	Member (Ex-Officio)
7.	Prof. Hm. S. Zillur Rahman, Chairman, Ibn-e-Sina Academy,Tijara House, Doodhpur,Aligarh-202001	Member
8.	Dr.Tajuddin,Chairman, Dept. of Ilmul Advia, A.K.Tibbia Collage,AMU,Aligarh-202001	Member
9.	Dr.E.H.Qureshi, Famida Cottage,92,Katra Mohd. Ali Road, Tope Darwaza, Lucknow-3	Member
10.	Dr. S.M. Ashraf, C-117,Street No. 3, Greater Azad Enclave, Doharra Mafi, Aligarh	Member

11.	Prof. MSY Khan, Professor Emeritus, Hamdard University, Hamdard Nagar,New Delhi-62	Member
12.	Prof. Shakir Jamil, Dean, F/O Unani Medicine Hamdard University, Hamdard Nagar, New Delhi-62	Member
13.	Prof. S.H. Afaq I/C Pharmacogonosy Division Dept. of Ilmul Advia, A.K.Tibbia Collage,AMU,Aligarh-202001	Member
14.	Prof. R. K. Khar, Dept. of Pharmaceutics, F/O Pharmacy, Hamdard University, Hamdard Nagar,New Delhi-62	Member
15.	Dr.Surender Singh, Dept. of Pharmacology, AIIMS, Ansari Nagar, New Delhi	Member
16	Prof. Mohd. Ali, Dept. of Chemistry, F/O Pharmacy, Hamdard University, Hamdard Nagar, New Delhi-62	Member
17.	Dr. Asad Mueed,Manager, R&D Division, Hadard Dawakhana, Delhi-110006	Member
18.	Hm. Farooqi FIDAI Dawakhana, P.O. Murad Nagar, Distt Ghaziabad	Member
19	Dr.(Mrs.) Alia Aman. D-109,Abul Fazl Enclave, Jamia Nagar, New Delhi-110025	Member

The functions of the committee shall be as follows:-

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

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

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

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

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

The Unani Pharmacopoeia Committee have already prepared and published five Volumes of National Formulary of Unani Medicine consisting of 441,202,103, 166 and 178 compound formulations respectively.

For the purpose of determining and finalizing pharmacopoeial standards for Unani Medicine, the Pharmacopoeia Committee considered various aspects relating to the development of pharmacopoeial standards. The laboratory work for the development of standards is being carried out by the laboratories of CCRUM as well as in various other laboratories under Central Scheme for the development of pharmacopoieal standards of ASU drugs. So far 250 monographs of single drugs of plant origin included in National Formulary of Unani Medicine has been finalized by the present Unani Pharmacopoeia Committee. The format adopted for laying down standards has been prepared more or less on the pattern of different pharmacopoeia of Herbal medicines.

Chairman
Unani Pharmacopoeia Committee

LEGAL NOTICES

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

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

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

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

GENERAL NOTICES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Percentage of alcohol: All statements of percentage of alcohol (C_2H_5OH) refer to percentage by volume at 15.56 ^{0}C.

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

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

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

Solubility: When stating the solubilities of Chemical substances, the term 'Soluble' is necessarily sometimes used in a general sense irrespective of concomitant chemical changes.

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

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

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

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

The following table indicates the meaning of such terms:-

Descriptive terms	*Relative quantities of solvent.*
Very soluble	less than 1 part.

Freely soluble	From 1 to 10 parts.
Soluble	From 10 to 30 parts.
Sparingly soluble	From 30 to 100 parts.
Slightly soluble	From 100 to 1000 parts.
Very slightly soluble	From 1000 to 10,000 parts.
Practically insoluble	More than 10,000 parts.

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

Doses : The doses mentioned in each monograph are in metric system of weights which are the approximate conversions from classical weights mentioned in Unani texts. A conversion table is appended giving classical weights of Unani System of Medicine with their metric equivalents.
Doses mentioned in the Unani Pharmacopoeia of India (U.P.I.) are intended merely for general guidance and represent, unless otherwise stated, the average range of quantities per dose which generally regarded suitable by clinicians for adults only when administered orally.

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

ABBREVIATIONS OF TECHNICAL TERMS

The abbreviations commonly employed are as follows:-

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

MONOGRAPHS

ABRESHAM
(Silk Cocoon)

The drugs Abresham consist of Abresham silk cocoon spun by the larvae of *Bombyx mori* Linn. (Fam.– Bombycidae); the finest silk often known as mulberry silk comes from the larvae which feeds on the leaves of mulberry *Morus alba* Linn. (Fam. – Moraceae). The silk worm is the larvae or caterpillar of a moth in the family Bombycidae, an important producer of silk. The stage between the caterpillar to the chrysalis or pupal stage, it secretes around itself an oval cocoon about 2 to 5 cm long consisting of continuous thread upto 1200m.

OTHER NAMES:

Urdu	:	Abresham
Arabic	:	Abresham
Persian	:	Abresham
Bengali	:	Pat
English	:	Raw Silk Cocoon
Gujarati	:	Resham-na-Potan
Hindi	:	Resham
Marathi	:	Reshmi-Chi-Keed
Sanskrit	:	Pat
Tamil	:	Putloo puchie
Telugu	:	Lutloo purughu, Narputtio

DESCRIPTION:

Macroscopic: Silk cocoon pale to dark yellow in colour and upto 5 cm in length and 2 cm in breadth with silk threads which are very fine, smooth and solid and light yellow in colour. Silk is soft and smooth to touch and posses considerable strength and elasticity and hygroscopic. Silk thread consists of two silk or fibroin fibres cemented together by a layer of silk glue or sericin. Strands of semi liquid fluid fibroin produced by two glands in the insect flow into a common exit tube in the head, where they meet the secretion of silk glue produced by another pair of glands. The double with its coating of sericin emerges from a spinneret in the head of the worm, coagulates and hardens on contact with air and is spun into the cocoon. The double fibre in the cocoon is known as Bave and its single constituent fibres are known as Brins.

It is easily soluble in Cuoxam, cold Sulphuric acid 66%, strong Hydrochloric acid (s.g. 1.16) and it dissolves with difficulty even on boiling with aqueous Caustic alkali solutions.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent Appendix 2.2.2
Total ash	:	Not more than 1.5 percent Appendix 2.2.3
Acid insoluble ash	:	Not more than 1.0 percent Appendix 2.2.4

Alcohol soluble extractives : Not less than 0.5 percent Appendix 2.2.6
Water soluble extractives : Not less than 5 percent Appendix 2.2.7
Loss in weight on drying at 105°C : Not more than 7 percent , Appendix 2.2.9

T.L.C.:

Two g extract of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene : Ethyl acetate (5 : 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm). It shows major spot at Rf 0.85 (Sky blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spot at Rf 0.85 and 0.59 (Violet). Appendix 2.2.10

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm). It shows major spot at Rf 0.78 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spot at Rf 0.78 (Violet) and 0.51 (Dark blue). Appendix 2.2.10

CHEMICAL CONSTITUENTS **:** Protein fibroin, glycine, alanine, serine, tyrosine and other aminoacids.

TEMPERAMENT **:** Hot and Dry

ACTION **:** Mufarreh (Exhilarant), Munaffis-e-Balgham (Expectorant), Mulattif (Demulcent), Jali (Detergent), Muqawwi-e-Hafeza (Memmory tonic)

THERAPEUTIC USES **:** Khafqan (Palpitation), Zof-e-Qalb (Weakness of the Heart), Sual (Cough), Zeeq-un-Nafas (Asthma), Nazla (Catarrh)

DOSE **:** 3-5 g

IMPORTANT FORMULATIONS **:** Dawa-ul-Misk Motadil Jawahirwali, Dawa-ul-Misk Motadil Sada, Khamira Abresham Arshadwala, Khamira Abresham Sada, Khamira Gaozaban Sada and Majoon-e-Chobchini, Sharbat-e-Abresham Sada.

ADAS
(Seed)

The drug Adas consists of dried seeds of *Lens culinaris* Medic. (Fam. Fabaceae), a small, erect, pubescent herb, 15-75 cm high, cultivated throughout north India, particularly in Uttar Pradesh, Madhya Pradesh, Bihar and West Bengal, and to a smaller extent in Punjab, Rajasthan, Maharashtra and Gujarat.

OTHER NAMES:

Urdu	:	Masur
Arabic	:	Adas Msallam
Bengali	:	Masuri
English	:	Lentil
Gujarati	:	Masura, Masoor, Masur
Hindi	:	Masur
Kannad	:	Masura Bele
Malayalam	:	Chanam payar, Vattupparupu
Marathi	:	Masur, Massora
Punjabi	:	Masur, Masara
Sanskrit	:	Masur
Tamil	:	Masoor Paruppu
Telugu	:	Masura Pappu, Masooralu

DESCRIPTION:

Macroscopic : Seed lens-shaped, smooth, about 4 mm thick, greyish-brown and faintly mottled, Cotyledons pink; taste characteristic.

Microscopic : Seed testa consists of a single layer of epidermis composed of palisade-like cells, columnar and sclerenchymatous, with a tiny projection and shows a light, transparent line. Below this, a single layer of hypodermis consisting of beaker or dumbbell shaped cells present; testa followed by cotyledons consisting of a thin layer of upper and lower epidermis covered with a thin layer of cuticle. Epidermis made up of rectangular cells oriented along their long axis; below epidermis, mesophyll consists of thin-walled, rounded or oval shaped, parenchymatous cells, generally filled with simple, round to oval starch grains, many with striations showing a fissured hilum; mostly measuring between 30-40ì in diameter.

Powder : Cream coloured; shows black particles due to pieces of testa; fragments of thick-walled, elongated, oval to polygonal cells of testa and a few sclerenchymatous cells in surface view; irregular, wavy palisade-like cells, and simple, round to oval, starch grains upto 40 ì in diameter with striations and a fissured hilum.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than 3 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 6 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 10 percent, Appendix 2.2.7

T. L. C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid: water (4:1:5) shows on exposure to Iodine vapour six spots at Rf. 0.11, 0.40, 0.44, 0.50, 0.65 and 0.80 (all yellow). On spraying with Ninhydrin reagent and heating the plate for about ten minutes at 110°C seven spots appear at Rf. 0.11, 0.18, 0.24, 0.33, 0.44, 0.50 and 0.65 (all pink). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Flavonoids, Vitamins and Proteine
TEMPRAMENT	**:**	Cold and Dry
ACTION	**:**	Qabiz (Constipative), Munaffikh (Flatulent), Habis-e-Baul (Antidiuretic), Habis-e-Tams (Antiemmmenagogic)
THERAPEUTIC USES	:	Kasrat-e-Baul (Polyuria) Kasrat-e-Tams (Polymenorrhagia)
DOSE	**:**	10-20 g
IMPORTANT FORMULATIONS	**:**	Majoon Masikul Baul.

AJWAIN
(Fruit)

The drug Ajwain consists of dried fruits of *Trachyspermum ammi* (Linn.) Sprague ex Turril Syn. *Carum copticum* Benth. & Hook. f., *Ptychotis ajowan* DC. (Fam. Apiaceae), an annual, erect herb, upto 90 cm tall, cultivated almost throughout India, uprooted and thrashed for collecting the fruits

OTHER NAMES:

Urdu	:	Ajwain
Arabic	:	Ami
Persian	:	Nankhah
Assamese	:	Jain
Bengali	:	Yamani, Yauvan, Yavan, Javan, Yavani, Yoyana
English	:	Bishop's weed
Gujarati	:	Ajma, Ajmo, Yavan, Javain
Hindi	:	Ajwain, Jevain
Kannada	:	Oma, Yom, Omu
Kashmiri	:	Kath
Malayalam	:	Omam, Ayanodakan
Marathi	:	Onva
Oriya	:	Juani
Punjabi	:	Lodhar
Sanskrit	:	Ajamoda
Tamil	:	Omam
Telugu	:	Vamu

DESCRIPTION:

Macroscopic : Fruit, consists of two mericaprs, greyish brown, ovoid, compressed, about 2 mm long and 1 mm wide with pale coloured protuberances. Five ridges and 6 vittae in each mericarp, usually separate, 5 primary ridges pale in colour. Odour characteristic, thymolic, taste pungent.

Microscopic : Transverse section of fruit shows two hexagonal structures attached with each other by a carpophore, epicarp consists of a single layer of tangentially elongated tubular cells, externally covered with cuticle at some places having thick-walled, unicellular trichomes as protuberances with serrate wall. Mesocarp consists of moderately thick walled, rectangular to polygonal tangentially elongated cells having some vascular bundles and vittae. Carpophore present as groups of thick-walled radially elongated cells. Integument, barrel shaped of tangentially elongated cells. Endosperm consists of thin walled cells filled with oil globules and aluorone grains, Embryo small and circular, composed of polygonal thin walled cells.

Powder : Oily, greyish-brown, under microscope, presence of oil globules and groups of endosperm cells, characterised.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 9 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.2 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 2 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 13 percent, Appendix 2.2.7
Volatile Oil	:	Not less than 2 percent, Appendix 2.2.10

T. L. C.:

T.L.C. of the petroleum ether(60-80° C) extract on Silica gel 'G' plate using toluene :ethyl acetate(9:1) on spraying with 5% H_2SO4 in ethyl alocohol shows five spots at Rf. 0.28, 0.38, 0.43, 0.48 and 0.72. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential oil and fixed oil.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mushtahi (Appetizer), Kasir-e-Riyah (Carminative), Daf-e-Tashannuj (Antispasmodic), Daf-e-Taffun Antiseptic)
THERAPEUTIC USES	**:**	Nafkh-e-Shikam (Flatulence in the stomach), Waj-ul-Meda (Gastric Pain), Zof-e-ishteha (Anorexia), Qulanj (Colic), Shaheeqa (Pertussis), Is-hal (Diarrhoea), Ikhtenaq-ur-Rahem (Hysteria), Haiza (Cholera)
DOSE	**:**	3-6 g of the drug in powder form.
IMPORTANT FORMULATIONS	**:**	Arq-e-Ajwain, Majoon Nankhah and Majoon Zabeeb.

ANAR
(Fresh Seed)

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

OTHER NAMES:

Urdu	:	Anar
Arabic	:	Rumman
Persian	:	Anar, Nar
Bengali	:	Dadima
English	:	Pomegranate
Gujarati	:	Dadama
Hindi	:	Anar
Kannada	:	Dalimba
Malayalam	:	Matalam
Marathi	:	Dadimba
Punjabi	:	Anar
Sanskrit	:	Dadima
Tamil	:	Madalai, Maadalai. Madalam
Telugu	:	Danimma

DESCRIPTION:

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

Microscopic : Seed shows testa consisting of thin-walled, parenchymatous cells followed by stony tegmen consisting of lignified, round, oval, triangular and rectangular, thick-walled stone cells having narrow as well as wide lumen. Beneath this, reddish-brown pigmented layer is present; endosperm absent; cotyledons coiled, consisting of oval to polygonal, thin walled, parenchymatous cells, containing a few oil globules. Starch grains present in testa are round to oval, simple, measuring 3-17 ì in diameter.

Powder: Reddish-brown; shows stone cells, oil globules, and a few simple round to oval starch grains measuring 3-17 ì in diameter.

IDENTITY, PURITY AND STRENGTH

Foreign matter	:	Not more than 2 per cent, Appendix 2.2.2
Total Ash	:	Not more than 4 per cent, Appendix 2.2.3

Acid-insoluble ash	:	Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 20 per cent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 35 per cent, Appendix 2.2.7

T. L. C.:

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

CHEMICAL CONSTITUENTS	**:**	Sugars, Vitamin C, Sitosterol, Ursolic acid, Protein, Fat and Mineral matters, Nicotinic acid, Pectin, Riboflavin, Thiamine, Delphinidin diglycoside, Aspartic, Citric, Ellagic, Gallic and Malic acids, Glutamine, Isoquercetin, Estrone and Punicic acid.
TEMPERAMENT	**:**	Anar Shireen-Cold and Moist Anar Tursh-Cold and Dry
ACTION	**:**	**Anar Shireen-** Muqawwi-e-Qalb (Cardiac tonic), Muqawwi-e-Jigar (Liver tonic), Musakkin Atash (Allays'thirst), Muwwalid-e-Dam (Haematogenic), Muddir-e-Baul (Diuretic), **Anar Tursh**-Qabiz (Constipative), Muqqawi-e-Qalb (Cardiac tonic), Muqawwi-e-Jigar (Liver Tonic), Musakkine-e-Safra (Bile sedative), Musakkine-e-Dam (Blood sedative), Mudirre-e-baul (Diuretic),Qat-e-Safra (Antibilious).
THERAPEUTIC USES	**:**	**Anar shireen**: Atash-e-Mufrit (Polydipsia), Zof-e-Am (General Weakness), Faqruddam (Anaeia), **Anar Tursh** : Sozish-e-Sadr (Burning in the chest), Ghasiyan (Nausea), Qai (Vomitting), Yarqan (Jaundice), Atash-e-Mufrit (Polydipsia).
DOSE	**:**	Juice of Anar- 25-60 ml
IMPORTANT FORMULATIONS	**:**	Sharbat-e-Anar, Jawarish-e-Anarain, Jawarish-e-Pudina

ANGOOR
(Fruit)

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

OTHER NAMES:

Urdu	:	Angoor, Munaqqa
Arabic	:	Ainab, Aanab
Persian	:	Angur
Assam	:	Dakh, Munaqqa
Bengali	:	Maneka
English	:	Dry Grapes, Raisins
Gujarati	:	Drakh, Darakh
Hindi	:	Angoor, Munkka
Kanad	:	Draksha
Malayam	:	Munthringya
Marathi	:	Draksha, Angur
Oriya	:	Drakya, Gostoni
Punjabi	:	Munaca
Sanskrit	:	Draksha
Tamil	:	Drakshai, Kottai Drakshai
Telugu	:	Draksha Kottai, Drakshai

DESCRIPTION:

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

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

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 Percent, Appendix 2.2.2

Total ash	:	Not more than 3 Percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.2 Percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 25 Percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 70 Percent, Appendix 2.2.7
Loss on drying	:	Not more than 15 Percent, Appendix 2.2.9

T.L.C.:

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

CHEMICAL CONSTITUENTS	**:**	Malic, Tartaric & Oxalic Acids, Carbohydrates and Tannins.
TEMPERAMENT	**:**	Hot and Moist
ACTION	**:**	Mughazzi (Nutrient), Muwwalid-e- dam (Haematogenic), Mubhi (Adipogenous), Muqawwi-e-Badan (General Tonic), Musakkin-e-Atash (Allays'thirst), Mulaiyin (Laxative)
THERAPEUTIC USES	**:**	Zof-e-Dam (General weakness), Atash-e-Mufrit (Polydipsia), Faqr-ud-Dam (Anaemia), Humma Muzmina (Chronic Fever), Qabz (Constipation)
DOSE	**:**	125-250 g
IMPORTANT FORMULATIONS	**:**	Sharbat-e-Angoor.

ARUSA
(Leaf)

The drug Arusa consists of fresh, dried, mature leaves of *Adhatoda vasica* Nees (Fam. Acanthaceae), a sub-herbaceous bush, found throughout the year in plains and sub-Himalayan tracts in India, ascending upto 1200 m. It flowers during February-March and also at the end of rainy season. Leaves stripped off from older stems and dried in sheds.

OTHER NAMES:

Urdu	:	Adusa, Basa
Persian	:	Bansa
Assamese	:	Titabahak, Bahak, Vachaka
Bengali	:	Baksa, Vasaka
English	:	Vasaka
Gujarati	:	Aduso, Ardusi, Adulso
Hindi	:	Aduss, Arusa
Kannada	:	Adsale, Adusoge, Atarusha, Adsole, Adasale
Kashmiri	:	Vasa
Malayalam	:	Attalataka m, Atalotakam
Marathi	:	Vasa, Adulsa
Oriya	:	Basanga
Punjabi	:	Bhekar, Vansa, Arusa
Sanskrit	:	Vasaka
Tamil	:	Vasambu, Adathodai
Telugu	:	Addasaramu

DESCRIPTION:

Macroscopic: Leaves, 10-30 cm long and 3-10 cm broad, lanceolate to ovate-lanceolate, slightly acuminate, base tapering, petiolate, petioles 2-8 cm long, exstipulate, glabrescent, 8-10 pairs of lateral vein bearing few hairs. Dried leaves dull brown above, light greyish brown below. Odour characteristic, taste bitter.

Microscopic: Transverse section of leaf shows, dorsiventral surface with 2 layers of palisade cells. In surface view, epidermal cells sinuous with anomocytic stomata on both surfaces, more numerous on the lower, clothing trichomes few, 1-3, rarely upto 5 celled, thin walled, uniseriate, upto 500 ì and glandular trichomes with unicellular stalk and 4 celled head measuring, 25-36 ì in diameter. In surface view cystoliths in mesophyll layers elongated and cigar shaped, acicular and prismatic forms of calcium oxalate crystals present in mesophyll.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2

Total Ash	:	Not more than 21 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 3 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 22 percent, Appendix 2.2.7

T.L.C.:

T.L.C of the pet. ether extract on Silica gel 'G' plate using pet. ether: ethyl acetate (24:1) shows five major spots on spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for about ten minutes at 110°C at Rf. 0.94, 0.42, 0.32, 0.24 and 0.13. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alkaloids and essential oil.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Munaffis-e-Balgham (Expectorant), Daf-e-Tashannuj (Antispasmodic), Mudir-e-Tams (Emmenagogue)
THERAPEUTIC USES	**:**	Sual (Cough), Zeeq-un-Nafas (Asthma), Sil (Pthisis), Waj-ul-Asnan (Odontalgia)
DOSE	**:**	5-10 ml Leaf decoction 3 g powder
IMPORTANT FORMULATIONS	**:**	Sharbat-e-Eijaz, Sharbat-e-Arusa

ASAROON
(Rhizome)

The drug Asaroon consists of the dried rhizomes of *Asarum europaeum* Linn. (Fam.-Aristolochiaceae). An evergreen plant with glossy foliage. It is found in Europe and temperate Mediterranean regions. The drug is imported into India.

OTHER NAMES:

Urdu	:	Asaroon
Arab	:	Asaroon
Bengali	:	Mushk Bala
Hindi	:	Taggar
Sanskrit	:	Upana

DESCRIPTION:

Macroscopic: Rhizomes are available in the form of pieces of about 2 to 4 cm long and 0.7 to 1.5 cm in thickness; irregular in shape, hard. External appearance dark brown and warty due to scars of leaf bases. Inflorescence and lateral branches outer surface is slightly coarse dark coloured with a layer of thin bark and a ring of vascular tissue. Odour characteristic aromatic, taste indistinct.

Microscopic: Irregular in outline, bark contains cork, cork cambium, secondary cortex, xylem and phloem. Cork 150 to 180 µ in width 3 to 6 seriate composed of tangentially elongated rectangular, compactly arranged stratified thick walled, suberised cells. Secondary cortex composed of tangentially elongated thin walled, loosely arranged cells are about 200 to 400 ì in width containing tannin as shown by a dark brown colour upon treatment with a mixture of freshly prepared 5% w/v Ferric Chloride solutions in 90% alcohol and 25% basic lead acetate solution in carbon dioxide free water. Endodermis and pericycle crushed, endodermis single layer, cells barrel shaped compactly arranged, radial and tangential walls are thick and turn reddish in phloroglucinol and also in sudan III. Pericycle 2 or 3 seriate composed of compactly arranged isodiametric cells. Secondly phloem has sieve tubes companion cells, extensive phloem parenchyma and phloem fibers. Sieve tubes short with thin walls and simple sieve parenchymatous one or two companion cells are associated with each sieve tube. Phloem leaving large spaces; cells store tannin and oil globules. Xylem is smaller with 12 to 20 in patches arranged in the form of a ring, each patch containing vessels, parenchyma and fibbers, perforation plate. Protoxylem elements possess spiral thickenings and met. Xylem vessels have bordered pits arranged alternately; xylem fibres scanty, 235 to 450 µ in length, lignified with thick walls, pith crushed.

Powder: Dark brown in color, oily fine, not easily flowing and forms clamps; shows the presence of cork tissue, parenchyma, fibres and xylem vessles; xylem fibres, 225 to 350 µ in length thick walled with simple pits; vessels 180 to 250 µ long, having spiral thickenings; pitted, wide and short vessels are also present end walls oblique with pertoration plates.

IDENTITY PURITY AND STRENGTH;

Foreign matter	:	Not more than 2 percent Appendix, 2.2.2
Total ash	:	Not more than 6 percent Appendix, 2.2.3
Acid insoluble ash	:	Not more than 2 percent Appendix, 2.2.4
Alcohol sqluble extractive value	:	Not less than 20 percent Appendix, 2.2.6
Water soluble extractive value	:	Not less than 25 percent Appendix, 2.2.7

T.L.C.:

TLC of the alcoholic extract on silicagel 'G' plate using n-hexane;ethyi acetate (9;1) mobile phase shows under U.V. (366 nm) four fluresoent spots (blue) Rf values 0.06, 0.11, 0.20, and 0.37 on exposure to lodine vapour five spots (all Yellow) appear ar Rf values 0.06, 0.11, 0.20, and 0.55, on spraying with 5% methanolic sulphric acid reagent and heating the plate, for 10 minutes at 1050 C seven spots appear at Rf values 0.06, 0.11, 0.20, 0.37, 0.45, 0.55 and 0.61.

CHEMICAL CONSTITUENTS	**:**	Asarine and Asarone
Temperament	:	Hot and Dry
Actions	:	Moharrik-e-Asab (Nerve Stimulant), Mudirr-e-Baul (Diuretic), Mudirr-e-Haiz (Emmenagogue)
Therapeutic Uses	:	Sara (Epilepsy), Falij (Paralysis), Ehtebas-e-Baul (Anuria), Ehtebas-e-Tams (Amenorrhoea)
DOSE	:	3 g
IMPORTANT FORMULATIONS	**:**	Jawarish Jalinoos, Majoon Suranjan, Dawaul Kurkum

BAHARANGI
(Root)

The drug Baharangi consists of dried mature roots of *Clerodendrum phlomidis* Linn. f. (Fam.- Verbenaceae); a large shrub or small tree reaching upto 9 m in height, with more or less pubescent branches, found in dry parts throughout the country.

OTHER NAMES:

Urdu	:	Baharangi
Hindi	:	Urni, Arni
Bengali	:	Ganiyari, Arani, Goniari
Gujarati	:	Arani, Aranimula, Arni
Kanad	:	Taggi, Taggi Beru
Malayalam	:	Munja, Thutali
Marathi	:	Takalimula
Oriya	:	Ganiary
Sanskrit	:	Vataghni
Tamil	:	Tazhutazhai, Taludalai
Telugu	:	Taluki

DESCRIPTION:

Macroscopic: Drug pieces 7-15 cm long, 0.2 -3.0 cm thick, occasionally branched, cylindrical, tough, yellowish-brown externally. Bark thin, occasionally easily peeled, outer surface rough due to exfoliation. Wood light yellow, fracture hard; taste, slightly astringent.

Microscopic: Root shows cork, consisting of 10-15, occasionally more, rows of tangentially elongated, thin-walled cells. Secondary cortex consists of round to oval parenchymatous cells, a few containing rhomboidal crystals of calcium oxalate. Secondary phloem consists of isodiametric, thin-walled, parenchymatous cells, a few of them containing rhomboidal crystals of calcium oxalate. Phloem rays distinct, consisting of radially elongated cells; secondary xylem shows a wide zone, consisting of usual elements, all being lignified. Vessels found in single or in groups of 2-3, scattered throughout xylem region. Xylem parenchyma simple pitted, squarish wide lumen. Xylem rays 1-5 seriate, consisting of radially elongated cells; rhomboidal crystals of calcium oxalate packed in xylem parenchyma and xylem rays; abundant simple, round starch grains measuring 6-17 ì in diameter, found scattered throughout.

Powder: Dull yellow; shows fragments of cork cells, small, pointed, aseptate, lignified fibres, simple, pitted vessels, lignified cells packed with rhomboidal crystals of calcium oxalate and numerous simple, round to oval starch grains having narrow hilum, measuring 6-11 ì in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter : Not more than 2 percent, Appendix 2.2.2

Total ash	:	Not more than 6 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 2 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 5 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Chloroform: Methanol (85:15) shows under U.V. (366 nm) four fluorescent zones at Rf. 0.10 (light yellow), 0.38, 0.59 and 0.90 (all blue). On exposure to Iodine vapour six spots appear at Rf. 0.10, 0.38, 0.59, 0.78, 0.87 and 0.98 (all yellow). On spraying with 5% Methanolic- Phosphomolybdic acid reagent and heating the plate for about ten minutes at 105°C six spots appear at Rf. 0.10, 0.38, 0.59, 0.78, 0.87 and 0.98 (all grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Sterols
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Moharrik (Stimulant), Mohallil-e-Waram (Anti-Inflammatory), Dafe-Tashannuj (Antispasmodic)
THERAPEUTIC USES	**:**	Zofe-Asab (Neurasthenia), Rasha (Tremor), Laqwa (Facial Paralysis), Falij (Paralysis), Khanazeer (Scrofule), Zeeq-un-Nafas (Asthma), Waram (Inflammation)
DOSE	**:**	Decoction of 12 to 24 g of the durg
IMPORTANT FORMULATIONS	**:**	Majoon Jograj Gugal

BARG-E-SUDAB
(Leaf)

The drug sudab (Barg) consists of dried leaves of *Ruta graveolens* Linn. (Fam. Rutaceae). The plant is a native of the Mediterranean region and also cultivated in Indian gardens. It grows during August-November flowering and fruiting take place during October-November.

OTHER NAMES:

Urdu	:	Barg-e-Sudab
Arabic	:	Waraq-us-Sudab
Persian	:	Barg-e-Suddab
Bengali	:	Ermul, Ispund
English	:	Avw Grace, Common Rue, Countryman's Treacle
Gujarati	:	Satapa
Hindi	:	Pismarum, Sadab, Satri
Sanskrit	:	Guchhapatra, Pitapushapa, sadaoaha, Sarpadanshta
Tamil	:	Aruvadam, Arvada, Pambugolli
Telugu	:	Aruda, Sadapa

DESCRIPTION:

Macroscopic : The dried leaves are 5.0 to 7.5 cm long and 2.0 to 2.5 mm broad in size, pale green in colour, 2-3 pinnate segments oblong to spathulate in shape. Odour of the leaves strongly aromatic and the taste is slightly bitter.

Microscopic : In transverse section the upper epidemis of the leaves shows rectangular to squarish parenchymatous cells which are coated with cuticle on the outer side. Beneath the upper epidermis the palisade cells are found which are radially elongated, compact and contain chloroplast. The spongy parenchymatous cells are 4-5 layer in thickness, polygonal to oval in shape and they are loosely arranged and contain starch grains which are oval to round in shape. Lower epidermal cells are smaller than upper epidermal cells. The stomata are found on the lower epidemis. In the spongy parenchymatous region vascular bundles are found scattered, which are almost circular in shape. In surface view the lower epidermis shows the polygonal or squarish cells with anomocytic type of stomata.

The powder analysis of the drug shows the presence of fragments of epidemis, palisade, spongy parenchyma, lower epidermis with stomata xylem parenchyma, fibres and vessels with sclariform thickenings.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent (Appendix 2.2.2)

Total ash	:	Not more than 14 percent (Appendix 2.2.3)
Acid insoluble ash	:	Not more than 4 percent (Appendix 2.2.4)
Alcohol soluble extractives	:	Not less than 11 percent (Appendix 2.2.6)
Water soluble extractives	:	Not less than 23 percent Appendix 2.2.7

T.L.C.:

T.L.C of the pet. ether (60-80) extract on Silica gel 'G' plate using Benzene: Ethyl acetate (24:1) shows six major spots on exposure to Iodine vapours at Rf. 0.92, 0.68, 0.28, 0.22, 0.16 and 0.03. (Appendix 2.2.10)

CHEMICAL CONSTITUENTS	**:**	Alkaloids, resins, carbohydrate, glycosides, saponins, steroids, flavonoids, iron, sodium, potassium and magnesium.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mukharrish (Prurict), Mohallil (Anti inflammatory), Kasir-e-Riyah (Carminative), Mujaffif (Desiccant), Mudirr-e-Haiz (Emmenagogue), Moharrik-e-Asab (Nerve stimulant).
THERAPEUTIC USES	**:**	Bahaq (Pityrisis), Bars (Vitiligo), Nafkh-e-Shikam (Flatulence in the stomach), Ehtebas-e-Tams (Amenorrhoea), Ikhtenaq-ur-Rahem (Hysteria), Um-us-Sibyan (Infantile Epilepsy), Waj-ul-Meda (Stomachache).
DOSE	**:**	5-10 g
IMPORTANT FORMULATIONS	**:**	Jawarish Kamooni, Zimad-e-Kibreet, Zimad-e-Tehal

BER

(Fruit Pulp)

The drug Ber consists of dried fruit pulp (devoid of seed) of *Zizyphus mauritiana* Lam. Syn. *Z. jujuba* Lam. (Fam. Rhamnaceae); a small, evergreen sub-deciduous tree, wild and also extensively cultivated throughout the country and found in Himalayan region upto about 1370 m.

OTHER NAMES:

Urdu	:	Ber
Assamese	:	Vagari
Bengali	:	Kul Vadar, Vadar, Vadai, Narkolikul
English	:	Jujube
Gujarati	:	Desi Ber
Kannad	:	Borehannu
Malayalam	:	Lanta, Lantakkura
Marathi	:	Bor
Oriya	:	Borakoli
Punjabi	:	Desi ber
Sanskrit	:	Badari
Tamil	:	Ilandai
Telugu	:	Regi

DESCRIPTION:

Macroscopic: Pulp pieces irregular in shape, shrunk, with external surface smooth and glossy, 2 mm in thickness, brittle, colour orange red; odour, not distinct; taste sour.

Microscopic: Fruit pulp shows single layered epicarp consisting of thin-walled, parenchymatous cells, covered with thin layer of cuticle. Mesocarp differentiated into two zones, outer zone consisting of 5-10 layers of rectangular, thin-walled, parenchymaous cells: inner mesocarp consisting of oval to polygonal, thin-walled, crushed parenchymatous cells, most of the mesocarp cells filled with reddish-brown substance, which is tannin when tested; a few fibro- vascular bundles found scattered in this region,

Powder: Orange; shows round to oval, thin-walled, reddish-brown cells of mesocarp, slightly thick-walled, polygonal epicarp cells in surface view.

DENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than 5 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.2 percent, Appendix 2.2.4

Alcohol-soluble extractive	:	Not less than 25 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 45 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (9: 1: 10) shows under UV (366 nm) a fluorescent zone at Rf. 0.34 (light blue). On exposure to Iodine vapour seven spots appear at Rf. 0.11, 0.17, 0.34, 0.43, 0.54, 0.66 and 0.84 (all yellow). On spraying with 60 % Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 120°C five spots appear at Rf. 0.17, 0.34 (both black), 0.43, 0.66 and 0.84 (all grey). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C two spots appear at Rf. 0.17 and 0.34 (both black). Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Vitamin C, Sugars and Minerals.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Qat-e-Safra (Antibilious), Musakkin-e-Atash (Allays' Thirst), Mufatteh Sudad-e-Jigar (Deobstruent of liver), Qatil -e-Deedan (Vermicidal)
THERAPEUTIC USES	**:**	Deedan-e-Ama (Worm Infestation), Amraz-e-Safrawi (Bilious Diseases), Amraz-e-Jigar (Liver Diseases)
DOSE	**:**	20-25 g
IMPORTANT FORMULATIONS	**:**	Sufoof-e-Suzak Qawi

BISBASA
(Aril)

The drug Bisbasa consists of dried aril of *Myristica fragrans* Houtt. Syn. *M. moschata* Thumb., *M. officinalis* Linn. (Fam. Myristicaceae). A Medium sized evergreen tree 8-15 m high, native of the East Moluccas. It is cultivated in the Malaya Peninsula and the Malaya Islands. In India it is found in a few localities, chiefly botanic gardens, Kerala where the climate is sufficiently hot and moist.

OTHER NAMES:

Urdu	:	Javitri
Arabic	:	Bisbasa
Persian	:	Charkaun
Bengali	:	Jayatri
English	:	Arillus of the Nut Mace
Gujarati	:	Japatri, Jatri
Hindi	:	Javitri
Kannada	:	Jadipattiri, Jajikai
Malayalam	:	Jati, Jatikka, Jatikosam
Marathi	:	Jotri
Punjabi	:	Javatri
Sanskrit	:	Jatikosha, Jati
Tamil	:	Salugami, Samuttirandam
Telugu	:	Javitri

DESCRIPTION:

Macroscopic : The drug consists of reddish pieces of about 2-4 cm size. They are flat, smooth, irregularly slit, slightly flexible or brittle. When pressed the drug exudes reddish or orange coloured oily substance.

Microscopic : the cross section of the aril shows somewhat leaf like structure. It is bounded by single layered epidermis on either sides, the rest of the area is occupied by simply thick walled cells with oil cavities in abundance.

CHEMICAL CONSTITUENTS: Fats, Terpenoids, Phenols, Alcohol, Saponins, Resins, Stasrch, Carbohydrates, Aluminium, Strontium, Calcium, Magnesium, Sodium, Potassium, Sulphate and Phosphate.

IDENTITY, PURITYAND STRANGTH:

Foreign organic matter	:	Not more than 2 percent, Appendix 2.2.2

Total Ash	:	Not more than 4 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 3 percent, Appendix 2.2.4
Water-soluble ash	:	Not less than 3 percent, Appendix 2.2.6
Loss on drying at 100°C	:	Not more than 14 percent, Appendix 2.2.9
Alcohol soluble extractives	:	Not less than 5 percent, Appendix 2.2.6
Water soluble extractives	:	Not less than 13 percent, Appendix 2.2.7

T.L.C.:

T.L.C of pet. ether (60-80°) extract of the drug on precoated aluminium plate of silica gel 60 F-254, using Benzne : Chloroform (4:1) as a solvent system shows seven spots with Rf 0.24 (light orange), 0.27 (Pinkish purple) 0.17, 0.23, 0.35, 0.43, 0.50, 0.79 and 0.91 (all Light orange) on spraying with 4% ethanolic sulphuric acid and heating the plate for about ten minutes at 110^0 C in oven. , Appendix 2.2.10

TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Meda (Stomachic), Hazim (Digestive), Kasir-e-Reiyah (Carminative), Muqawwi-e-Qalb (Cardiac Tonic).
THERAPEUTIC USES	**:**	Su-e-Hazm (Dyspepsia), Zof-e-Bah (Sexual Debility)
DOSE	**:**	2-5 g
IMPORTANT FORMULATIONS	**:**	Anoshdaru, Halwa-e-Baiza-e-Murgh, Itrifal-e-Kabir, Jawarish-e-Bisbasa, Jawarish-e-Kundur, Jawarish-e-Narmushk, Jawarish-e-Utraj, Jawarish Zarooni Sada, Luboob Kabir, Majoon-e-Aarad Khurma, Majoon-e-Baladur, Majoon-e-Bandkushad, Majoon-e-Muluki, Majoon-e-Nankhwah, Majoon-e-Salab, Mufarreh Sosambari, Raughan-e-Babuna Qawi, Araq-e-Chobchini.

DEODAR
(Heart Wood)

The drug Deodar consists of dried heart wood of *Cedrus deodara* (Roxb.) Loud. (Fam. Pinaceae). A very large and tall ever green tree, upto 75 m in height and ranging from 2.4 to 3.6 m in girth, occasionally even upto 13.5 m in girth, found in North Western Himalayas from Kashmir to Garhwal, between 1200 to 3000 m and also cultivated in Kumaon.

OTHER NAMES:

Urdu	:	Deodar
Assamese	:	Shajar Tuljeen
Bengali	:	Devdaroo
English	:	Deodar, Himalayan Cedar
Gujarati	:	Devdar, Teliyo Devdar
Hindi	:	Devdar, Devdaroo
Kannada	:	Deevdar
Malayalam	:	Devtaram
Marathi	:	Devdar, Telya Dedaroo
Punjabi	:	Diyar, Dewdar
Sanskrit	:	Devadaru
Tamil	:	Devdaroo
Telugu	:	Devdari Chettu, Devdaree

DESCRIPTION:

Macroscopic: Wood moderately hard, light yellowish-brown to brown; wood splits readily longitudinally; annual rings well marked; medullary rays appear as whitish lines; resin canals, arranged in long tangential rows, showing up as dark, narrow line on the radial surface of the wood pieces. Odour aromatic; taste not distinct.

Microscopic: Mature wood almost entirely of narrow, quadrangular or rarely five or six sided tracheids, having very thick-wall with pits and a narrow lumen. Xylem rays very fine, numerous and run straight throughout the region, uniseriate and 2 to 16 cells high in tangential section; vessels absent.

Powder: Brownish-yellow in colour and oily, shows entire or fragments of tracheids and xylem ray cells.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 2 percent, Appendix 2.2.3

Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 7 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 1 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of alcoholic extract on Silica gel 'G' using Toluene: Ethylacetate (9:1) shows under U.V. (366 nm) six fluorescent zones at Rf. 0.11. 0.18. 0.32. 0.46, 0.65 and 0.75 (all blue). On exposure to Iodine vapour seven spots appear at Rf. 0.14. 0.42. 0.51, 0.67, 0.78, 0.84 and 0.92 (all yellow). On spraying with Methanolic-Sulphuric acid reagent and on heating the plate for ten minutes at 105°C eight spots appear at Rf. 0.10 (violet), 0.18 (violet), 0.52 (grey), 0.64 (violet), 0.71 (violet). 0.78 (violet). 0.89 (violet), 0.92 (green). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Terpenoids, Flavonoids and Glycosides.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Qabiz (Constipative), Kasir-e-riyah (Carminative), Mohallil-e-Waram (Anti-inflammatory), Musakkin-e-Alam (Analgesic), Mudirr-e-Baul (Diuretic), Moarriq (Diaphoretic)
THERAPEUTIC USES	**:**	Waj-ul-meda (Stomachache), Is-hal (Diarrhoea), Tap-e-Nobati (Intermittent fever), Humma-e-Safrawi (Bilious Fever)
DOSE	**:**	Burada-e Deodar - 3 g
IMPORTANT FORMULATIONS	**:**	Marham-e-Jadwar

GHARIQOON
(Fruiting body)

The drug Ghariqoon consists of fruiting body of *polyporus officinalis* Fries. A saprophytic fungus commonly known as mushroom, it is an edible gilled fungus, cosmopolitan in its distribution and grows wild on damp and dead organic substances.

OTHER NAMES:

Urdu	:	Ghariqun
Arabic	:	Ghariqoon
Persian	:	Bashman
English	:	White agaric, Touch wood
Hindi	:	Chhattri
Kashmiri	:	Jangli Bulgar
Marathi	:	Gharicum
Punjabi	:	Kiain

DESCRIPTION:

Macroscopic: The market sample was a solid mass of various sizes and of white to light yellow colour. The consistency was friable; hymenium was concrete, pileus, crocky-fleshy, zoned and smooth.

Microscopic: The internal structure shows an outer context, trama, pores and hymenium. The context made up of thick walled hyphae. The trama a loose mass of much branched, stipitate and anastomosing hyphae. The hymenium made up of basidia, Iining each pore or tube. The basidia are club shaped and projected slightly into the cavity of the pore. Each basidium terminated into the bas diophore, which is oval and unicellular. The starch grains present in between the parenchyma cells. The acicula's crystals are also demarcated among them.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent , Appendix 2.2.2
Total ash	:	Not more than 2 percent , Appendix 2.2.3
Acid insoluble ash	:	Not more than 0.2 percent , Appendix 2.2.4
Loss in weight on drying at 105°C	:	Not more than 10 percent , Appendix 2.2.9
Water soluble ash	:	Not less than 0.2 percent
Fixed Oil	:	Not less than 0.2 percent

T.L.C.:

TLC of petroleum ether extracts using Pet.Eth. Diethyl ether (4:1) as mobile phase shows five spots at R_f 0.16, 0.28, 0.37, 0.60, 0.93 (all black in color) when sprayed with 10% perchoric acid and kept the plate in one oven at 105^0 for 10 mins.

CHEMICAL CONSTITUENTS	**:**	Glucosides, steroids, Resins, Saponins, Carbohydrates, Proteins Phenolic Compounds / Tannins.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Habis (Astringent), Mushil (Cathartic), and Munafise-Balgham (Expectorant)
THERAPEUTIC USES	**:**	Sil (Phthisis), and Nafs-ud-Dam (Haemoptysis)
DOSE	**:**	3 - 20 minis.
IMPORTANT FORMULATIONS	**:**	Itrifal Ghudadi, Majoon-e-Antaki, Majoon-e-Talkh and Sabadaritoos

GUL-E-GAOZABAN
(Flowers)

The drug Gule-Gaozaban consists of dried flowers of *Borago officinalis* Linn. (Fam. – Boraginaceae); an annual plant, flowers numerous in terminal drooping bunches found in Mediterranean regions, Europe and Northern Asia.

OTHER NAMES:

Urdu	:	Gul-e-Gaozaban
Arabic	:	Zohr Lisan-us-Saur, Taharatulsanulshur, Lasanulshur
Bengali	:	Gaozaban
English	:	Cow's Tongue pant
Persian	:	Gul-e-Gaozaban

DESCRIPTION:

Macroscopic: Flowers bluish purple and turned dull brown in colour; corolla 5, gamopetalous, tubular or funnel shaped with wavy margins; stamens 5, epipetalous (filaments attached to the corolla tube at their basal ends and free above), stamen unequal in length; style bifid; characteristic pleasant odour and no taste.

Microscopic:

Corolla - T. S. of corolla shows epidermis single layered with numerous hairs; vascular strands at regular intervals (prominent veins and veinlets running all along its length), 3 to 8 prominent vessels surrounded by a small undifferentiated cellular mass; rest of the corolla region consisting of tangentially elongated parenchyma cells.

Style – Style shows bifid segments, glabrous with capitate stigma and rest of the style bears aseptate long hairs of upto 1000µ and width upto 20µ.

Style – T. S. of style shows single layered epidermis with numerous hairs; central column of thick walled compact cells while the vascular strands run on both the sides of the column with very small 6 to 8 vessels and parenchymatous cortex.

Pollen grains – Pollen grains small, oval in shape with germ pores, each individual pollen grain measuring upto 20µ.

Powder: Pale brown; epidermal cells in surface view; with hairs; elongated parenchyma cells; spiral vessels upto 20µ; pollen grains upto 20µ; hairs upto 1000µ and anther walls in surface view.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 8 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.99 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 19.44 percent, Appendix 2.2.6
Water soluble extractives	:	Not less than 56.00 percent, Appendix 2.2.7

Thin Layer Chromatography:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm). It shows major spots at R_f 0.95, 0.92 (Light blue), 0.78 (Reddish blue), 0.65 (Violet), 0.32 and 0.08 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.95 (Dark blue), 0.78, 0.65 (Violet), 0.58 (Dark blue) and 0.08 (Green).

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm). It shows major spot at R_f 0.32 (Reddish blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.72 (Violet), 0.64 (Greenish blue), 0.22 (Green) and 0.12 (Violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Thesinine
TEMPERAMENT	**:**	Hot and Moist
ACTION	**:**	Mufattit-e-Hasat (Lethotriptic), Daf-e-Humma (Antipyretic), Muqawwi (Tonic), Mudirr-e-Baul (Diuretic) and Qabiz (Astringent)
THERAPEUTIC USES	**:**	Sual-e-Yabis (Dry cough), Zeequn Nafas (Asthma), Warm-e-Lissa (Gingivitis), Qula (Stomatitis) and Khafqan (Palpitation)
DOSE	:	5 - 7 g
IMPORTANT FORMULATIONS	**:**	Khamira Gaozuban, Khamira Abresham, Dawaul Misk

JADWAR
(Root)

The drug Jadwar consists of dried tuberous roots of *Delphinium denudatum* Wall. (Fam. – Ranunculaceae); an annual glabrous or slightly downy herb found in Western Himalayas from Kumaon to Kashmir at altitudes of 3,000 to 4,500 m specially on grassy slopes.

OTHER NAMES:

Urdu	:	Jadwar
Arabic	:	Zhadvar
Persian	:	Maah Parveen
English	:	Blood veined sage
Gujarati	:	Nirvishi
Hindi	:	Judwar, Nirbishi
Marthy	:	Nirvishi
Sanskrit	:	Nirvisha

DESCRIPTION:

Macroscopic : Root dark brownish black in colour, 3 to 6 cm long and 1 to 2 cm wide at the crown in length, conical shape, very hard, externally covered by a suberised metaderm, and bears numerous small circular scars i.e., the remains of lateral rootlets. Longitudinal wrinkles present, fracture short. Odour characteristic; taste bitter.

Microscopic : Tranverse section of tuberous root shows circular and wavy outline; metaderm (epidermis) - outer region consisting of single layer of irregularly arranged brown tabular cells with suberised walls; cortex consisting of narrow zone of about 5 to 10 layers of thin walled, polygonal to rectangular parenchymatous cells. Endodermis distinct with suberised radial walls; cambium present; secondary phloem present above the cambium and secondary xylem present below the cambium; primary xylem present near the pith region; starch grains present in the entire parenchymatous cells of the tuberous root.

Powder : Brown, vessels with scalariform thickening of length upto 200µ and breadth upto 50µ; suberised metaderm (epidermal) cells in surface view with rectangular cells and cortical parenchyma cells in surface view.

IDENTITY PURITY AND STRANGTH:

Foreign matter	**:**	Not more than 2 percent , Appendix 2.2.2
Total ash	**:**	Not more than 3 percent , Appendix 2.2.3
Acid insoluble ash	:	Not more than 0.4 percent , Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 2 percent , Appendix 2.2.6

Water soluble extractives : Not less than 42 percent , Appendix 2.2.7
Loss in weight on drying at 105°C : Not more than 10 percent , Appendix 2.2.9

T.L.C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spots at R_f 0.88 (Sky blue), 0.75 (Light blue) and 0.08 (Yellowish). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.96, 0.61, 0.54 (Dark blue) and 0.08 (Greenish blue).

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spots at R_f 0.90 (Sky blue), 0.77, 0.14 and 0.08 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.96 (Dark blue), 0.62 (Violet), 0.60, 0.56, 0.14 (Dark blue), 0.12 and 0.08 (Violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Delpho-cuarine, conelphine, denudatine and denudatidine
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Asab (Nerve tonic), Muqawwi-e-Qalb (Cardio tonic), Tiryaqe-sumoom (Antidote to poison), Mufarreh (Exhilarent), Musakkin (Sedative), Dafe Humma (Antipyretic), Mufatteh (Deobstruent), Mohallil (anti-inflammatory)
THERAPEUTIC USES	**:**	Nazla Muzmin (Chronic Catarrh), Iltehab Tajaweef-e-Anaf (Sinusitis), Sara (Epilepsy), Istirkha (Paralysis), Haiza (Chlorea), Yarqan (Jaundice), Zof-e-Meda (Weakness of the Stomach), Qulanj (Colic)
DOSE	**:**	0.5 - 1 g
IMPORTANT FORMULATIONS	**:**	Habbe-Jadwar, Khamira Gaozaban Ambari Jawahirwala Ood-e-Saleeb Wala, Jawhar Mohra, Marham-e-Jadwar.

JAO
(Fruit)

The drug Jao consists of dried fruit of *Hordeum vulgare* Linn. Syn. *H. sativum* Pers. (Fam. Poaceae); an annual, erect herb, 50-100 cm high, cultivated chiefly in North India.

OTHER NAMES:

Urdu	:	Jau
Bengali	:	Jau, Jav
English	:	Barley
Gujarati	:	Cheno, Jau
Hindi	:	Jav
Malayalam	:	Javegambu
Marathi	:	Yava, Java
Punjabi	:	Javo
Sanskrit	:	Divya
Tamil	:	Barley, Barliyayisi
Telugu	:	Barlibiyam, Yava Dhanya

DESCRIPTION:

Macroscopic: Fruit a caryopsis, elliptic, oblong, ovoid-and tapering at both ends, smooth, about 1 cm long and 0.2-0.3 cm wide, dorsally compressed and flattened on the sides with a shallow longitudinal furrow, 3-5 ridges having shallow depression between them, grains tightly enclosed and adhering the lemma and palea; pale-greenish-yellow; odour, not distinct; taste, sweetish-acrid.

Microscopic: Fruit shows single layered epidermis consisting of crescent-shaped, round to oval wavy walled cells, followed by 2-3 layers, thick-walled, sclerenchymatous fibres; below the sclerenchyma are present irregular, square or quadrilateral, spongy parenchymatous cells, a few cell walls having silica bodies through which run the fibro-vascular bundles of the ribs, followed by more or less, polygortal inner epidermal cells, a few innerepidermal cells having unicellular claw-shaped hair and stomata. Pericarp composed of cells with more or less compressed parenchymatous cells. Seed coat appears as a colourless line; perisperm composed of cells with more or less wavy walls having narrow lumen; endosperm divided into two zones, 2-4 cells deep aleurone layers, and the rest starch layers; starch grains simple, round to oval, measuring 3-30 ì in diameter.

Powder: Creamish-white; shows groups of fragments of polygonal, thin-walled flowering glume cells in surface view, sclerenchymatous fibres, scalariform vessels and abundant round to oval, simple starch grains, measuring 3-30 ì in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2

Total Ash	:	Not more than 4 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 2 percent, Appendix 2.2.4
Water-soluble ash	:	Not less than 4 percent, Appendix 2.2.5
Alcohol-soluble extractive	:	Not less than 2.5 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 5.5 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using n-Butanol :Acetic acid:Water (4: 1 :5) shows under U.V. light (366 nm) seven fluorescent zones at Rf. 0.10, 0.22, 0.31, 0.45, 0.68, 0.83 (all violet) and 0.92 (yellow). On spraying with Phosphomolybdic acid reagent and on heating the plate for ten minutes at 105°C six spots appear at Rf. 0.10, 0.22, 0.31, 0.68, 0.83 and 0.92 (all grey). On spraying with Ninhydrin reagent eleven spots appear at Rf. 0.06, 0.14, 0.16, 0.24, 0.31, 0.36, 0.44, 0.53, 0.56, 0.65 & 0.72 (all pink.). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Starch, Sugars, Fats, Proteins (Albumin, Globulin, Prolamin andGlutilin) also contains Flavone Glycosides viz, Orientoside, Orientin, Vitexin etc.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Qabiz (constipative), Mujaffif (Siccative), Jali (Detergent), Daf-e- Tap (Antipyretic), Mudirre-Baul (Diuretic), Muwallid-e-Dam (Haemotogenic)
THERAPEUTIC USES	**:**	Sil (Pthisis), Diq (Tuberculosis), Zat-ul-Janb (Pleurisy), Sual (Cough), Suda (Headache)
DOSE	**:**	25-50 g
IMPORTANT FORMULATIONS	**:**	Aash-e-Jao, Maus-Shaeer, Zimad-e-Waram-e-Unsayain Haad

JAWANSA
(Whole Plant)

The drug Jawansa consists of dried whole plant of *Alhagi pseudalhagi* (Bieb.) Desv. (Fam. Papilionceae); a small thorny hrub, mostly found in arid and dry regioons of Gujarat, Punjab, Uttar Pradesh and Rajasthan.

OTHER NAMES:

Urdu	:	Turanjabeen
Assamese	:	Bhatuashak
English	:	Persian Manna Plant
Gujarati	:	Javaso
Hindi	:	Javasa
Kannada	:	Turuchana gida, Javasa, Neladangara, ballidurabi, Duralabha
Malayalam	:	Venkatithura, Valiya Kotithuva
Sanskrit	:	Durlabha
Marathi	:	Dhamasa
Tamil	:	Punaikanjuri, Kanchori
Telugu	:	Chinnadoolagondi, Dhanvayasamu

DESCRIPTION:

Macroscopic: Root - Well developed, 20-30 cm long and 0.2-1 cm thick; gradually tapering, secondary and tertiary root absent; dark brown; fracture, short.

Microscopic: **Stem** - Cylindrical, glabrous, slightly rough at basal region with slender; hard, sharp auxiliary spines upto 3.8 cm long; branched, terete, striate, glabrous, nearly 0.1-cm thick; yellowish-green to yellowish-brown.

Leaf - Simple, alternate, oblong, mucronate obtuse, drooping, opposite, extipulate, 0.5-1 cm long, 0.5-0.7 cm broad. Elliptical, smooth or puberlous with very short petiole, stipules green. No taste and odour.

Root -Shows 6-10 layers of tangentially elongated, radially arranged cork cells; cork cambium single layered, filled with reddish-brown contents; secondary cortex almost absent; phloem composed of sieve elements, phloem parenchyma and phloem fibres; some phloem parenchyma cells filled with tannin; xylem consists of vessels, tracheids, fibres parenchyma and xylem rays. Vessels mostly solitary with simple pits; tracheids and fibres thick-walled, aseptate with bluntly pointed ends; medullary rays 1-4 cells wide, 3-45 cells long. Pith composed of a few thin-walled, angular, parenchymatous cells; starch grains simple, rounded to oval, 5.5-14.75 ì in diameter present throughout the region.

Stem - Shows a single layered epidermis covered externally with thick cuticle; cortex composed of 8-15 layers of oval, tangentially elongated cells, numerous tanniniferous cells found scattered in this

region; pericycle present in form of fibre groups; phloem composed of sieve elements, parenchyma and fibres; some parenchyma cells filled with tannin; xylem consists of vessels, tracheids, xylem fibres, xylem parenchyma and xylem rays; vessels solitary or in groups of 2-3 with simple pits; tracheids and fibres, a few with thick wall and simple pits; medullary rays 2-3 cells wide pith composed of rounded, thin-walled, parenchymatous cells, some cells filled with tannin.

Petiole - appears circular in outline; shows single layered epidermis covered externally with cuticle; hypodermis 2-3 layered, filled with tannin, 'D'' shaped collateral vascular bundle resent in central region; rest of tissue between vasculr bundle and hypodermis composed of thin-walled, parenchymtous cells some of which are filled with tannin.

Midrib - appears biconvex in outline; epidermis single layered, covered externally with thick cuticle; hypodermis 1-2 layered, filled with tannin; pericycle present in the form of fibres trands; vascular bundle collateral; xylem situated above phloem, rest of tissue between vascular bundle and pericyclic strand is parenchymatous.

Lamina - epidermis consisting of single layered cells, covered with cuticle; paracytic stomata present on both surfaces hypodermis single layered filler vith tannin; mesophyll not differentiated into palisade and spongy parenchyma, consisting of thin-walled oval to polygonal cells having chlorophyll; rounded to elongated tanniniferous cells found scattered in mesophyll.

Powder: Greenish-brown; shows fragments of epidermal cells consisting of rectangular to polygonal, elongated, thin-walled, parenchymatous cells with paracytic stomata, pitted vessels, fibres, tanniniferous cells, simple, round and oval starch grains measuring 5.5- 14.75 ì in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 14 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 3 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 2 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 10 percent, Appendix 2.2.7

T.L.C.:

T.L.C of the pet. ether (60-80) extract on Silica gel 'G' plate using pet. ether: diethyl ether (19:1) shows three major spots on exposer to Iodine vapour at Rf. 0.38, 0.51, and 0.61. Appendix 2.2.10

CHEMICAL CONSTITUENTS **:** Sugars (Melizitose, Sucrose, Invert Sugars).

TEMPERAMENT **:** Hot and Dry

ACTION	**:**	Mudirr-e-Baul (Diuretic), Musaffi-e-Dam (Blood Purifier), Musakkin (Sedative), Tiryaq (Antidote)
THERAPEUTIC USES	**:**	Bawaseer Amya (Blind Piles), Bawaseer Damvi (Bleeding Piles), Muzarrat-e-Seemab (Toxicity of Mercury), Waj-ul-Mafasil (Joint Pain)
DOSE	**:**	3-5 g
IMPORTANT FORMULATIONS	**:**	Arq-e-Juzam, Arq-e-Musaffi-e-Khoon Qawi

KATEERA
(Gum)

The drug Kateera consists of dried gum obtained from *Cochlospermum religiosum* (Linn.) Alston. Syn. *Cochlospermum gossypium* D C. (Fam. - Cochlospermaceae); a tree, in India found in Bihar, Orissa, Bengal, Central India, Deccan, West Penninsula, Madras Presidency in Dry forests, especially on stony hills in all districts.

OTHER NAMES:

Urdu	:	Katira
Arabic	:	Katira, Samgh-e-qatad
Bengali	:	Katila
Persian	:	Gone, Katira
English	:	Gum Tragacanth, tragacanth
Gujarati	:	Kadachogund
Hindi	:	Gadbi, Falgal, Gangal, Ganiar, Kumbi, Gejra
Malayalam	:	Appakutakka, Chempanni, Chimappanni, Panninara, Parapanni
Marathi	:	Galgal, Ganeri, Ganglay, Gongal, Gulgul, Gunglay, Kathalyagonda
Punjabi	:	Kumbi
Tamil	:	Kannigaram, Kattilavu, Kattolaga, Kattuparatti, Pachaigiluvai, Tanakku Tanaka, Turumarbalam
Telugu	:	Adaviburaga, Akshotamu, Buraga, Gungu, Kondagogu, Kongu, Parjatamu, Pratti

DESCRIPTION:

Macroscopic: The gum Tears, cream brown colour, irregular with varying size, tears glassy and marked with minute fissures, brittle in nature, broken tears with angular fragments, no characteristic odour, bland mucilaginous.

Powder gum yellowish brown to white in colour; it is soluble in 50% H_2SO_4, insoluble in alcohol and alcoholic 1N NaOH; in water gum swollen by the absorption of water into a jelly like mass as well as in 1N HCl and aqueous 1N NaOH.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent , Appendix 2.2.2
Total ash	:	Not more than 8 percent , Appendix 2.2.3
Acid insoluble ash	:	Not more than 0.2 percent , Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 36 percent , Appendix 2.2.6
Loss in weight on drying at 105°C	:	Not more than 19 percent , Appendix 2.2.9

T.L.C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spots at R_f 0.67 and 0.20 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.92 (Dark blue), 0.67, 0.53, 0.42, 0.35 and 0.20 (Violet).

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spots at R_f 0.90, 0.79, 0.47, 0.29 (Light blue) and 0.18 (Reddish blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.90, 0.79 (Dark blue), 0.60, 0.52, 0.40 and 0.29 (Violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	L-arabinose, D-galactose, D-rhamnose, aldobiuronic acid, 6-0-â-D-glucopyranosyl uronic acid-D-galactose, 3-O-â-D-galactopyranosyl-D-galactose and O-â-D-Galactopyranosy l (1-3) -D-galactop-yranose.
TEMPERAMENT	**:**	Moderate and Moist
ACTION	**:**	Mulattif (Demulcent), Habis (Astringent), Musakkin (Sedative), and Atishak (Syphilis)
THERAPEUTIC USES	**:**	Sual-e-Muzmin (Cough), Bohat-us-Sauthaad (Horse throat), Ishal (Diarrhoea), Zaheer (Dysentery), and Zeequn-Nafas (Asthma)
DOSE	:	1-3 g
IMPORTANT FORMULATIONS	**:**	Laooq-e-Shamoon, Laooq-e-Sapistan, Laooq-e-Behidana, Laooq-e-Hulba, Laooq-e-Badam, Itrifal Zamani and Majoon-e-Azaraqi, Sharbat-e-Ejaz.

KATH
(Stem Bark)

The drug Katha Safaid consists of dried stem bark of *Acacia leucophloea* Willd. (Fam. Mimosaceae); a moderate-sized deciduous tree, upto 3 m in height, characteristic of dry regions, found in the plains of Punjab and in the dry forest tracts throughout the country.

OTHER NAMES:

Urdu	:	Kat, Katha
Bengali	:	Guyababla, Sadabala
Gujarati	:	Haramibaval, Pilobaval, Haribaval
Hindi	:	Arimeda
Malayalam	:	Karivelam, Velvelam, Velvelakam
Marathi	:	Pandal Babal
Oriya	:	Arimeda
Sanskrit	:	Shveta-barbura
Tamil	:	Velvelam

DESCRIPTION:

Macroscopic Mature bark 0.5-1 cm thick, hard, rough, incurved, exfoliating in irregular scales. Externally yellowish-grey or almost black and longitudinally fissured. Internally light brown to reddish-brown, internal surface longitudinally striated and fibrous. Fracture fibrous; odour and taste not distinct.

Microscopic : Stem Bark -Mature bark shows dead tissues of rhytidoma consisting of cork cells, thinwalled cortical cells, stone cells and phloem cells, traversed by multiseriate edullary rays; cork consisting of 4-8 layers of thin-walled, square to rectangular cells, followed by umerous groups of sclereids of various shapes and sizes; secondary phloem wide, consisting of sieve elements, parenchyma, fibres and crystal fibres, all traversed by medullary rays; sieve elements get collapsed in outer and middle region forming tangential bands of ceratenchyma; phloem parenchyma thin-walled some cells contain prismatic crystals of calcium oxalate; phloem fibres thin-walled, lignified, with tapering ends, arranged in more or less concentric bands forming tangential strips alternating with-thinwalled phloem elements; crystal fibres elongated, thick-walled having numerous chambers containing a prismatic crystals of calcium oxalate in each chamber; medullary rays multiseriate dilating towards outer side, composed of thin-walled, radially elongated cells.

Powder: Reddish-brown; shows groups of cork cells, sclereid, fibres, crystal fibres and prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2

Total Ash	:	Not more than 11 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 14 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 13 percent, Appendix 2.2.7

T.L.C.:

T.LC. of alcoholic extract of drug on Silica gel 'G' plate using Chloroform: Ethyl acetate: Formic Acid (54: 1) only one spot at Rf 0.69 (grey) is seen in visible light. Under UV (366 nm) two fluorescent zones appear at Rf.0.78 and 0.91 (both blue).On exposure to Iodine vapour a yellow coloured tailing appears from Rf.0 to 0.39 and a spot at Rf. 0.91 (yellow). On spraying with 10% aqueous Ferric Chloride solution a bluish grey coloured tailing appears from Rf. 0 to 0.39 and a spot at Rf. 0.91 (bluish grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	n-Hexacosanol, â -Amyrin, â-Sitosterol and Tannin.
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Qabiz (Constipative), Musaffi-e-Dam (Blood Purifier), Mujaffif (Desiccant) and Habis (Styptic)
THERAPEUTIC USES	**:**	Is-hal (Diarrhoea), Lissa-e-Damiya (Bleeding Gums) Qula (Stomatitis), Aatishak (Syphilis), Amraz-e-Dam (Diseases of Blood)
DOSE	**:**	3-5 g Powder, 40 g drug for decoction
IMPORTANT FORMULATIONS	**:**	Zaroor-e-Qula, Habb-e-Lemu

KHAJUR
(Fruit)

The drug Khajur consists of ripe and mature fruit, of *Phoenix dactylifera* Linn. (Fam. Arecaceae), a tall palm tree upto 36 m high, cultivated or occasionally self-gown in arid parts of the country.

OTHER NAME

Urdu	:	Khurma (Khajoor)
Bengali	:	Khejur
English	:	Date
Gujarati	:	Khajur
Hindi	:	Khajur, Pinda, Khajur
Kannada	:	Kharjura, Pinda Kharajura
Malayalam	:	Prantha Puzam
Marathi	:	Khajur
Oriya	:	Khejuri
Punjabi	:	Pinda Khajur
Sanskrit	:	Pinda-kharjura
Tamil	:	Pericham Pazham
Telugu	:	Khajur pupandu

DESCRIPTION:

Macroscopic: Fruit a berry, oval to oblong, compressed, of varying shapes; 2 to 3 cm long, smooth or slightly wrinkled, reddish-brown to yellowish-brown; pulp fleshy, sticky, soft, viscous; odour, not distinct; taste sweet.

Microscopic: Fruit shows single layered epidermis with striated cuticle, containing heavily cutinized cells and having stomata; below epidermis, 4 or 5 layered tangentially elongated, thin-walled, parenchymatous hypodermis present, followed by a row of stone cells with narrow lumen, thick-walled, 28 to 55 ì in dia., with clear striations; mesocarp differentiated into two zones, outer consisting of thin-walled parenchyma cells with scattered tannin, and oil globules, inner consisting of collapsed, crushed and disorganized cells appearing as loose, shining, 'fibrous' mass, representing the so called "rag." scattered sclerosed cells also occur in this region; endocarp composed of single layered inner epidermis together with underlying compact tissues.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 3 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 percent, Appendix 2.2.4

Alcohol-soluble extractive	:	Not less than 20 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 65 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of alcoholic extract on Silica Gel 'G' using n-Butanol: Acetic acid: Water (5:1:4) shows in visible light one spot at Rf. 0.12 (grey). On exposure to Iodine vapour two spots appear at Rf. 0.12 and 0.25 (both yellow). On spraying with 5% Methanolic- Sulphuric acid reagent four spots appear at Rf. 0.12, 0.25 (both black), 0.33 and 0.62 (both grey). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Sugars, Protein and Vitamins
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Aam (Gerneral tonic), Muwallid-e-Dam (Haematogenic)
THERAPEUTIC USES	**:**	Faqr-ud-Dam (Anaemia), Zof-e-Bah (Sexual Debility), Zof-e-Asab (Neurasthenia), Yarqan (Jaundice)
DOSE	**:**	10-15 g
IMPORTANT FORMULATIONS	**:**	Majoon-e-Aarad Khurma

KHARNOOB
(Fruit)

The drug Kharnoob consists of the dried pods of *Ceratonia siliqua* Linn. (Fam. Caesalpiniaceae). a native of the East Mediterranean region., introduced into India; and has become naturalized in Punjab and a few other regions.

OTHER NAMES:

Urdu	:	Kharnoob
Arabic	:	Khurnoob-ush-Shank
Bengali	:	Sai
Hindi	:	Cikura, Jhand
Marathi	:	Shami
Persian	:	Kharnoob
Sanskrit	:	Sami
Sindhi	:	Kandi
Tamil	:	Perumbe

DESCRIPTION:

Macroscopic : Fruit dark brown, 10-15 cm long, 2.5-3.5 cm wide, dorsiventrally compressed, curved; ventral sutured grooved. Seeds many on marginal placenta seeds campylotropus, dark brown, obovate; compressed.

Microscopic : T.S of pericarp shows epicarp, mesocarp and endocarp. Epicarp has epidermis, hypodermis and cortex. Epidermis is covered by a cuticle of 3-5µ thick; 6-8 seriate, parenchymatous, cells thick walled, tangentially elongated, inner one or two layers of epidermal cells possess thick walls and filled with brown pigment. Hypodermis multiseriate made of alternate patches of parenchyma and sclerenchyma. Cortex15-20 seriate, peripheral 8-10 layers parenchymatous followed by 3-4 layers of tangentially elongated stone cells. Innermost layer of epidermal cortex is made of large, radially elongated sclerenchymatous cells with simple pits. Mesocarp 5-8 seriate composed of tangentially elongated polygonal sclereids. Endocarp parenchymatous mostly crushed.

T. S of Seed shows seed coat, and cotyledons. Seed coat contains testa and tegmen. Testa has a 3-5µ thick cuticle, uniseriate epidermis composed of tangentially elongated parenchymatous cells. Hypodermis made of a layer of hourglass cells followed by a single layer of maphigian cells, 3-5 seriate parenchymatous ground tissue and a uniseriate inner epidermis. Tegmen layers mostly crushed. Cotyledons contain uniseriate epidermis with radially elongated cells and mesophyll composed of polygonal parenchyma. Cells filled with aleurone grains.

Powder characters : Brown, rough, freely floating on the surface of water. Taste and odour indistinct; contains. It sclereids, parenchymatous cells containing brown pigment, large elongated stone cells and hourglass cells.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 12 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 7 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 14 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 26 percent, Appendix 2.2.7

T.L.C.:

TLC of the Petroleum ether extract on silica gel "G" plate using n-Hexane: diethyl ether (95:5) mobile phase shows two spots at Rf values 0.40 and 0.60 upon spraying the plate with 5% methanolic sulphuric acid and heating for 10 minutes at 105°C. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Tannins and Saponins
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Qabiz (Constipative), Habis (Retentive), Musakkin (Sedative), Mudirr-e-Baul (Diuretic)
THERAPEUTIC USES	**:**	Sual Muzmin (Chronic Bronchitis), Waj-ul-Sadr (Chest Pain)
DOSE	**:**	5-10 g
IMPORTANT FORMULATIONS	**:**	Sufoof-e-Habb-ur-Rumman, Sharbat-e-Anjbar

MAGHZ-E-CHILGHOZA
(Kernel)

The drug Maghz-e-Chilghoza consists of kernels of *Pinus gerardiana* Wall. (Fam.- Pinaceae; a moderate size deciduous tree found in the outer Himalayas from Sutlej to Sikkim and fairly common throughout the hotter parts of India as far east as Assam.

OTHER NAMES:

Urdu	:	Chulgozah
Arabic	:	Habbus-Sanobar
Persian	:	Chilgozha, Tukhum-e-Sanobar
English	:	Neozapine, Edible pine
Gujarati	:	Chilgoza, Galgoja
Hindi	:	Chilgoza, Gunobar, Neoza
Marathi	:	Chilgoza, Galgoja
Punjabi	:	Chiri, Galboja, Galgoja, Kashti, Mirri, Neoza, Prita, Shangti
Sanskrit	:	Bhutamari, Chida, Darugandha, Gandhamadani, Tara, Taruni

DESCRIPTION:

Macroscopic: The kernel creamish yellow; cylindrical, long upto 2 cm in length and 0.5 cm wide, surface smooth and glassy, kernel consists of 3 to 9 cotyledons, no characteristic odour and taste sweetish oily.

Microscopic: T. S. of kernel shows circular in outline, the central core of cotyledons surrounded by the endosperm; outer layer of endosperm consisting of single layer of tabular epidermal cells; endosperm consisting of several layers of thin walled parenchymatous cells filled with oil globules and starch grains followed by few layers of collapsed tissue on the inner side; cotyledons vary in number; each cotyledons surrounded by a single layer of epidermal cells followed by cotyledonary parenchyma of thin walled polygonal cells filled with aleurone grains and oil globules; vascular tissue present in the centre of the cotyledons.

Powder: Creamish yellow; endosperm cells; parenchyma cells from the cotyledons; starch grains simple, round to oval measuring upto 15µ and compound starch grains (upto 6 starch grains unite) and spiral vessels upto 12µ.

IDENTITY, PURITYAND STRENGTH:

Foreign matter	:	Note more than 2 percent , Appendix 2.2.2
Total ash	:	Not more than 3 percent, Appendix 2.2.3
Acid insoluble ash	:	Not more than 2 percent, Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 47 percent, Appendix 2.2.6

Water soluble extractives : Not less than 16 percent, Appendix 2.2.7
Loss in weight on drying at 105°C : Not more than 6 percent, Appendix 2.2.9

T.L.C.:

Extract 2 g of sample with 20 ml of alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (2546nm). It shows major spot at R_f 0.65 (Pink). Under UV (366 nm) it shows major spot at R_f 0.13 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.65, 0.52, 0.50 (Dark blue), 0.41 (Bluish green) and 0.13 (Violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS : Fixed oil

TEMPERAMENT : Hot and Moist

ACTION : Moharrik (Stimulant), Muqawwi-e-Bah **A**phrodisiac), Muwallid-e-Mani (Haematogenic), Musammin-e-Badan (Adipogenous), Munaffis-e-Balgham (Expectorant)

THERAPEUTIC USES : Waj-ul-Mafasil (Joint Pain), Zof-e-Bah (Sexual Debility), Sailan-ur-Rahem (Leucorrhoea), Falij (Hemiplegia), Laqwah (Facial Paralysis), Sual (Bronchitis), Zeeq-un-Nafas (Asthma)

DOSE : 7-10 g

IMPORTANT FORMULATIONS : Halwa-e-Gajar, Khamira-e-Ustukuuddus, Luboob-e-Kabir, Luboob-e-Sagheer, Majoon-e-Azaraqi, Majoon-e-Baladur, Majoon-e-Aarad Khurma and Majoon-e-Falasfa

MAGHZ-E-TUKHME-KADDU-SHIREEN
(Kernel)

The drug Maghz-e-Tukhm-e-Kaddu-Shireen consists of kernels of *Cucurbita moschata* (Duch. ex Lam.) Duch. ex Poir. (Fam.- Cucurbitaceae), an annual, herbaceous, tendril climber, large and spreading, cultivated throughout tropical and sub-tropical regions in India. It is cultivated for its fruits used as vegetables.

OTHERS NAMES:

Urdu	:	Kaddu
Arabic	:	Q'ra
Persian	:	Khayar-e-Kaddu
Bengali	:	Kumra
Hindi	:	Jangli Kaddu, Sitaphal
Marathi	:	Kali-dudhi, Kashiphal, Kala Bhopala
Tamil	:	Sorakai

DESCRIPTION:

Macroscopic : White to cream; ovoid or oblong; compressed; size about 10 mm length, 5 mm breadth and 2 mm width: surface smooth, glossy, a groove or slight depression on one side: no characteristic odour and taste sweetish oily.

Microscopic : T.S. of kernels shows single layer of inner epidermis of the testa followed by cotyledons consisting of polygonal parenchymatous cells containing aleurone grains and abundant oil globules; outer epidermis of cotyledons single layer, innermost two layers much more elongated palisade like cells and distinct; each cotyledons shows five distinct patches of small thin walled polygonal cells present midway in a roughly trapezoidal shape.

Powder : Cream, palisade like elongated cotyledonary parenchyma cells from the inner most layer of cotyledons, cotyledonary parenchyma containing aleurone grains and oil globules and spiral vessels upto 40 microgram.

IDENTITY PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Aappendix 2.2.2
Total ash	:	Not more than 4 percent, Appendix 2.2.3
Alcohol soluble extractives	:	Not less than 52 percent, Appendix 2.2.6
Water soluble extractives	:	Not less than 9 percent, Appendix 2.2.7
Loss in weight on drying at 105^0C	:	Not more than 8 percent, Appendix 2.2.9

T.L.C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath

for 309 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm). It shows major spots at Rf 0.79 (Dark blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110^0 for about 10 min and observe under visible light. The plate shows major spots at Rf 0.95, 0.79 and 0.57 (Dark blue).

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and dip the plate in vanillin-sulphuric acid reagent followed by heating at 110^0 for about 10 min and observe under visible light., The plate shows major spots at Rf 0.96 (Dark blue), 0.79, 0.72 and 0.59 (Violet). Aappendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Avenasterol, codisterol, clerosterol, isofucosterol, compesterol, sitosterol, spinasterol, palmitic, palmitoleic, stearic, oleic, linoleic acid, rhamnose, fructose, glucose, galactose, sucrose and raffinose.
TEMPERAMENT	**:**	Cold and Moist
ACTION	**:**	Daf-e-Kirm-e-Ama (Anthelmintic), Mudirr-e-Baul (Diuretic), Mulaiyin-e-Shikam (Laxative)
THERAPEUTIC USES	**:**	Qurooh (Ulcer), Mufatteh Sudad (Deobstruent), Yarqan (Jaundice), Zarb-wa-khilfah (Sprue / Malabsorption Syndrome)
DOSE	**:**	4-8 g
IMPORTANT FORMULATION	**:**	Laooq-e-Sapistan, Laooq-e-Behidana,Khamira-e-Khashkhaash, Mufareh Barid, Muffarreh Barid Jawahirwali, Muffarreh Barid Qawi and Luboob-e-Barid.

MAYEEN KALAN
(Galls)

The drug Mayeen Kalan consists of the dried galls of *Tamarix gallica* Linn. Syn. *T. troupiirtole* (Fam.- Tamaricaceae).It grows in Punjab, Uttar Pradesh, Sindh, Baluchistan and Mount Abu.

OTHER NAMES:

Urdu	:	Mayeen Kalan
Arabic	:	Samratur-Turfa, Jooz-e-Turfa
Persian	:	Kazmazaj
Bangali	:	Jhaoghacch
Hindi	:	Jhau, Jhav
Gujarati	:	Jhav-nu-jhad
Punjabi	:	Palchai, Koa, Pilchi
Sanskrit	:	Jhavuka
Tamil	:	Shirushavakku
Telugu	:	Erusarumanu

DESCRIPTION:

Macroscopic : The galls are grey, hard, 1.5-3.5 cm in diameter, fracture brittle, surface porous; taste bitter; odour indistinct.

Microscopic : T.S of gall consists of epidermis, ground tissue and vascular tissue ; epidermis multilayered, cells tangentially elongated, thick walled, externally covered by thick cuticle of 5-6µ thick; ground tissue parenchymatous, cells irregular , thin walled with intercellular spaces; some of the cells contain brown pigment; prismatic calcium oxalate crystals are also found in the ground tissue. Vascular tissue consists of xylem and phloem; xylem contains vessels with spiral and scalariform thickenings, xylem fibres and xylem parenchyma. Phloem contains sieve tubes, phloem fibres and phloem parenchyma.

Powder: Brown, free floating on the surface of water, odour indistinct; and bitter taste, contains vessels with annular and spiral thickenings, and prismatic calcium oxalate crystals.

IDENTITY, PURITY AND STRENGTH:

Foreign Matter	:	Not more than 2 percent, Aappendix 2.2.2
Total Ash	:	Not more than 12 percent, Appendix 2.2.3
Acid insoluble ash	:	Not more than 5 percent, Appendix 2.2.4
Water soluble ash	:	Not less than 5 percent, Appendix 2.2.5

T.L.C.:

Petroleum ether extract on silica gel “G” plate using n-Hexane: diethyl ether(95:5) as mobile

phase shows four spots at Rf values 0.15, 0.40, 0.65, and 0.85 on spraying the plate with 5% methanolic sulphuric acid and heating for 10 minutes at 105°C. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Tannins and saponins
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Qabiz (Constipative), Habis (Styptic)
THERAPEUTIC USES	**:**	Istirkha-e-Lissa (Losening of Gum), Lissa-e-Damiya (Bleeding Gums), Waja-ul-Asnaan (Odontalgia), Qula (Stomatitis), Ishal (Diarrhoea), Surat-e-Inzaal (Premature Ejaculation), Riqqat-e-Mani (Attenuated Semen), Kasrat-e-Ehtelam (Excessive nocturnal emission) Sailan-ur-Reham (Leucorrhoea)
DOSE	**:**	7 g
IMPORTANT FORMULATIONS	**:**	Habb-e-Paichish, Safoof-e-Salab, Safoof-e-Sailan-ur-Reham

NISHASTA-E-GANDUM
(Seed)

The drug Nishasta-e-Gandum consists of Starch powder obtained from seeds of *Triticum aestivum* Linn. (Fam. – Poaceae*)*; an annual cereal, herbaceous in nature; it is cultivated all over the world for its grains.

OTHER NAMES:

Urdu	:	Gandum, Gehun
Arabic	:	Hantha
Persian	:	Aabguwan
Bengali	:	Gam
English	:	Wheat starch
Hindi	:	Gehun
Marathi	:	Pivla-Potia
Tamil	:	Godumai
Telugu	:	Godumulu
Sanskrit	:	Godhuma

DESCRIPTION:

Macroscopic : White fine powder and no characteristic taste or odour.

Microscopic : Simple starch grains of two sizes; smaller circular, oval upto 15µ and large oval or sub-reniform upto 50µ, central hilum with concentric striations.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than 0.1 percent, Appendix 2.2.3
Acid insoluble ash	:	Nil, Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 5 percent, Appendix 2.2.6
Water soluble extractives	:	Not less than 1 percent, Appendix 2.2.7
Loss in weight on drying at 105°C	:	Not more than 11 percent, Appendix 2.2.9

T.L.C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under

visible light. The plate shows major spots at R_f 0.62 (Dark blue).
Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.70, 0.59 and 0.29 (Pale blue).
Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Starch
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Muqawwi-e-Bah (Aphrodisiac), Mulaiyin (Laxative), and Mohazzil (Thinning specially due to loss of fat), Mughazzi (Nutritive).
THERAPEUTIC USES	**:**	Zof-e-Ishteha (Loss of appetite), Ghalba-e-Safra (Biliousness)
DOSE	:	5 - 7 g
IMPORTANT FORMULATIONS	**:**	Halwa-e-Gajar, Laooq-e-Badam, Laooq-e-Shamoon, Majoon-e-Sohag, Majoon-e-Muqawwi-e-Rahem and Majoon-e-Suparipak

OOD HINDI
(Heart Wood)

The drug Ood Hindi consists of dried heart wood of *Aquilaria agallocha* Roxb. (Fam. Thymelaeaceae), a large evergreen tree, distributed in North East part of India.

OTHER NAMES

Urdu	:	Ood Hindi, Agar
Assamese	:	Agaru
Bengali	:	Agaru, Agarkashtha, Agar Chandan
English	:	Eagle Wood
Gujarati	:	Agar
Hindi	:	Agar
Kannada	:	Krishna Agaru
Malayalam	:	Akil
Marathi	:	Agar
Punjabi	:	Ooda, ooda, pharsi
Sanskrit	:	Aguru, Lauha, K£mija
Tamil	:	Akil kattai
Telugu	:	Agaru

DESCRIPTION:

Macroscopic: Drug available in cut pieces, dark brown to nearly black in colour; fracture, hard; having characteristic smell.

Microscopic: Shows mostly uniseriate sometimes biseriate xylem rays; vessels isolated having simple pitted thickening and filled with dark brown contents; xylem fibres short having narrow lumen occupying a major portion of wood; xylem parenchyma less in number and simple pitted; included phloem tissues in pockets partially disorganised, leaving large circular or oval holes, containing collapsed and broken tissues.

Powder: Dark brown; shows numerous aseptate fibres, simple pitted vessels with dark brown contents.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 13 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 1 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 2 percent, Appendix 2.2.7

T.L.C.:

T.L.C.: of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows in visible light two spots at Rf. 0.17 and 0.27 (both light brown). Under U.V. (366 nm) five fluorescent zones appear at Rf. 0.17, 0.27, 0.36, 0.57 and 0.80 (all blue). On exposure to Iodine vapour eight spots appear at Rf. 0.05, 0.11, 0.15, 0.24, 0.33, 0.57, 0.73 and 0.80 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and after heating the plate for ten minutes at 105°C five spots appear at Rf. 0.13, 0.18, 0.25, 0.37 and 0.59 (all violet). , Aappendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential Oil
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Asab (Nervine Tonic), Mushtahi (Appetizer), Daf-e-Taffun (Antiseptic), Munaffis-e-Balgham Expectorant)
THERAPEUTIC USES	**:**	Zof-e-Asab (Neurasthenia), Zof-e-Ishteha (Anorexia), Sual (Cough), Amraz-e-Meda (Gastric Diseases)
DOSE	**:**	1-3 g
IMPORTANT FORMULATIONS	**:**	Jawarish Ood Shireen, Jawarish Ood Tursh, J awarish Jalinoos, Khamira Abresham Hakim Arshad Wala

PALAS PAPRA
(Seed)

The drug Palaspapra consists of dried seed of *Butea monosperma* (Lam.) Kuntze Syn. *B. frondosa* Koen. ex Roxb. (Fam.- Papilionaceae), a medium sized tree with a somewhat crooked trunk, 12 to 15 m high with irregular branches. Commonly found throughout the greater part of the India upto about 915 m altitude.

OTHER NAMES:

Urdu	:	Dhak (Tesu)
Bengali	:	Palash Gachha
English	:	Bengal Kinotree
Gujarati	:	Kesudo, Khakharo
Hindi	:	Dhak, Palash
Kannada	:	Muttuga
Malayalam	:	Palashu
Marathi	:	Palash
Punjabi	:	Dhak, Palash, Tesoo, Kesoo
Sanskrit	:	Palasha
Tamil	:	Purashu
Telugu	:	Moduga mada

DESCRIPTION:

Macroscopic: Seed flat, kidney-shaped, 2.5 to 4 cm long, 1 to 3 cm wide, dark reddish-brown, thin, glossy. Hilum clear, situated near middle of concave edge ‘of seed. Odour, faint; taste, slightly acrid and bitter.

Microscopic: Shows a wide zone of testa, consisting of a layer of palisade cells, a row of bearer cells and many layers of parenchymatous cells; palisade cells compactly arranged, columnar shaped and covered with thick cuticle, followed by a single row of bearer cells; parenchymatous layers consisting of many rows of cells, filled with reddish-brown contents; a number of vascular bundles occur in a row, in middle region of parenchymatous zone; cotyledons consists of a single layered epidermis, composed of square to oval cells, covered with cuticle; mesophyll cells bear hyaline walls, oval to irregular shaped with small intercellular spaces; simple, oval to round, starch grains with concentric striations, and centric hilum, compound grains having 2 to 4 components measuring 8 to 16 ì in dia., present in cotyledons.

Powder: Cream or grey; shows fragments of testa, bearer cells, numerous simple oval to round starch grains with concentric striations and a centric hilum, and also compound starch grains having 2 to 4 components, measuring 8 to 16 ì in diameter.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 7 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 9 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 25 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows under U.V. light (366 nm) three fluorescent at Rf. 0.41, 0.49 to 0.65 (elongated and light blue) and 0.91 (blue). On exposure to Iodine vapour six spots appear at Rf. 0.04, 0.19, 0.28, 0.41, 0.49 to 0.65 (elongated) and 0.91 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for about ten minutes at 110°C six spots appear at Rf. 0.04, 0.19, 0.28, 0.41, elongated spot (0.49-0.65) and 0.91 (all violet). On spraying with Dragendorff reagent followed by 5% Methanolic- Sulphuric acid reagent three spots appear at Rf. 0.41, 0.49 to 0.65 (elongated) and 0.91 (all light orange). , Aappendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Fixed Oil, Enzymes and small quantities of Resins and Alkaloids.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mohallil (Anti-inflammatory), Musakkin (Sedative), Mudirr-e-Baul (Diuretic), Qatil-e-Deedan-e-Ama (Vermicidal)
THERAPEUTIC USES	**:**	Waj-ul-Masana (Cystalgia), Waram-e-Masana (Cystitis), Usr-ul-Baul (Dysuria), Deedan-e-Ama (Intestinal Worms)
DOSE	**:**	3 g

IMPORTANT FORMULATIONS : Habb-e-Deedan, Sufoof Sailan-ur-Reham

POST-E-ANJEER DASHTI

(Stem Bark)

The drug Post-e-Anjeer Dashti consists of dried pieces of the stem bark of *Ficus hispida* Linn. f. (Fam. - Moraceae); a small or medium sized tree found wild more or less throughout India.

OTHER NAMES:

Urdu	:	Post-e-Shaq-e-Anjeer Dashti
Arabic	:	Teen-e-Barri
Persian	:	Anjeer-e-Dashti
Hindi	:	Daduri, Gobla
Bengali	:	Kakoudambura
Gujarati	:	Janglianjir
Karnad	:	Adaviatti
Malayam	:	Vedeumde
Punjabi	:	Phagwada
Sanskrit	:	Kakadumbura
Tamil	:	Peyatti, Sonath
Telugu	:	Bodamamidi

DESCRIPTION:

Macroscopic : Patches of bark grey, outer surface rough due to horizontal lenticels, inner surface dull white, soft; fractutr hard, surface smooth; tasre bitter odour in distinct

Microscopic : T.S. Bark shows cork, cork cambium, secondary cortex and secondary phloem; cork 8-10 seriate, cells tangentially elongated, stratified, contained tannins; cork cambium crushed; secondary cortex parenchymatous, cells globular with intercellular spaces; cells contain dark pigment and rosettes calcium oxalate crystals; single or groups of 4-5 stone cells are situated in the secondary cortex; unarticulated latex vessels are also found in the secondary cortex; phloem contains sieve tubes , companion cells, phloem parenchyma and fibres

Powder characters: Brownish, free floating on the surface of water, shows stone cells, fibres and sphaeroraphides.

IDENTITY PURITY AND STRENGTH

Foreign Matter	:	Not more than 2, Appendix 2.2.2.
Total Ash	:	Not more than 13 percent, Appendix 2.2.3
Acid insoluble Ash	:	Not more than 5 percent, Appendix 2.2.4
Water soluble Ash	:	Not more than 5 percent, Appendix 2.2.5

T.L.C.:

TLC of the Petroleum ether extract on silica gel "G" plate using toluene: chloroform: Acetic acid (70:20:10) mobile phase shows five spots, Rf values0.25, 0.61, 0.64, 0.67 and 0.96 on spraying the plate with D- Phosphoric acid, Water (1:1) and heating for 10 minutes at 105°C. Aappendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Chebulinic and chebulagic acid and chebupentol
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mukhrrish (Pruritic), Mohammir (Rubefacient)
THERAPEUTIC USES	**:**	Quba (Ring worm), Bars (Leucod ermaVitiligo), Kalaf (Freckle)
DOSE	**:**	4- 6 g
IMPORTANT FORMULATIONS	**:**	Safoof-e-Bars

RAAL
(Resinous Exudate)

The drug Raal consists of resinous exudate of *Shorea robusta* (family: Dipterocarpaceae), a large, evergreen tree, upto 30 m high with a cylindrical bole, indigenous to the evergreen forests of the Western Ghats from North Kanara to Kerala and also extensively planted as an avenue tree in Karnataka; resinous exudate is obtained by making semicircular incisions on the stem through the cork cambium up to the surface of sapwood.

OTHER NAMES:

Urdu	:	Sandaras, Raal
Bengali	:	Shakgachha, Chandras
English	:	White Damar tree, India Cop tree
Gujarati	:	Chandras
Hindi	:	Sandras, Safed Damar
Kannada	:	Rala
Malayalam	:	Payin
Marathi	:	Raal
Oriya	:	Sava
Sanskrit	:	Ajakarna
Tamil	:	Kungiliyam, Vellai Kuntarakam, Vellai Kundarakam
Telugu	:	Tellaguggilarnu, Telladamaramu

DESCRIPTION:

Macroscopic: Rough, irregular, solid, brittle masses, breaking into angular pieces, upto 1.5 cm thick, light-yellow to pale yellow in colour; odour fragrant; tasteless.

Microscopic: Slightly soluble in alcohol in which it forms ajelly-like mass; insoluble in etroleum ether (40°C-60°C), forming white precipitate; insoluble in carbon-disulphide but yields jelly-like mass, dissolves entirely and gives a dense red colour with concentrated sulphuric acid; dissolves mostly in chloroform giving white or milky solution; (Sal resin dissolves almost entirely in petroleum ether forming a pale cream solution and also dissolves entirely in carbon-disulphide).

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total Ash	:	Not more than 0.1 percent, Appendix 2.2.3.
Acid-insoluble ash	:	Negligible, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 60 percent, Appendix 2.2.6.

T.L.C.:

T.L.C.: of alcoholic extract on Silica gel 'G' using Benzene: Methanol (95:5) shows under UV (366 nm) three fluorescent spots at Rf. 0.04, 0.28 and 0.93 (all blue). On exposure to Iodine vapour seven spots appear at Rf. 0.04, 0.28, 0.48, 0.65, 0.76, 0.85 and 0.93 (all yellow). On spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate for ten minutes at 110°C seven spots appear at Rf. 0.04, 0.28, 0.48, 0.65, 0.76, 0.85 and 0.93 (all violet). , Aappendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Resins.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Qabiz (Constipative), Daf-e-Taffun (Antiseptic), Mohallil-e-waram (Anti-inflammatory) Munaffis-e-Balgham (Expectorant), Mudammil (Cicatrizant)
THERAPEUTIC USES	**:**	Sual-e-Muzmin (Chronic Bronchitis), Is-hal (Diarrhoea), Zaheer (Dysentery), Damameel (Boils), Jiryan-e-Mani (Spermatrrhoea), Sil (Pthisis), Diq (Tuberculosis) Waj-ul-Mafasil (Joint Pain)
DOSE	**:**	1-3 g
IMPORTANT FORMULATIONS	**:**	Habb-e-Raal, Marham-e-Raal, Marham-e-Basaliqoon, Marham-e-Gulabi

REESH-E-BARGAD
(Aerial Root)

The drug Reesh-e-Bargad consists of dried aerial Roots of *Ficus bengalensis* Linn. (Fam. Moraceae), a very large tree with spreading branches. It occurs throughout the country, and also planted on road sides and in gardens.

OTHER NAMES:

Urdu	:	Reesh-e-Bargad
Bengali	:	Bar, Bot
English	:	Banyan Tree
Gujarati	:	Vad Vadavai
Hindi	:	Baragada jata, Valajatta
Kannada	:	Alada Chirugu
Malayalam	:	Peralveru
Marathi	:	Vada Paranika
Oriya	:	Bara gachha
Punjabi	:	Bardajattu
Sanskrit	:	Vata
Tamil	:	Alamvizhuthu
Telugu	:	Peddamatti, Marri Udalu

DESCRIPTION:

Macroscopic: Drug occurs in cut pieces, 4 to 8 cm long, 0.1 to 1.2 cm thick, cylindrical, unbranched or branched; rough due to longitudinal and transverse cracks and transverse rows of lenticels. External surface grey; cut surface reddish-brown; fracture fibrous in bark portion and tough and short in wood portion.

Microscopic: Aerial root shows cork consisting of 4 to 6 or more rows of narrow, tangentially elongated cells; secondary cortex consisting of a zone of 4 or 5 rows of stone cells, followed by wide zone of thin-walled parenchymatous cells, filled with reddish-brown contents. A number of large groups of stone cells, oval to elliptical, elongated, thick walled, with wide lumen and clear pit canals found scattered throughout secondary cortex. Secondary phloem a wide zone consisting of sieve tubes, phloem fibres and phloem parenchyma, traversed by phloem rays; phloem fibres numerous, arranged in tangential bands alternating with sieve elements. Secondary xylem very wide consisting of pitted xylem vessels, fibres and xylem parenchyma. All elements being lignified; vessels single or in groups, xylem parenchyma numerous, xylem fibres numerous, thick walled with blunt tips and wide lumen; xylem rays numerous, uni to tetraseriate.

Powder: Reddish-brown; shows oval to elliptical, elongated, thick-walled stone cells with wide lumen and clear pit canals; fibres, thick-walled with blunt tips and wide lumen; xylem vessels showing pitted thickening.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 7 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 3 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 4 percent, Appendix 2.2.7

T.L.C.:

T.L.C of alcoholic extract on Silica gel 'G' using Toluene: Ethyl acetate (7:3) shows under U.V. (366 nm) three fluorescent zones at Rf. 0.34 (sky blue), 0.63 (sky blue) and 0.78 (blue). On spraying with 10% Methanolic-Sulphuric acid regent and on heating the plate for about ten minute at 105°C three spots appear at Rf. 0.63 (grey), 0.78 (brownish grey) and 0.96 (brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Tripene, friedelin, â-sitosterol
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Qabiz (Constipative), Mughalliz-e-Mani (Inspissant to Semen)
THERAPEUTIC USES	**:**	Is-hal (Diarrhoea), Jaryan (Spermatorrhoea), Zaheer (Dysentery), Zof-e-Bah (Sexual Debillity)
DOSE	**:**	2-5 g

SALAB MISRI
(Tuberous Root)

The drug Salab Misri (Khusiyat-us-Salab) consists of the dried tuberous roots of *Orchis latifolia* Linn. (Fam. Orchidaceae). It is found growing in Western temperate Himalayas, from Kashmir to Nepal and West Tibet, between 3,000-4,000 m.

OTHER NAMES:

Urdu	:	Satooreen
Arabic	:	Khusiyat-us-Salab
Persian	:	Khaya Rooba
Hindi	:	Kuka Mamdi

DESCRIPTION:

Macroscopic: Roots yellowish brown, 1.00-2.50 cm. long, 0.5-2.0 cm in diameter, round to ovoid, longitudinally wrinkled; fracture hard; odour characteristic and taste mucilaginous.

Microscopic : T.S of root shows epidermis , cortex and stele; epidermis single layered, cells brick shaped, covered by a thin cuticle; cortex multiseriate, parenchymatous with large intercellular spaces, some cells filled with mucilage; vascular bundles numerous , scattered in the pith, conjoint, collateral and open; xylem contains vessels with annular and spiral thickenings.

Powder characters: Powder brownish yellow, freely floating on the surface of water, contains vessels with annular and spiral thickenings. Patches with parenchymatous with large intercellular spaces, some cells filled with mucilage.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than 6 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 2 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 3 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 10 percent, Appendix 2.2.7

T.L.C.:

TLC of the alcoholic extract on silica gel 'G' plate using n-hexane: ethyl acetate (9:1) mobile phase shows under UV (366 nm) four fluorescent spots (blue) Rf values 0.15, 0.36, 0.50 and 0.60; on spraying with 5% methanolic sulphuric acid reagent and heating the plate for 10 minutes at 105°C four spots appear at Rf values 0.15, 0.36, 0.50 and 0.60. Appendix 2.2.10

CHEMICAL CONSTITUENTS	:	Phenols and glycosides
-TEMPERAMENT	**:**	Hot and Moist
ACTION	**:**	Muharrik (Stimulant)
THERAPEUTIC USES	**:**	Zof –e-Bah (Sexual Debility),Tashannuj (Convulsion) Mughallliz-e-Mani (Inspissant to Semen).
DOSE	**:**	9 g
IMPORTANT FORMULATIONS	**:**	Habb-e-Jalinoos, Habb-e-Mumsik, Majoon Chob Chini, Laboob Kabir

SAMAGH-E-ARABI
(Gum)

The drug Samagh-e-Arabi consists of dried gum obtained from *Acacia nilotica*(L.) Willd. ex Del. (Fam. – Mimosaccae); an evergreen tree found in India, Sri Lanka, Sudan, Morocco and Africa. It occurs through out India.

OTHER NAMES:

Urdu	:	Babul
Arabic	:	Umm-e-Ghilan
Persian	:	Mughilan
Bengali	:	Bable, Babul, Babur, Kikar
English	:	Black Babool, Indian gum, Arabic tree, Gum Acacia
Gujarati	:	Babalia, Baval
Hindi	:	Babla, Babul, Babur, Kikar
Malayalam	:	Karuvelakam, Karuvelam
Marathi	:	Babhula, Kalikikar, Kikar, Ramakali, Ramkanti
Punjabi	:	Babla, Babul, Babur, Kikar
Sanskrit	:	Babbula, babula, Pitaka, Pitapushpa, Svarnapushpa, Varvara
Tamil	:	Karuvel, Karuvelam, vel
Telugu	:	Barbaramu, Nallatumma, Tumma

DESCRIPTION:

Macroscopic: The gum tears, creamy brown to red in colour, irregular with varying size, tears glassy and marked with minute fissures, brittle in nature, broken tears with angular fragments. No characteristic odour, bland mucilaginous.

Powder gum white to yellowish brown in colour; it is soluble in water, 0.1N HCl, aqueous 1N NaOH and 50% H_2SO_4; where as it is insoluble in alcohol and alcoholic 1N NaOH.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 02 percent, Appendix 2.2.2
Total ash	:	Not more than 2.5 percent, Appendix 2.2.3
Acid insoluble ash	:	Not more than 0.1 percent, Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 0.5 percent, Appendix 2.2.6
Loss in weight on drying at 105°C	:	Not more than 14 percent, Appendix 2.2.9

T. L.C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the

chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.94 (Dark blue), 0.78, 0.58 and 0.52 (Violet).

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm). It shows major spot at R_f 0.95, 0.76 (Light blue) and 0.12 (Yellowish green). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spot at R_f 0.95, 0.59, 0.45 (Violet) and 0.12 (Brown). Appendix 2.2.10

CHEMICAL CONSTITUENTS **:** â - sitosterol, á – amyrin, quercetin, gallic acid, cyanidin chloride, dopamine-3-O-glucoside, prosapogenin A and lupeol.

TEMPERAMENT **:** Cold and Dry

ACTION **:** Habis (Astringent), Mulattif (Demulcent), Muqawwi-e-Bah (Aphrodisiac) and Munaffis-e-Balgham (Expectorant)

THERAPEUTIC USES **:** Ishal (Diarrhoea) and Zaheer (Dysentery)

DOSE : 1-3 g

IMPORTANENT FOURMULATIONS: Laooq-e-Hulba, Laooq-e-Behinana, Laooq-e-Badam and Majoone-Aarad Khurma.

SAMAGH-E-DHAK
(Gum)

The drug Samagh-e-Dhak consists of dried gum exuding from natural cracks and artificial incisions in the stem bark of *Butea monosperma* (Lam.) Kuntze Syn. *B. frondosa* Koen. ex Roxb. (Fam. Papilionaceae), a medium sized tree with somewhat crooked trunk, 12 to 15 m high with irregular branches commonly found throughout greater parts of the country upto 915 m altitude.

OTHER NAMES:

Urdu	:	Dhak (Tesu)
Assamese	:	Palash
Bengali	:	Palas
English	:	Flame of forest, Bengal Kino
Gujarati	:	Khakharo, Kesudo
Hindi	:	Dhak, Palas, Teshu
Kannada	:	Mattuga, Muthuga
Malayalam	:	Palashu
Marathi	:	Palas
Punjabi	:	Dhak
Sanskrit	:	Palasha
Tamil	:	Purasu
Telugu	:	Moduga, Modugu

DESCRIPTION:

Macroscopic : Drug occurs in pieces, flattish, brittle, perfectly transparent, smooth and shining, ruby red to dark brown; buff coloured pieces of bark attached; no peculiar odour; taste astringent.

Microscopic : Angular fragments, opaque in transmitted light; shows plants debris form thickwalled rectangular cork and polygonal, thin-walled cortex, and phloem parenchymatous cells, depved from the parent plant. Identification: It dissolves partially in boiling alcohol and freely, almost completely, in cold water, forming. a milky solution; when treated with 5% aqueous solution of perchloride of iron (Ferric chloride) it gives greyish-green precipitate and with lead acetate gives white precipitate. Fluorescence: Colour of 5% aqueous solution light brown in day light and greyish green in U.V. light (366 nm); colour of 5% alcoholic solution reddish-brown in daylight, and light green in U.V. light (366 nm).

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 3 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 69 percent, Appendix 2.2.6

Water-soluble extractive : Not less than 63 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid: Water (5:1:4) shows in visible light six spots at Rf. 0.30, 0.42, 0.67, 0.74, 0.84 and 0.92 (all yellowish brown). Under U.V. (366 nm) three blue fluorescent zones are visible at Rf. 0.74, 0.84 and 0.92. On exposure to Iodine vapour eight spots appear at Rf. 0.07, 0.23, 0.30, 0.42, 0.67, 0.74, 0.84 and 0.92 (all yellow). On spraying with 5% MethanolicSulphuric acid reagent and heating the plate for about ten minutes at 110°C eight spots appear at Rf. 0.07, 0.23, 0.30, 0.42, 0.67, 0.74, 0.84 and 0.92 (all violet). , Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Anthocyanins and Tannins.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Qabiz (Constipative), Habis (Retentive),
THERAPEUTIC USES	**:**	Is-hal (Diarrhoea), Kasrat-e-Tams (Polymenorrhagia), Bawaseer Damiya (Bleeding Piles), Nafsud-Dam (Haemoptysis), Qai-ud-Dam (Hematemesis)
DOSE	**:**	0.5 to 1.5 g
IMPORTANT FORMULATIONS	:	Qurs-e-Kaknaj, Qurs-e-Bawaseer, Majoon Teewaj, Habb-e-Deedan, Sufoof Sailan-ur-Reham

SAMANDER PHAL
(Fruit)

The drug Samander phal consists of dried fruit of *Barringtonia acutangula* (Linn.) Gaertn. (Fam. Lecythidaceae); a moderate sized, evergreen, glabrous tree, fairly common in sub Himalayan tracts Bihar, Orissa, Bengal, Assam, Central and South India. It prefers moist situations but is not found in mangrove forests.

OTHER NAMES:

Urdu	:	Hijjal
Assamese	:	Hindole
Bengali	:	Hijjala
Gujarati	:	Samudraphala
Hindi	:	Hijjala, Samudraphala
Kannada	:	Nerruganegalu, Holegonvamara
Malayalam	:	Manjal Kadamba, Manjal Kadam
Marathi	:	Samudraphala
Oriya	:	Kijolo
Punjabi	:	Samuderphal
Sanskrit	:	Dhatriphala
Tamil	:	Samudrapullarni, Samutrapalam
Telegu	:	Kanapu, Kadaps

DESCRIPTION:

Macroscopic : Fruit - A drupe, yellowish-brown, oblong, 2.5-3.3 by 1.00 - 1.3 cm, bluntly quadrangular, broadest in the middle, slightly narrow and truncate at each end, fibrous; no characteristic odour and taste. Seed - Single, 2-2.5 by 0.7-1.0 cm, wrinkled longitudinally, dark brown in colour.

Microscopic : Fruit - Epicarp shows several layers of tangentially elongated, thin-walled parenchymatous cells; mesocarp composed of several layers of loosely arranged, thinwalled parenchymatous cells with intercellular spaces forming cavities; vascular bundles found cattered in this region; endocarp not distinct; a few rosette crystals of calcium oxalate in the form of irregular cluster, present in this region. Seed - Shows two integuments, endosperm and embryo; outer integument consists of single layered epidermis, 2-3 layered sclereids and 7-10 layered closely arranged cells; vascular bundles also found scattered in this region; inner integument consists of 1-2 layered, crushed cells; endosperm and embryo consists of isodiametric cells having small intercellular spaces; abundant, irregular starch grains, single and compound found scattered in cells of endosperm simple, 4-27 ì in dia., round to oval. Powder - Whitish-purple; shows a few parenchymatous, brown coloured cells rosettes of calcium oxalate crystals in cluster numerous simple and compound starch grains, measuring 4-27 ì in diameter, a few xylem vessels with spiral thickening.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 Percent, Appendix 2.2.2
Total ash	:	Not more than 7 Percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 Percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 5 Percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 9 Percent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under U.V. (366 nm) three fluorescent zones at Rf. 0.56 (blue), 0.81 (black) and 0.94 (blue). On exposure to Iodine vapour eight spots appear at Rf. 0.41, 0.48, 0.56, 0.61, 0.81, 0.87, 0.92 and 0.96 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate at 105°C for ten minutes eight spots appear at Rf. 0.14 (brown), 0.41, 0.48, 0.56, 0.61 (all violet), 0.87 (blue), 0.92 (violet) and 0.96 (brown). , Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Saponins and Sapogenins.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Jali (Detergent), Mahallil (Resolvent), Jazib-e-Rutubat-e-Dimagh (Absorb fluids from the brain), Munaffis-e-Balgham (Expectorant) Kasir-e-Riyah (Carminative)
THERAPEUTIC USES	**:**	Jiryan (Spermatorrhoea), Shaqeeqa (Migrain), Sara (Epilepsy), Bayaz-ul-chashm (Opacity), Aqrab Gaqeedgi (Scorpion Sting)
DOSE	**:**	Half to One fruit
IMPORTANT FORMULATIONS	**:**	Habb-e-Hindi Chashm

SANDAL SAFAID
(Heart Wood)

The drug Sandal safaid consists of dried heart wood of *Santalum album* Linn. (Fam. Santalaceae), an evergreen, semi parasitic tree (in early phese), 8 to 18 m in height and 2 to 4 m in girth, widely distributed in the country, commonly found in the dry regions of peninsular India especially in Karnataka and Tamil Nadu. It is cultivated for its aromatic wood and oil.

OTHER NAMES:

Urdu	:	Sandal Safed
Assamese	:	Sandale Avyaj
Bengali	:	Chandan
English	:	Sandal Wood
Gujarati	:	Sukhad
Hindi	:	Chandan, Safed Chandan
Kannada	:	Shrigandhamara, Shrigandha, Chand
Malayalam	:	Chandanam
Marathi	:	Chandan
Punjabi	:	Chandan
Sanskrit	:	Chandana
Tamil	:	Chandana maram, Sandanam, Ingam
Telugu	:	Gandhapu Chekka, Manchi Gandham, Tella Chandanam, Sriga

DESCRIPTION:

Macroscopic : Yellowish-brown to pale-reddish orange, heavy, dense, hard but split easily; transversely smooth surface shows alternating light and dark concentric zones with numerous pores, traversed by very fine medullary rays; odour, persistently aromatic; taste, slightly bitter.

Microscopic : Wood consists of tracheids, vessels, fibres, xylem parenchyma and traversed by medullary rays; vessels numerous scattered singly throughout the region, rarely two together, barrel-shaped, pitted and with transverse to oblique pen oration with tail-like projections, at one or both ends; a few tracheids elongated with tapering ends and possess bordered pits on their walls; fibres many, lignified with pointed tips; xylem parenchyma mostly rectangular, a few of them contain prismatic crystals of calcium oxalate; xylem rays numerous, run straight, uni to triseriate, mostly biseriate, thickwalled, radially elongated having golden yellow to brownish contents and contain a few prismatic crystals of calcium oxalate.

Powder : Light-brown and aromatic; shows pitted vessels with tails, isolated or associated with fibres, fragments of fibres, square to rectangular-shaped parenchyma, prismatic crystals of calcium oxalate, and numerous oil globules.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 Percent, Appendix 2.2.2
Total ash	:	Not more than 1 Percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.2 Percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 8 Percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 1 Percent, Appendix 2.2.7
Volatile Oil	:	Not less than 1.5 Percent, Appendix 2.2.10

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (93 : 7) shows on exposure to Iodine vapour six spots at Rf 0.05, 0.10, 0.27 (all yellowish brown), 0.60 (dark brown), 0.82 and 0.91 (both yellowish brown). On spraying with Anisaldehyde-Sulphuric acid reagent- and heating the plate for about ten minutes at 1I0·C six spots appear at Rf. 0.05, 0.10, 0.27 (all bluish violet), 0.60 (violet). 0.82 and 0.91 (both bluish violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Volatile oil (á- and â- Santalol)
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Mufarreh (Exhilarant), Musakkin (Sedative), Daf-e-Taffun (Antiseptic), Munaffis-e-Balgham (Expectorant)
THERAPEUTIC USES	**:**	Khafqan (Palpitation), Hirqat-ul-Baul (Burning Micturation), Suzak (Gonorrhoea), Sual (Cough),
DOSE	**:**	3-6 g
IMPORTANT FORMULATIONS	**:**	Dawa-ul-Misk Motadil, Khamira Abresham Hakim Arshad Wala, Khamira Marwarid, Mufarreh Barid

SATAWAR
(Tuberous Root)

The drug Satawar consists of tuberous roots of *Asparagus recemosus* Willd. (Fam. Liliaceae), an ascending, spinous much branched, perennial climber found throughout the country.

OTHER NAMES:

Urdu	:	Satawari
Assamese	:	Satmull
Bengali	:	Satamuli, Satmuli, Shatamuli
English	:	Asparagus
Gujarati	:	Satavari
Hindi	:	Satavar, Satamul
Kannada	:	Ashadi poeru, Halavu Bau, Narayani, Makkala
Malayalam	:	Satavari Kizhangu
Marathi	:	Shatavari
Punjabi	:	Satavar
Sanskrit	:	Shatavari
Tamil	:	Shimai-Shadvari, Nilichedi Kishangu
Telugu	:	Sima-Shatawari (Dry Root), Pippipichara, Pilliteegalu (Fresh Root)

DESCRIPTION:

Macroscopic : Root tuberous, 10 to 30 cm in length and 0.1 to 0.5 cm thick, tapering at both ends with longitudinal wrinkles; colour cream; taste, sweetish.

Microscopic : Shows an outer layer of piliferous cells, ruptured at places, composed of small, thin-walled, rectangular asymetrical cells, a number of cells elongated to form unicellular root hairs; cortex comprises of 25 to 29 layers, distinct in two zones, outer and inner cortex; outer cortex consists of 6 or 7 layers, compactly arranged, irregular to polygonal, thick walled, lignified cells; inner cortex comprise of 21 to 23 layers, oval to polygonal, thin-walled, tangentially elongated cells with intercellular spaces; stone cells, either singly or in groups, form a discontinuous to continuous ring in the upper part of this region; raphides of calcium oxalate also present in this region; 2 or 3 layers of stone cells encirle the endodermis; endodermis composed of thin-walled parenchymatous cells; pericycle present below endodermis; stele ex arch and radial in position; xylem consist of vessels, tracheids and parenchyma; xylem vessels have pitted thickening; phloem patches consists of usual element; pith composed of circular to oval parenchymatous cells, a few cells slightly lignified.

Powder : Yellowish-cream; fragments of lignified, thick-walled cells; vessels with simple pits, pieces of raphides, numerous, lignified, rectangular elongated' stone cells having clear triations with wide as well as narrow lumen and groups of parenchyma.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2.
Total Ash	:	Not more than 5 percent, Appendix 2.2.3.
Acid-insoluble ash	:	Not more than 0.5 percent, Appendix 2.2.4.
Alcohol-soluble extractive	:	Not less than 10 percent, Appendix 2.2.6.
Water-soluble extractive	:	Not less than 45 percent, Appendix 2.2.7.

T.L.C.:

T.L.C. of alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid: Water (4:1:5) v/v shows on exposure to Iodine vapour three spots at Rf. 0.07, 0.50 and 0.67 (all yellow). On spraying with 5% methanolic sulphuric acid reagent and heating the plate for ten minutes at 110°C four spots appear at Rf. 0.07 (black), 0.41 (grey), 0.50 and 0.83 (both brownish yellow). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Sugar, Glycosides, Saponin and Sitosterol.
TEMPERAMENT	**:**	Cold and Moist
ACTION	**:**	Mugharri (Agglutinant), Muqawwi-e-Bah (Aphrcdisiac), Mughalliz-e-Mani (Inspissant to Semen), Muqawwi-e-Rahem (Uterine Tonic)
THERAPEUTIC USES	**:**	Is-hal (Diarrhoea), Jiryan (Spermatorrhoea), Kasrat-e-Ehtelam (Execessive Nocturnal emission), Sailan-ur-Rahem (Leucorrhoea), Surat-e-Inzal (Premature ejaculation), Zaheer (Dysentery)
DOSE	**:**	5-7 g
IMPORTANT FORMULATIONS	**:**	Sufoof-e-Sailan-ur-Reham, Sufoof-e-Salab

SHAHTARA
(Whole Plant)

The drug Shahara consists of dried whole plant of *Fumaria parviflora* Lam. (Fam. Fumaraceae), a pale green, branched, annual, diffuse herb, about 60 cm high, distributed as a weed of cultivated fields over the greater parts of the country, and also commonly growing on road sides during cold season.

OTHER NAMES:

Urdu	:	Parpata
Assamese	:	Shahtaraj
Bengali	:	Vanshulpha, Bansulpha
Gujarati	:	Pittapapada, Pitpapado, Pittapapado
Hindi	:	Pittapapada, Dhamgajra, Pittapapara
Kannada	:	Kallu Sabbasige, Parpatu, Chaturasigide
Marathi	:	Pittapapada, Shatara, Parpat
Punjabi	:	Shahtara, Pittapapara
Sanskrit	:	Parpataka
Tamil	:	Tura, Tusa
Telugu	:	Parpatakamu

DESCRIPTION:

Macroscopic : Root - Buff or cream coloured, branched, about 3 mm thick, cylindrical; taste, bitter.Stem - Light green, smooth, diffused, hollow, about 2 to 4 mm thick; taste, bitter and slightly acrid. Leaf - Compound, pinnatifid, 5 to 7 cm long, divided into narrow segments; segments 5 mm long and about 1 mm broad, linear or oblong, more or less glaucous, acute or subacute; petiole, very thin, 2.5 to 4.0 cm long; taste, bitter. Flower - Racemes with 10 to 15 flowers, peduncle upto 3 mm, pedicels about 2 mm, flowers about 7 mm long, bract much longer than the pedicels; sepals 2, white, minute, about 0.5 mm long, triangular ovate, acuminate; corolla in 2 whorls with very small 4 petals, each about 4 mm long; inner petals with a purple or green tip; outer petals with narrow spur, without purple spots stamens 3+3 , staminal sheath subulate above, about 4 mm long, stigma 2 lipped. Fruit - Capsule, 2 mm long and slightly broader, subrotund, obovate, obtuse or subtruncate, obscurely apiculate, rugose when dry; nutlets globose, upto 2 mm long, single seeded.

Microscopic : Root - Root shows single layered epidermis, followed by 5 or 6 layers of cortex consisting of thin-walled, rectangular, parenchymatous cells, outer I or 2 layers irregular and brown in colour; endodermis not distinct; secondary phloem very narrow and consisting of 2 or 3 rows with usual elements; central core shows a wide zone of xylem and consists of usual elements; vessels mostly solitary having reticulate and spiral thickening, medullary ray less developed and mostly uniseriate; fibres moderately long, thick-walled, having narrow lumen and blunt tips. Stem - Stem shows a pentagonal outline, having prominent angles composed of collenchymatous cells; epidermis

single layered of thin-walled, oblong, rectangular cells, covered with thin cuticle; cortex narrow, composed of 2 to 4 layers of chlorenchymatous cells endodermis not distinct; vascular bundles collateral, 5 or 6 arranged in a ring; each vascular bundle capped by a group of sclerenchymatous cells; phloem consists of usual elements; xylem consists of vessels, tracheids, fibres and xylem parenchyma; vessels much elongated, having reticulate, annular or spiral thickening or simple pits; xylem fibres narrow elongated with pointed ends having a few simple pits; centre either hollow or occupied by narrow pith consisting of thinwalled, parenchymatous cells. Leaf Petiole - V -shaped outline; single layer epidermis consisting of thin-walled, parenchymatous cells followed by ground tissue composed of thick-walled round, oval or polygonal, parenchymatous cells, outer cells smaller than inner; collenchymatous cells present at corners; three vascular bundle scattered in ground tissue, one central and two in wings; vascular bundle consists of phloem and xylem, phloem capped with fibrous sheath, lower epidermis single layered. Lamina - Shows single layer epidermis' on either side, consistmg of thin-walled, rectangular, oval-shaped, parenchymatous cells; mesophyll composed of oval to polygonal thin-walled parenchymatous cells, filled with green pigment and not differentiated into palisade and spongy parenchyma; vascular bundles scattered throughout the mesophyll; stomata anomocytic, present on both surfaces.

Powder : Light greenish-brown; shows fragments of parenchyma; tracheids, fibres, and vessels having simple pits and spiral thickenings; anomocytic stomata and wavy walled epidermal cells in surface view.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 30 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 10 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 7 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 29 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Chloroform: Methanol (8:2) shows under visible light one spot at Rf. 0.93 (green). Under U.V. (366 nm) eight fluorescent zones are visible at Rf. 0.07 (blue), 0.13 (blue), 0.29 (light blue), 0.50 (light pink), 0.60 (light yellow), 0.67 (yellow), 0.79 (blue) and 0.93 pink). On exposure to Iodine vapour twelve spots appear at Rf. 0.07, 0.10, 0.13, 0.19, 0.29, 0.50, 0.60,0.67,0.74,0.79,0.86 and 0.93 (all yellow). On spraying with Dragendorff reagent followed by 5% Methanolic-Sulphuric acid reagent one spot appears at Rf. 0.07 (orange). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Alkaloids, Tannins, Sugars and salt of Potassium
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Musaffi-e-Dam (Blood Purifier), Mudirr-e-Baul (Diuretic), Mulaiyin (Laxative)

THERAPEUTIC USES	**:**	Aatishak (Syphilis) Busoor (Acne), Suzak (Gonorrhoca), Humma (Fever)
DOSE	**:**	5-7 g
IMPORTANT FORMULATIONS	**:**	Itrifal Shahatra, Arq–e-Shahtra

SHAHM-E-HANZAL
(Fruit Pulp)

The drug Shahm-e-Hanzal consists of dried fruit pulp of *Citrullus colocynthis* Schard. Synonym *Cucumis colocynthis* Linn. (Fam.Cucurbitaceae). A perennial. trailing. scarbrid herb with prostrate or climbing stem. The plant occurs wild particularly in the North –west, Central and South India and on the sea shores of the coromandal coast, Gujarat, and other parts of western India.

OTHER NAMES:

Urdu	:	Sham-e-Hanzal
Arabic	:	Shahm-e-Hanzal
Persian	:	Maghz-e-Khurpuza-e-Talkh,
Bengali	:	Indrayan Makhai
English	:	Bitter Apple, Bitter Cucumber, Colocynth
Gujarati	:	Indark, Indrana, Indravan, Indravaanan
Hindi	:	Ghorumba, Indrayan, Makal
Kannada	:	Pavamekkekayi
Malayalam	:	Peuykommutti
Marathi	:	Indraphal, Indravana, Indrauyan, Kaduvrindavana
Punjabi	:	Hanzal
Sanskrit	:	Atmaraksh Brihavaruni,K Brihatphala, Chitrala
Tamil	:	Payekkumutti, Peyttumatti, Verikkummatti
Telugu	:	Chittipapara, Etipuchchha, Paparabudama

DESCRIPTION:

Macroscopic : The fruit of *Citrullus colocynthis* Schard are spherical or globose, the skin is smooth and striped with dark green and white. They are 8-10 cm in diameter and contain a soft pulp with very bitter taste but odourless.

Macroscopic : The epicarp of fruit consists of polygonal to oval, thin walled parenchymatous cells which are thickened on the outer and anticlinal walls only; this thickening appears like inverted U. The stomata are large circular, ranumculaceous or anomocytic type and surrounded by smaller and thin walled cells. Within the epicarpic region the vascular strands occur here and there. The upper layer consists of oval to round and small collenchymatous cells. Beneath this there are several layers of sclerenchmatous cells. The cells adjacent to the collenchyma are small polygonal, with thick pitted walls having small lumen and futher inwards cells become larger and thinner walled, the parenchymatous cells of pulp are large, oval to rounded, thin walled with faint, finely pitted areas.

CHEMICAL CONSTITUENTS : Glycosides, steroids, phenolic compound/tannins, resins, saponins, proteins, flavonoids, carbohydrates, iron, magnesium, calcium and potassium, hentriacontane, phytosterole, fatty acids.

IDENTITY, PURITYAND STRANGTH:

Foreign organic matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 19 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 7 percent, , Appendix 2.2.4
Water-soluble ash	:	Not more than 9 percent , Appendix 2.2.6
Alcohol soluble extractives	:	Not less than 10 percent , Appendix 2.2.6
Water soluble extractives	:	Not less than 26 percent , Appendix 2.2.7

T.L.C.:

T.L.C of the pet. ether (60-80) extract on Silica gel 'G' plate using Benzene: ehthyl acetate (9:1) shows seven major spots on exposure with Iodine vapour at Rf. 0.91, 0.81, 0.72, 0.62, 0.54, 0.43 and 0.10. Appendix 2.2.10

TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mushil (Purgative), Mohallil-e-Waram (Anti inflammatory), Musqit-e-Hamal (Abortifacient)
THERAPEUTIC USES	**:**	Istisqa (Dropsy), Yarqan (Jaundice),Waram-e-Kabid (Hepatitis), Usr-e-Viladat (Dystocia)
DOSE	**:**	125-250 mg
IMPORTANT FORMULATIONS	**:**	Habb-e-Falij, Habb-e-Ghariqoon, Habb-e-Iyarij, Habb-e-Suranjan, Iyarij-e-Loghaziya

TAMAR HINDI
(Fruit Pulp)

The drug Tamar Hindi consists of fruit pulp without seeds of *Tamarindus indica* Linn. (Fam. Caesalpinaceae), a moderate sized to large evergreen tree upto 24 m in height and 7 m in girth, cultivated throughout India, or self sown in waste places and in forest lands; also planted as avenue trees

OTHER NAMES:

Urdu	:	Imli
Assamese	:	Tamar, Teteli
Bengali	:	Tetula, Tentul, Ambli
English	:	Tamarind Tree
Gujarati	:	Anvali
Hindi	:	Imli
Kannada	:	Hunisemale
Malayalam	:	Puli, Amlam
Marathi	:	Chinch
Oriya	:	Koina, Omlika
Punjabi	:	Imli, Amli
Sanskrit	:	Amlika
Tamil	:	Puli, Aanvilam
Telugu	:	Chint, Chinta

DESCRIPTION:

Macroscopic : Fruit pulp occurs as a reddish-brown, moist, sticky mass, in whichy ellowishbrown fibres are readily seen; odour, pleasant; taste, sweetish and acidic.

Microscopic : Fruit pulp consists of thin-walled, elongated to polygonal, parenchymatous cells of considerable size, traversed by a number of long fibro-vascular bundles and having a very few small starch granules, and numerous prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 4 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 0.5 percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 46 percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 59 percent, Appendix 2.2.7

T.L.C.:

T.L.C. of alcoholic extract on Silica Gel 'G' using n-Butanol: Acetic acid: Water (5:1:4) shows under U.V. (366 nm) two spots at Rf. 0.27 and 0.46 (both yellowish blue). On exposure to Iodine vapour five spots appear at Rf. 0.27, 0.46, 0.57, 0.65 and 0.87 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate at 105°C for ten minutes five spots appear at Rf. 0.46, 0.57. 0.65, 0.71 and 0.87 (all grey) Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Inorganic acids, Sugars, Saponin and bitter Principle-Tamarindinca
TEMPERAMENT	**:**	Hot and Moist
ACTION	**:**	Mus-hil-e-Safra (Bile Purgative), Musakkin (Sedative)
THERAPEUTIC USES	**:**	Atash-e-Mufrit (Polydipsia), Ghasiyan (Nausea), Qai (Vomiting)
DOSE	**:**	4-10 g
IMPORTANT FORMULATIONS	**:**	Jawarish-e-Tamar Hindi, Sikanjabeen Tamar Hindi

TAMBOL
(Leaf)

The drug Tambol consists of leaf of *Piper betle* Linn. (Fam. Piperaceae); a dioecious, perennial creeper, climbing by many short adventitious rootlets. It is widely cultivated in hotter and damper parts of India.

OTHER NAMES:

Urdu	:	Pan
Assamese	:	Pan
Bengali	:	Pan
English	:	Betel Leaf
Gujarati	:	Pan
Hindi	:	Pan
Kannad	:	Veelyadele Ele
Malayalam	:	Vettila
Marathi	:	Pan, Nagvel, Vidyachepan
Punjabi	:	Pan
Sanskrit	:	Tambuli
Tamil	:	Vettilai
Telugu	:	Tamalapaku, Tamulapaku

DESCRIPTION:

Macroscopic : Leaf varies greatly in size, 7.5-20.0 cm, ovate cordate, entire, glabrous, apex acuminate to acute, lamina membranous, upper surface deep green and lower surface lighter in colour, primary or sub-primary nerves usually 7, sometimes 5-9; odour, aromatic; taste, tightly pungent.

Microscopic : Petiole - Single layered epidermis composed of cubical to slightly tangentially elongated cells covered with thick, striated cuticle; epidermal cells elongate to form uni to bicellular, occasionally multicellular hairs; epidermis followed by a discontinuous collenchymatous zone in the form of arcs, and a multilayered parenchymatous zone; vascular bundles arranged in the arcs, phloem surrounds xylem; vascular bundles usually of two sizes larger ones 7 in number and smaller ones 2 in number.

Midrib - Epidermis single layered, composed of colourless cubical cells, covered with wavy cuticle; epidermis followed by 2-3 layers of irregular colourless cells of hypodermis and a few layers of collenchyma, towards lower side collenchyma multilayered; vascular bundle shows phloem surrounding xylem; lower epidermis single layered and covered with wavy cuticle; some epidermal cells elongate to form uni to bicellular-occasionally multicellular hairs.

Lamina - Shows dorsi ventral structure; epidermis single layered, tangentially elongated,

covered with thick striated cuticle on both sides; hypodermis 2-3 layered; having chloroplasts, occasionally with secretory cells; mesophyll differentiated into palisade and spongy parenchyma; palisade single layered; spongy parenchyma 3-4 layered composed of irregularly round cells, a few secretory cells also present in this region; hairs a few uni to bicellular, occasionally multicellular, all being uniseriate present on both surfaces; stomata anisocytic palisade ratio not over 4; stomatal index 11-13; vein islet number 2-7.

Powder: Greyish-green; shows polygonal epidermal cells in surface view, simple pitted vessels and a few uni to tricellular hairs, anisocytic type of stomata, palisade and spongy parenchyma cells and simple pitted vessel.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 Percent, Appendix 2.2.2
Total ash	:	Not more than 17 Percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 3 Percent, Appendix 2.2.4
Alcohol-soluble extractive	:	Not less than 10 Percent, Appendix 2.2.6
Water-soluble extractive	:	Not less than 20 Percent, Appendix 2.2.7

T.L.C.:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) shows in visible light five spots at Rf. 0.11 (green), 0.18 (light green), 0.23 (yellow), 0.34 (grey) and 0.61 (greyish green). Under U.V. (366 nm) seven fluorescent zones are visible at Rf. 0.11, 0.16 (both pink), 0.23 (brown), 0.34 (pink), 0.43 (pink), 0.61 (pink) and 0.76 (grey). On exposure to Iodine vapour seven spots appear at Rf. 0.08, 0.11. 0.18. 0.34, 0.61, 0.76 and 0.88 (all yellow). On spraying with Vanillin- Sulphuric acid reagent and heating the plate for ten minutes at 110°C seven spots appear at Rf. 0.08, 0.11, 0.18 (all the three greenish grey), 0.34 (grey), 0.43 (violet), 0.61 and 0.76 (both light green). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential Oil, Amino Acids, Vitamins and Enzymes.
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Dimagh (Brain tonic), Muqawwi-e-Hafiza (Memory tonic), Mufarreh (Exhilarant), Mukhrij-e-Loab-e-Dahan (Sialogague), Muwallid-e-Dam (Haemotogenic), Muqawwi-e-Qalb (Cardiac tonic), Muqawwi-e-Lissa (Gumtonic), Muqawwi-e-Asnan (Strengthening Teeth), **M**ukhrij -e-Balgham (Expectorant), Mohallil-e-Waram (Anti-inflammatory), Jali (Detergent)
THERAPEUTIC USES	**:**	Sual (Cough), Zeeq-un-Nafas (Asthma), Bohot-us-

		Saut (Hoarseness of Voice) Waj-ul-Asnan (Odontalgia), Amraz-e-Qalb (Cardiac Diseases), Faqr-ud-Dam (Anaemia)
DOSE	**:**	1 leaf daily
IMPORTANT FORMULATIONS	**:**	Habb-e-Pan, Habb-e-Kattha, Jawarish-e- Utraj, Arq-e-Juzam, Habb-e-Nishat

TUKHM-E-BALANGO
(Seed)

The drug Tukhm-e-Balango consists of dried seeds of *Lallemantia royleana* Benth. Synonym *Nepeta cordifolia* Boiss, *Darcocephalum royleanum* Benth. (Fam. Lamiaceae). The plant grows in Punjab plains and hills.

OTHER NAMES:

Urdu	:	Balango
Arabic	:	Habb-ul- Balango
Persian	:	Tukkm-e- Balango
English	:	Salvia seed
Hindi	:	Ghareikashamalu
Kashmiri	:	Tukhmibalangu
Marathi	:	Tukhmi Balangu
Punjabi	:	Ghareikashamalu, Tukhmbalangu, Tukhmmalanga

DESCRIPTION:

Macroscopic : The seeds are small, black oblong smooth 3 angled. The narrow end of the seed is amblicus which is marked by acharacteristic white spot. One side of the seed is comparatively broader than the other two sides and also slightly curved. Embryo smallwhite and consists of two plano-convex cotyledons. Seeds when soaked in water show opaque tenacious grey mucilaginous coating. The seeds are non-oily and tasteless.

Macroscopic : Cross section of seed is more or less triangular in outline and externally it is densely covered with long mucilagenous hairs. In longitudinal section it is oblong elliptic. Seed coat is very thin and reduced to just few layers of cells. The outer epidemis comprises single layer of radially elongated compactly arranged tubular cells which show bar like thickening on the inner tangential wall. The mesophyll of the seed coat comprises a few layers of crushed mass but this region is rich in blackish pigments. The endosperm forms a thin layer outside the embryo which is made up of parenchymatous cells. The embryo is also parenchymatous but the cells lying at the inner surface of the cotyledons are elongated while others are almost iso-diametric. The cells of cotyledons are rich in aleurone grains and oil droplets.

CHEMICAL CONSTITUENTS : Steroids, phenols, glycosides, carbohydrates, aluminium iron, magnesium and potassium.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent Appendix 2.2.2

Total ash	:	Not more than7 percent Appendix 2.2.3
Acid insoluble ash	:	Not more than 3.00 percent Appendix 2.2.4
Water-soluble ash	:	Not more than 3 percent, Appendix 2.2.5
Alcohol soluble extractives	:	Not less than 3 percent Appendix 2.2.6
Water soluble extractives	:	Not less than 5.76 percent Appendix 2.2.7

T.L.C.:

T.L.C of the petroleum ether (60-80) extract on Silica gel 'G' plate using benzene: chloroform (4:1) shows two major spots on exposure to Iodine vapours at Rf. 0.47 and 0.13. Appendix 2.2.10

TEMPERAMENT	**:**	Cold and moist
ACTION	**:**	Musakkin (Sedative), Mudirr-e-Baul (Diuretic), Muqawwi-e-Qalb (Cardiac tonic), Daf-e-Zaheer (Anti dysentric)
THERAPEUTIC USES	**:**	Zof-e-Qalb (Weakness of Heart), Dard-e-Shikam (Stomachache), Zaheer (Dysentery), Atash-e-Mufrat (Polydipsia)
DOSE	**:**	3-5 g
IMPORTANT FORMULATIONS	**:**	Khameera-e-Gaozaban Ambari Jawahirwala, Khameera-e- Gaozaban-Sada

TUKHM-E- GANDANA
(Seed)

The drug Tukhm-e-Gandana consists of seeds of *Asphodelus tenuifolius* Cav. (Family – Liliaceae) an annual herb with leaves 15-30 cm by 2.5-3mm. in size , terete,sheathing at the base : flowers white; capsules globose,erect, the valves deeply wrinkled. The plant is found throughout India in fields.

OTHER NAMES:

Urdu	:	Gandana
Arabic	:	Ashrash; Khunashi
Persian	:	Ashrash; Khunashi
Gujrati	:	Dungro
Hindi	:	Bokat; Pyajh
Punjabi	:	Bringharby; Piazi

DESCRIPTION:

Macroscopic : The seeds are black in colour 2.2-2.8 mm long and 1-1.6 mm wide; sharply trigonous in shape. The surface is glabrous, showing 3-4 dorsal ridges and many laterally elongated pits. The seeds have a slight peculiar odour but have no taste.

Microscopic : The cross section of the seed shows a triangular outline. The seed coat is multilayered; the outer epidermal layer covered with thick cuticle, dark coloured, uneven giving a papillose appearance. The cells of the inner layer also have thickened walls. The endosperm is large consisting of parenchyma of various shapes and sizes; the cells containing aleurone grains and oil globules. The embryo is erect, centrally placed consisting of parenchyma; the cotyledondry cells, having minute aleurone grains.

Powder : The powder is black in appearance somewhat sticky with no particular odour and taste. Microscopic examination after clearing the powder in chloral hydrate shows a lot of cuticularised tissue of the testa; endospermic parenchyma filled with aleurone grains and small oil globules. Small vascular elements are present occasionally.

IDENTITY, PURITY AND STRENGTHI:

Foreign matter	:	Not more than 2 percent , Appendix 2.2.2
Total ash	:	Not more than 5 percent , Appendix 2.2.3
Acid insoluble ash	:	Not more than 1 percent , Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 6 percent , Appendix 2.2.6
Water soluble extractives	:	Not less than 2 percent , Appendix 2.2.7
Loss in weight on drying at 105°C	:	Not more than 4 percent , Appendix 2.2.9

T.L.C.:

T.L.C of pet. ether (60-80°) extract of the drug on precoated aluminium plate of silica gel 60 F-254, using Toluene-Ethyl acetate (9:1) as a solvent system shows ten spots with Rf 0.24 (light orange), 0.27 (Pinkish purple), 0.30, 0.35, 0.44, 0.46, 0.53, 0.59, 0.77 and 0.95 (all Light orange) on spraying with 2% ethanolic sulphuric acid and heating the plate for about ten minutes at 110^0 C in oven. (Appendix 2.2.10)

CHEMICAL CONSTITUENTS	**:**	Steroids, fatty acid, phenolics, carbohydrate, proteins
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Muqawwi-e-Aam (General tonic), Muqawwi-e-Bah (Aphrodosiac), Hazim (Digestive), Daf-e-Kirm-e-Ama (Anthelmintic), Mushtahi (Appetizer), Mudirr-e-Baul (Diuretic), Mohallil (Resolvent).
THERAPEUTIC USE	**:**	Bawaseer Damiya (Bleeding Piles), Zaheer (Dysentery), Ishal (Diarrhoea), Zof-e-Istheha (Anorexia)
DOSE	**:**	1 to 7 g
IMPORTANT FORMULATIONS	**:**	Jawarish Fanjnosh, Sufoof-e-Maqliasa, Habb-e-Khabs-ul-Hadeed.

TUKHM-E-GAZAR
(Fruit)

The drug Tukhm-e-Gajar consists of fruits of *Daucus carota* Linn. (Fam. – Apiaceae), a hispid much branched biennial plant indigenous to Kashmir & Western Himalayas, now largely cultivated through out India.

OTHER NAMES:

Urdu	:	Gazar
Arabic	:	Jazar
Persian	:	Gazar, Zardaka
Bengali	:	Gagar
English	:	Carrot
Gujarati	:	Gajar
Hindi	:	Gagar, Gajar, Gajra
Kannad	:	Gajjari, Manjal
Kashmir	:	Mormuj, Bulmuj
Marathi	:	Gazara
Punjabi	:	Gajar
Sanskrit	:	Shikha-mulam, Shekhamulama, Garijard
Tamil	:	Gajjara-Kilangu
Telugu	:	Gajjaragedda, Pita-Kande

DESCRIPTION:

Macroscopic: Fruits elliptic, terate, somewhat dorsally compressed, ridges all prominent, all ridges or the secondary only bristly, lateral primary ridges little developed, seeds terate, dorsally sub compressed inner face plane, no characteristic odour and taste.

Microscopic: T. S. of mericarp (fruit splits into two halves, each termed mericarp) shows flat surface called the commissural surface and a rounded surface called the dorsal surface; four conspicuous secondary ridges and three inconspicuous primary ridges on the dorsal surface; two primary ridges on the commissural surface; vittae almost triangular in outline, four in the dorsal and two in the commissural surface, each below the secondary ridges (vittae run from the base of the mericarp to the apex near the stylopodium and its surface lined with parenchymatous epithelial cells; vittae elongated usually tapering at both end, multicellular, uniseriate filled with yellowish cellular contents and oil globules.

Epicarp consisting of single layer of tangentially elongated epidermal cells with thin cuticle with numerous unicellular trichomes; mesocarp consisting of 5 to 8 layers of thin walled, tangentially elongated parenchymatous cells; vascular bundle present below the primary ridges; vittae solitary, large almost triangular present in the secondary ridges; groups of thick walled sclerenchyamtous cells

present between the epicarp and vittae in the secondary ridges; endocarp consisting of inner epidermal cells lignified, elongated and about five parallel rows; endosperm consisting of large polygonal thick walled cells containing numerous oil globules and other reserve food materials almost globular in shape, numerous micro rosette of calcium oxalate crystals; thick walled pigmented (cells) layer present above the endosperm.

Powder: Cream; unicellular trichomes upto 300µ; pigmented cells in surface view; vittae; mesocarpic parenchyma cells; endosperm cells in surface view with globular reserve food materials and micro rosette crystals; sclerenchyma fibres length upto 350µ and breadth 20µ; tracheids with pitted and spiral thickenings.

IDENTITY, PURITY AND STRENGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than 7 percent, Appendix 2.2.3
Acid insoluble ash	:	Not more than 0.2 percent, Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 22 percent, Appendix 2.2.6
Water soluble extractives	:	Not less than 12 percent, Appendix 2.2.7
Loss in weight on drying at 105°C	:	Not more than 8 percent, Appendix 2.2.9

T.L.C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml and carry out the thin layer chromatography. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene : Ethyl acetate (5 : 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (254nm). It shows major spot at R_f 0.15 (Brownish). Under 366 nm it shows major spot at R_f 0.75 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spot at R_f 0.95 (Dark blue), 0.75 (Violet), 0.59 (Blue) and 0.15 (Greenish violet).

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm). It shows major spot at R_f 0.72 (Light blue) and 0.46 (Reddish). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spot at R_f 0.78, 0.64, 0.57 (Dark blue), 0.46 and 0.14 (Violet). , Appendix 2.2.10

CHEMICAL CONSTITUENTS : n–alkanes, â–sitosterol, glucose, amino acids, lipids, glycerides, á–thugene, á–pinene, camphene, â–pinene, â–phellandrene, â–bisabolene, â–selinene, limonene, geranyl acetate, terpenyl acetate, bornyl acetate, choline, carotol and daucol.

TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Mudirr-e-Baul (Diuretic) Mudirr-e-Haiz (Emmenagogue), Musakkin (Sedative), Mufattit-e-Hasat (Lithotriptic), Muqawwi-e-Bah (Aphrodisiac), Moharrik (Stimulant) and Kasir-e-Riyah (Carminative)
THERAPEUTIC USES	**:**	Ehtehas-e-Baul (Anuria) Ehtehas-e-Haiz (Amenorrhoea)**,** Zof-e**-**Bah (Sexual debility), Waj-us-Sadr (Chest pain), Sozish-e-Baul (Burning Micturation) , Hasat-e-Kulya wa Masana (Renal and Vesical Calculus)
DOSE	:	4 – 9 g
IMPORTANT FORMULATIONS	**:**	Jawarish Zarooni Sada, Habb-e- Khabs-ul-Hadeed, Sharabat Mudir, Luboob-e-Kabir, Luboob-e-Barid

TUKHM-E-HALYUN
(Seed)

The drug Tukhm-e-Halyun consists of seeds of *Asparagus officinalis* Linn. (Fam. - Liliaceae); a hardy perennial plant with an erect branching stem, indigenous to Europe and Asia. In India it is grown in the Northern regions.

OTHER NAMES:

Urdu	:	Halyun, Tukhm-i-halyun
Arabic	:	Ood-ul-Jabah
Persian	:	Marchobah
Bengali	:	Hikua-Naagdana
English	:	Garden asparagus, Common asparagus
Hindi	:	Halyun, Nakdown, Vilayati Karua, Marchuba, Malgiyah
Sanskrit	:	Dripi, Satavari

DESCRIPTION:

Macroscopic : Fruit berry; seeds black to brown colour, round, 2 to 4mm diameter, seed coat thin and very hard, endosperm abundant and very hard; no characteristic odour and taste.

Microscopic : T. S. of seed consisting of outer seed coat consisting of 5 to 7 layers of smaller, thick walled, parenchymatous cells filled with dark brown contents followed by a single layer of elongated thin walled parenchyma cells; endosperm present consisting of thick walled cellulosic, polygonal parenchyma cells filled with aleurone grains; plasmodesmata is seen in the endosperm very clearly i.e., the protoplast of the endosperm cells communicate through the cell walls by means of very fine protoplasmic threads.

Powder : Black to dark brown; parenchyma cells of the seed coat in surface view filled with brown contents; elongated thin wall parenchyma cells in surface view; endosperm cells with very thick walled cellulosic polygonal parenchyma cells filled with aleurone grains and endosperm cells with plasmodesmata.

IDENTITY, PURITY AND STRANGTH:

Foreign matter	:	Not more than 2 percent, Appendix 2.2.2
Total ash	:	Not more than5 percent, Appendix 2.2.3
Acid insoluble ash	:	Not more than 0.2 percent, Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 2 percent, Appendix 2.2.6
Water soluble extractives	:	Not less than 12 percent, Appendix 2.2.7
Loss in weight on drying at 105°C	:	Not more than 10 percent, Appendix 2.2.9

T. L. C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5 : 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spot at R_f 0.70 (Sky blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.91 (Dark blue), 0.86 (Greenish blue) and 0.48 (Pinkish blue).

Apply the alcohol extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5: 1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spots at R_f 0.70 (Sky blue) and 0.32 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.91, 0.87, 0.55 and 0.14 (Violet). Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Polysaccharides and -á–manosidase
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Moharrik (Stimulant), Mulattif (Demulcent), Muhallil, (Resolvent), Muqawwi (Tonic), Muqawwi-e-Bah (Aphrodisiac), Mudirr-e-Baul (Diuretic), Mudirr-e-Haiz (Emmenagogue), Musakkin (Sedative), Mufatteh Sudad (Deobstruent)
THERAPEUTIC USES	**:**	Nafkh-e-Shikam (Flatulence in Stomach), Hassat-e-Kulya wa Masana (Renal and Vesical Calculus), Istisqa (Dropsy), Waj-ul-Mafasil (Rheumatism), Niqras (Gout), Ehtebaas-e-Haiz (Ammenorrhoea), Zof-e-Bah (Sexual Debility).
DOSE	**:**	3 - 5 g
IMPORTANT FORMULATIONS	**:**	Majoon-e-Baladur, Luboob-e-Kabeer, Luboob-e-Sagheer

TUKHM-E-KASNI
(Seed)

The drug consists of seeds (cypsella) of *Cichorium intybus* Linn. (Fam. Asteraceae). It grows wild in Punjab, North West Frontier Province and Hyderabad (Dakhin). It is cultivated in Nadiad, Broach and Amalsad in Maharashtra.

OTHER NAMES:

Urdu	:	Kasni
Arabic	:	Bazr-ul-heudyba
Persian	:	Tukhm-e-kasmi
Bengali	:	Kasmi, Hinduba
English	:	Endive, Wild Chicory, Chicory
Gujarati	:	Kasmi, Himduba
Hindi	:	Kasmi
Marathi	:	Kachami
Punjabi	:	Hand, Gul, Suchal
Tamil	:	Karini Virai
Telugu	:	Kasini Vittulu

Macroscopic : The seeds brown wedge shaped, gradually tapering towards base, 0.20-0.30 cm. long, 0.10-0.15 cm wide, roughly 4-5 ridged; pappus present, sepals five, thin, membranous; seed one, anatropous on basal placentation;dicotyledonous, exalbuminous; taste and odour indistinct.

Microscopic : T.S. of seed shows testa and cotyledons; testa has uniseriate parenchymatous etidermis, sclerenchymatous hypodermis and crushed inner epidermis; epidermis of cotyledons uniserite, parenchymatous; mesophyll composed of columnar cells filled with chloroplasts and oil globules.

Powder characters : Powder light brown, fine, freely floating on the surface of water; taste and odour indistinct; contains malpighian cells, columnar cells filled with chloroplasts and oil globules. Chemical constituents Marker chemicals:

IDENTITY, PURITYAND STRANGTH:

Foreign matter	:	Not more than 2 percent , Appendix 2.2.2
Total ash	:	Not more than 7 percent , Appendix 2.2.3
Acid insoluble ash	:	Not more than 5 percent , Appendix 2.2.4
Water soluble ash	:	Not more than 4 percent , Appendix 2.2.6
Alcohol soluble extractives	:	Not less than 5 percent, Appendix 2.2.6
Water soluble extractives	:	Not less than 9 percent, Appendix 2.2.7
Loss in weight on drying at 105°C	:	Not more than 7 percent, Appendix 2.2.9

T.L.C.:

Chloroform extract on silica gel "G" plate using chloroform: methanol (5:1) as mobile phase shows six spots at Rf 0.08, 0.20, 0.30 0.41, 0.48,and 0.68 on exposing the plate to Iodine vapours. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Glycoside, lactucin, intybin
TEMPERAMENT	**:**	Cold and Dry
ACTION	**:**	Mufatteh Sudad (Deobstruent), Mudirr-e-Baul (Diuretic)
THERAPEUTIC USES	**:**	Yarqan Suddi (Obstructive Jaundice), Waram-e-Kabid (Hepatitis), Istisqa (Dropsy), Hummiyat-e-Muzmina (Chronic Fevers)
DOSE	**:**	5-7 g
IMPORTANT FORMULATIONS	**:**	Arq-e-Kasni, Sharbat-e-Kasni

TUKHM-E-SOYA
(Fruit)

The drug Tukhm-e-Soya consists of dried fruits of *Anethum sowa* Kurz Syn. *Peucedanum graveolens* Linn. (Fam. Apiaceae). The herb grows wild as well as cultivated throughout India.

OTHER NAMES:

Urdu	:	Sowa
Arabic	:	Shibt
Persian	:	Shibt, Shood
Bengali	:	Sowa, Shulupa
English	:	Dill seeds, Sowa
Gujarati	:	Suah, Surva
Hindi	:	Sowa, Soya
Malayalam	:	Chatukuppa
Punjabi	:	Soya
Sanskrit	:	Satapushpi
Tamil	:	Satakuppi, Shatakupivirai
Telugu	:	Sompa

DESCRIPTION:

Macroscopic: Dried fruits consist of separate but usually united mericarps with attached pedicels measuring 2-4mm long. Each mericarp is more or less oval about 3 mm long and 1-2mm broad. The fruits are mostly pressed dorsally. Dorsal ridges are not so much prominent as the ventral ones being extended into two membranous wings. Taste and odour of the drug is aromatic.

Macroscopic: The transverse section of the mericarp is almost plano-convex in out line. The epicarp composed of a layer of colourless cells with uniform well marked cuticular striations; in surface view the cells are variable in shape with thin slightly sinuous walls. Epicarp is followed by a thicker zone of mesocarp consisting of six vittae, sclereids and parenchymatous tissue. The innermost layer of mesocarp composed of yellowish brown cells with thick wall which are usually lignified and have a few indistinct pits, in surface view the cells are polygonal to rectangular in out line. This layer is frequently found adherent to the endocarp. The endocarp consists of a layer of thin walled lignified cells which elongated in surface view and arranged in groups with the long axes of adjacent groups with the long axis of adjacent groups approximately parallel to each other.Many of the cells have sinuous outline. Endosperm, testa and fibrovascular tissue are of typical umbelliferous type.

IDENTITY, PURITYAND STRANGTH:

Foreign matter	:	Not more than 2 percent , Appendix 2.2.2
Total ash	:	Not more than 9 percent , Appendix 2.2.3

Acid insoluble ash	:	Not more than 2 percent , Appendix 2.2.4
Alcohol soluble extractives	:	Not less than 6 percent , Appendix 2.2.6
Water soluble extractives	:	Not less than 9 percent , Appendix 2.2.7

TLC

T.L.C of pet. ether (60-80) extract on Silica gel 'G' plate using Petroleum ether;Ethyl acetate (24:1) shows six major spots on exposure to Iodine vapours at Rf. 0.95, 0.83, 0.71, 0.30, 0.15 and 0.04. Appendix 2.2.10

CHEMICAL CONSTITUENTS : Essental, á, â – pinene

TEMPERAMENT : Hot and dry

ACTION : Hazim (Digestive), Kasir-e-Riyah (Carminative), Mudirr-e-Baul (Diuretic), Musakkin-e-Alam (Analgesic), Mufattit-e-Hasat (Lithotriptic), Muqawwi-e-Jigar (Liver tonic), Mudammil (Cicatrizant)

THERAPEUTIC USES : Nafkh-e-Shikam (Ftlulence in the stomach), Zaheer (Dysentery), Ehtebas-e-Baul (Aruria), Hasat-e-Kuliya wa Masana (Renal & vesicular calculus), Zof-e-Kabid (Weakness of liver).

DOSE : 1-2 g

IMPORTANT FORMULATIONS : Jawarish-e-Fanjnosh, Sufoof-e-Moya

USHBA
(Root)

The durg Ushba consists of dried roots of *Smilax aristolociaefolia* Mill. (Fam. – Liliaceae); the plant a climber; native to America, Mexico and the West Indies.

OTHER NAMES:

Urdu	:	Ushba
Persian	:	Ushba Maghrabi
English	:	Mexican Sarsaparilla

DESCRIPTION:

Macroscopic: The roots are narrow, very long, cylindrical, upto 6mm in diameter and usually found in commerce folded and bound into bundles; pieces of rhizome present which is much thicker; external surface of the root varies from grayish to reddish brown, longitudinally wrinkled, occasionally smooth, fracture short or tough and fibrous in the central cylinder, taste sweetish and acrid and odourless.

Microscopic: T. S. of root shows circular in outline; epidermis consisting of single layer of compact polygonal tabular parenchyma cells with thin cuticle; a tubular unicellular root hairs present; cortex consisting of thin walled polygonal parenchymatous cells with intercellular spaces; raphides, starch grains and brown colour contents present in the cortex; exodermis consisting of a few layers of cortex immediately below the epidermis with thickened outer and lateral walls; endodermis consisting of single layer of barrel shaped compact cells with thickened inner and lateral walls; pericycle consisting of several layers of thick walled sclerenchymatous cells; pericycle is interrupted by the presence of xylem and phloem elements; the vascular tissue consisting of radially arranged alternating strands of xylem and phloem, vascular tissue polyarch and each xylem exarch; pith consisting of thick walled parenchymatous cells filled with starch grains.

Powder: Light brown to dark grayish brown; starch garins numerous single and compound, individual grains spherical or biconcave or spherical tetrahedral upto 22µ; raphides upto 70µ; exodermal and endodermal cells with reddish yellow porous walls with uneven or irregular thickening upto 370µ; pericyclic fibres with thick wall and narrow lumen of length 1200µ and breadth upto 40µ; tracheids with scalariform or reticulate thickening upto 120µ; very few spiral vessels upto 20µ, cortical parenchyma cells and thick walled pith parenchyma cells.

IDENTITY, PURITYAND STRANGTH:

Foreign matter	:	Not more than 2 percent , Appendix 2.2.2
Total ash	:	Not more than 6 percent , Appendix 2.2.3
Acid insoluble ash	:	Not more than 1 percent , Appendix 2.2.4

Alcohol soluble extractives : Not less than 7 percent , Appendix 2.2.6
Water soluble extractives : Not less than 31 percent , Appendix 2.2.7
Loss in weight on drying at 105°C : Not more than 10 percent , Appendix 2.2.9

T.L.C.:

Extract 2 g of sample with 20 ml of chloroform and alcohol under reflux on a water bath for 30 min. Filter and concentrate to 5 ml. Apply the chloroform extract on TLC plate. Develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spots at R_f 0.91 (Sky blue), 0.43 and 0.31 (Light blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.88, 0.40 and 0.12 (Light yellow).

Apply the alcohol extract on TLC plate and develop the plate to a distance of 8.5 cm using Toluene: Ethyl acetate (5:1.5) as mobile phase. After development allow the plate to dry in air and examine under UV (366nm), it shows major spots at R_f 0.89 (Sky blue), 0.75 (Reddish blue) and 0.28 (Greenish blue). Dip the plate in vanillin-sulphuric acid reagent followed by heating at 110° for about 10 min and observe under visible light. The plate shows major spots at R_f 0.89 (Yellow), 0.60 (Greenish yellow), 0.28 (Violet) and 0.12 (Yellow). Appendix 2.2.10

CHEMICAL CONSTITUENTS : Acetyl-parigenin, astilbin, â-sitosterol, dihydroquercetin, diosgenin, epsilon-sitosterol, eucryphin, ferulic acid, kaemferol, parillin, saponin, sarasaponin, smilagenin and stigmasterol.

TEMPERAMENT : Hot and Dry

ACTION : Daf-e-Atishak (Anti syphilis)

THERAPEUTIC USES : Suzak (Gonorrhoea), Atishak (Syphilis)

DOSE : 35 grains

IMPORTANT FORMULATIONS : Majoon-e-Ushba

ZAFRAN
(Style and Stigma)

The drug Zafran consists of dried style and stigma of *Crocus sativus* Linn. (Fam. Iridaceae). A small, bulbous, perennial, 15 to 25 cm high. It is cultivated by corms in the Kashmir valley, especially in the Pampor plateau, at about 1600 m.

OTHER NAMES:

Urdu	:	Zafran
Arabic	:	Kurkum
Persian	:	Zafarn
Assamese	:	Kumkum
Bengali	:	Zafran
English	:	Saffron
Gujarati	:	Keshar, Kesar
Hindi	:	Keshar, Keshara
Kannada	:	Kunkuma, Kesari
Malayalam	:	Kunkuma Puvu
Marathi	:	Keshar
Punjabi	:	Kesar, Keshar
Sanskrit	:	Kara, Ghuia, Kmra, Rakta
Tamil	:	Kungumapuvu
Telugu	:	Kunkuma Puvvu

DESCRIPTION:

Macroscopic: Yellowish style, broken or intact along with trifid stigma; stigma is dark red or reddish-brown, cornucopia shaped, with fimbriate margin, and about 25 mm long; broken style are very thin, upto about 10 mm ong; odour, strongly aromatic; taste, slightly bitter.

Microscopic: Stigma composed mostly of elongated, thin-walled, parenchyma cells containing colouring matter; at the upper end numerous cylindrical papillae or trichomes up to 150 microns long present; pollen grains, a few, spherical, nearly smooth, from 40 to 120 microns in diameter, occasionally germinated and exhibiting pollen tubes. Powder - Pale reddish-brown; aromatic, shows elongated, thin-walled, parenchymatous cells, unicellular trichomes, a few spherical, smooth, pollen grains measuring 40 to 120 ì in dia. and xylem vessels with annular and spiral thickenings.

IDENTITY, PURITYAND STRANGTH:

Identification: When sprinked on sulphuric acid, the stigmas turn blue immediately, gradually changing to purple and finally purplish red. ii. Stamens of safflower and florets of marigold should be absent; should be free from artificially dyed corn silk or fibres. Organic dyes: i. Digest about 0.1 g in 10 ml of water for 15 minutes with frequent shaking, filter and add 1 g of decolorising charcoal

to the filtrate; shake and allow to stand for 10 minutes; filter; the fitrate is colourless. ii. Macerate 10 mg in 5 ml of alcohol (95 per cent) or methanol; a distinct greenish

yellow colour is imparted to the liquid; with corresponding quantities of Kunkuma in ether or chloroform the solvents remain almost colourless; so also with xylene, benzene or carbon tetrachloride. Absence of Fixed oil or glycerin: Press between clear filter paper, the paper does not display translucent oily spots.

Foreign organic matter	:	Not more than 2 percent, Appendix 2.2.2
Total Ash	:	Not more than 8 percent, Appendix 2.2.3
Acid-insoluble ash	:	Not more than 1 percent, Appendix 2.2.4
Loss on drying at 100°C	:	Not more than 14 percent, Appendix 2.2.9

Assay: Weigh accurately 0.1 g in moderately fine powder and macerate at room temperature in 100 ml of water for 3 hours with frequent shaking. Filter immediately, adding sufficient water through the filter to make 100 ml. Dilute 10 ml of this filtrate, accurately measured, to 100 ml with water. Immediately compare the colour of this solution in Nessler tubes or in a colorimeter, with the colour of N/100 potassium dichromate. The color of the solution approximates that of the N/100 potassium dichromate, and the strength of the color is not less that of an equal depth in mm of the N /100 potassium dichromate.

T.L.C.:

T.L.C of the pet. ether (60-80) extract on Silica gel 'G' plate using pet. ether: benzene: chloroform (10:10:6) shows four major spots on spraying with 2% Methanolic-Sulphuric acid reagent and heating the plate for about ten minutes at 110°C at Rf. 0.96, 0.73, 0.46, and 0.30. Appendix 2.2.10

CHEMICAL CONSTITUENTS	**:**	Essential Oil, Bitter Glycoside, (Picrocrocin and Crocin)
TEMPERAMENT	**:**	Hot and Dry
ACTION	**:**	Jali (Detergent), Daf-e-Taffun (Antiseptic), Mohallil-e-Waram (Anti-inflammatory), Muqawwi-e-Qalb (Cardiac Tonic)
THERAPEUTIC USES	**:**	Amraz-e-Qalb (Cardiac Diseases), Nazla (Catarrh), Zukam (Coryza), Zof-e-Basarat (Asthenopia)
DOSE	**:**	25-50 mg
IMPORTANT FORMULATIONS	**:**	Dawa-ul-Kurkum, Dawa-ul-Misk Motadil Sada

APPENDICES

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APPENDIX – 1

APPARATUS FOR TESTS AND ASSAYS

1.1.1 Nessler Cylinders

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

1.1.2 Sieves

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

Sieves conform to the following specifications.:

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

150	106	7.4(5.2)
170	90	6.6(4.6)
200	75	6.1(4.1)
240	63	5.3(3.7)
300	53	4.8(3.4)
350	45	4.8(3.1)

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

1.1.3 Thermometers

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

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

1.1.4 Volumetric Glasswares

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

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

Volumetric Flask : I.S. 915-1975

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

One Mark Pipettes : I.S. 1117-1975								
Nominal Capacity, ml	1	2	5	10	20	25	50	100
Tolerance, ±ml	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.06

Graduated Pipettes : I.S. 4162-1967					
Nominal Capacity, ml	1	2	5	10	25
Subdivision, ml	0.01	0.02	0.05	0.10	0.2
Tolerance, ± ml	0.006	0.01	0.03	0.05	0.1

Burettes : I.S. 1997-1967				
Nominal capacity, ml	10	25	50	10
Subdivision, ml	0.05	0.05	0.1	0.1
Tolerance, ±ml	0.01	0.03	0.05	0.1

1.1.5 Weights and Balances

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

APPENDIX - 2

TESTING OF DRUGS

2.1. Systematic study of Crude Drugs

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

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

by clearing agents mostly by chloral-hydrate solution, before mounting on the slide.

The basic chemical nature of cell-wall of almost all the plants is cellulosic. However, lignin, suberin, cutin or mucilage are deposited on the cellulose. Cellulose gives blue colour with chlorozinc-iodine solution of with cuoxam (Copper-oxide-ammonia) reagent. Lignin present in the middle lamella and secondary cell-wall of many vessels, fibers and sclerieds gives red colour with phloroglucinol and concentrated hydrochloric acid. Suberin is present in cork and endodermis cells while cutin in the cuticle of leaf. Both are fatty in nature and when heated with Sudan Red-III give red colour.

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

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

2.1.1 Microscopical Methods of Examining Crude Vegetable Drugs

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

I Leaves, Herbs and Flowers

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

a) Entire and cut materials

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

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

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

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

(b) **Stem** - To examine stem material (without leaf) boil pieces in a solution of *caustic alkali* or in *nitric acid*. Remove the epidermis with a scalpel or a needle for examining the surface. For examining pressed specimen of stem, take separate tissue and press them with a scalpel on the slide.

b) Powder

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

II Fruits and Seeds

a) Entire materials

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

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

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

b) Powder

For examining the structure of the cells of the seed coat and the cells of the embryo take

a small amount of powder of the material on a slide in glycerol and cover it with a cover slip and examine.

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

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

2. Fixed Oil - For examining the presence of fixed oil, prepare a specimen in a solution of sudan III droplets of fixed oil are coloured orange pink. When examining objects containing small amount of fixed oil, prepare a specimen by slightly warming in chloral-hydrate solution, and when examining objects containing large amount of fixed oil then the powder is defatted and clarified as follows:

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

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

III Barks

a. Entire material

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

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

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

3. Tannin - Tannin is detected by treating with *ferric ammonium sulphate* solution (blue-

black or green black colour shows the presence of Tannin) or with *potassium-bi-chromate solution* (brown colour indicates the presence of Tannin).

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

b. Cut materials

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

c. Powder

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

IV Roots and Rhizomes

a. Entire materials

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

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

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

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

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

b. Cut material

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

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

C. Powder

Prepare several specimens of the powder on slides in *chloral hydrate solution* and perform the above mentioned standard tests for detection of starch, fixed oil, inulin, lignified elements, anthrquinone derivatives, tannins, mucilage, etc.

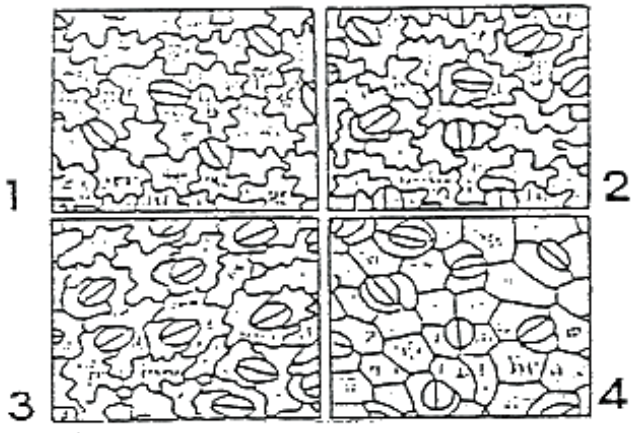
2.1.2 Types of Stomata

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

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

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

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



4. Paracytic (pareallel-celled) - Previously known as rubiaceous. The stoma has one each

side one or more subsidiary cells parallel to the long axis of the pore and guard cells.

Fig. 1. Various types of stomata

2.1.3 Determination of Stomatal Index

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

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

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

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

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

2.1.4 Determination of Palisade Ratio

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

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

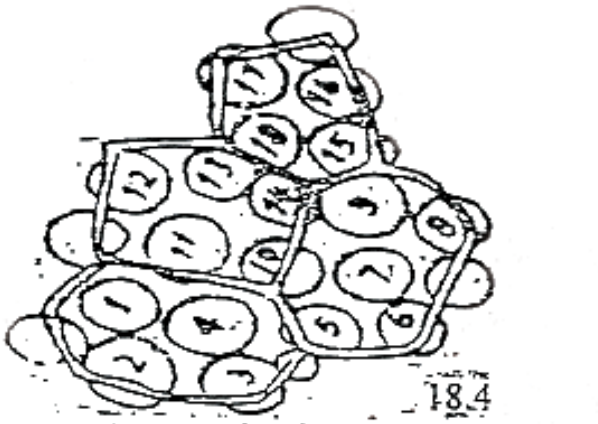


Fig. 2. Palisade ratio $\frac{18.4}{4} = 4.5$

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

Figure 2

2.1.5 Determination of vein-Islet Number

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

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

millimeters. For each sample of leaf make not fewer than three determinations and calculate the average number of vein-islets per square millimeter.

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

2.2 Determination of Quantitative Data of Vegetable Drugs

2.2.1 Sampling of Vegetable Drugs

Original Samples:

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

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

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

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

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

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

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

Test Sample

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

2.2.2 Foreign Matter and Determination of Foreign Matter

A. *Foreign Matter*

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

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

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

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

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

B. Determination of Foreign Matter

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

2.2.3 Determination of Total Ash

Incinerate about 2 to 3g accurately weighed of the ground drug in a tared platinum or silica dish at a temperature not exceeding 450°C until free from carbon, cool and weigh. If a carbon free

ash cannot be obtained in this way exhaust the charred mass with hot water, collect the residue on an ashless filter paper, incinerate the residue and filter paper, add the filtrate, evaporate to dryness, and ignite at a temperature not exceeding 450°C.

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

2.2.4 Determination of Acid-insoluble Ash

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

2.2.5 Determination of Water-soluble Ash

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

2.2.6 Determination of Alcohol-soluble extractive

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

2.2.7 Determination of Water-soluble extractive

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

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

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

reference to the air-dried drug.

2.2.9 Determination of Moisture Content (Loss on drying)

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

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

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

2.2.10 Thin Layer Chromatography

Preparation of chromatoplates

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

Method

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

Remove a narrow strip of the coating substance, about 5 mm wide, from the vertical sides

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

2.2.11 Determination of Sulphated Ash

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

2.2.12 Determination of Phenolics

Dissolve 5 gm of drug in water and filter. The filtrate is shaken with petroleum ether to remove greasy matter. It is precipitated with a saturated solution of lead acetate, digest for few minutes on water bath let the ppt. settle and filter. Dry the residue, then suspend it in alcohol and slightly warm on water bath and decompose by passing 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.

2.2.13 Determination of Volatile Oil

The determination of volatile oil in a drug is made by distilling the drug with a mixture of water and glycerin, collecting the distillate in a graduated tube in which the aqueous portion of the distillate is automatically separated and retuned to the distilling flask, and measuring the volume of the oil. The content of the volatile oil is expressed as a percentage v/w.

The apparatus consists of the following parts. The apparatus described below is recommended but any similar apparatus may be used provided that it permits complete distillation of the volatile oil.

All glass parts of the apparatus should be made of good quality resistance glass.

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

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

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

Bulb CD, length – 100 to 110 mm.
Internal diameter – 13 to 15 mm.

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

Tube EG, length – 80 to 90 mm.

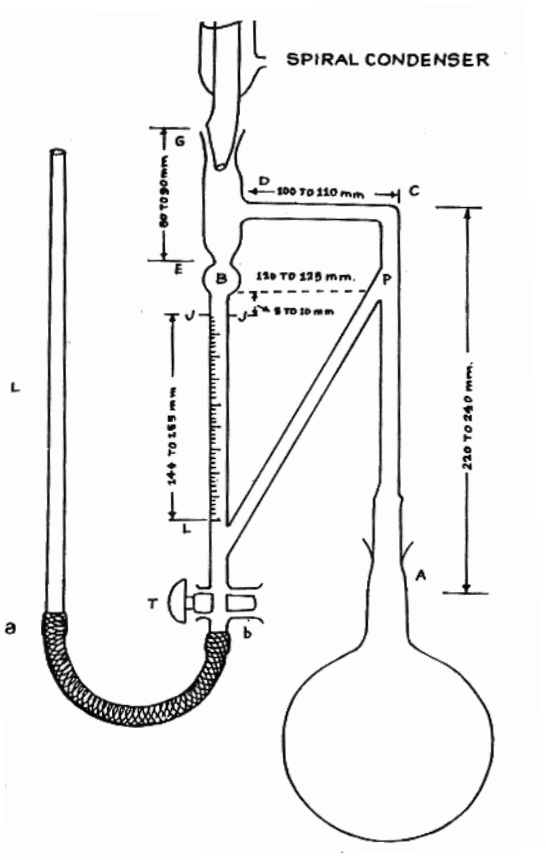


Fig. Apparatus for volatile oil determination

Internal diameter – 15 to 20 mm

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

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

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

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

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

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

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

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

The Whole of the apparatus is effectively screened from draught.

The apparatus is cleaned before each distillation by washing successively with acetone and water, then inverting it, filling it with chromic sulphuric acid mixture, after closing the open end at G, and allowing to stand, and finally rinsing with water.

Method of determination

A suitable quantity of the coarsely powdered drug together with 75 ml of glycerin and 175 ml of water in the one litre distilling flask, and a few pieces of porous earthern ware and one filter paper 15 cm cut into small strips, 7 to 12 mm wide, are also put in the distilling flask, which is then connected to the still head. Before attaching the condenser, water is run into the graduated receiver, keeping the tap T open until the water overflows, at P. Any air bubbles in the rubber tubing a-b are carefully removed by pressing the tube. The tap is then closed and the condenser attached. The contents of the flask are now heater and stirred by frequent agitation until ebullition commences. The distillation is continued at a rate which keeps the lower end of the condenser cool. The flask is roatated occasionally to wash down any material that adheres to its sides.

At the end of the specified time (3 to 4 hours) heating is discontinued, the apparatus is allowed to cool for 10 minutes and the tap T is opened and the tube L_1 lowered slowly; as soon as the layer of the oil completely enters into the graduated part of the receiver the tap is closed and the volume is read.

The tube L1 is then raised till the level of water in it is above the level of B, when the tap T is slowly opened to return the oil to the bulb. The distillation is again continued for another hour and the volume of oil is again read, after cooling the apparatus as before. If necessary, the distillation is again continued until successive readings of the volatile oil do not differ.

The measured yield of volatile oil is taken to be the content of volatile oil in the drug.

The dimensions of the apparatus may be suitably modified in case of necessity.

2.2.14 Estimation of Starch

Prepare 10% homogenate of the plant tissue in 80% Ethanol. Centrifuge at 2000 rpm for 15 minutes. To the residue thus obtained, add 4 ml of distilled water, heat on a water bath for 15 minutes and macerate with the help of glass rod. To each of the samples, add 3 ml of 52% perchloric acid and centrifuge at 2000 rpm for 15 minutes. The supernatant thus obtained is made upto known volume (generally upto 10 ml or depending on the expected concentration of starch). Take 0.1 ml aliquot, add 0.1 ml of 80% phenol and 5 ml conc. H_2SO_4. Cool and then read the absorbance at 490 nm.

2.3 Limit Tests

2.3.1 Limit Test for Arsenic

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

Apparatus

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

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

Reagents

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Stannated hydrochloric acid AsT:

Stannous chloride solution AsT	1 ml
Hydrochloric Acid AsT	100 ml

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

It complies with the following test:

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

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

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

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

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

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

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

Instead of this method of attaching the mercuric chloride paper, any other method may be used provided (1) that the whole of the evolved gas passes through the paper; (2) that the portion of the paper in contact with the gas is a circle 6.5 mm in diameter; and (3) that the paper is protected from sunlight during the test. The test solution prepared as specified, is placed in the wide-mouthed bottle, 1 g of potassium iodide AsT and 10 g of zinc AsT are added, and the prepared glass tube isj placed quickly in position. The action is allowed to proceed for fourty minutes. The yellow stain which is produced on the mercuric chloride paper if arsenic is present is compared by day light with the standard stains produced by operation in a similar manner with known quantities of dilute arsenic solution AsT. The comparison of the stains is made immediately at the completion of the test. The standard stains used for comparison are freshly prepared; they fade on keeping.

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

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

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

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

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

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

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

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

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

Ferrous sulphate - Dissolve 5 g in 10 ml of water and 15 ml of stannated hydrochloric acid AsT and distil 29 ml; to the distillate add a few drops of bromine solution AsT. Add 2 ml of stannated hydrochloric acid AsT, heat under a reflex condenser for one hour, cool and add 10 ml of water and 10 ml of hydrochloric acid AsT.

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

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

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

Phosphoric acid:

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

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

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

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

2.3.2 Limit Test for Chlorides

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

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

2.3.3 Limit Test for Heavy Metals

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

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

Special Reagents -

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

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

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

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

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

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

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

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

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

Standard lead solution: One the day of use, dilute 10 ml of lead nitrate stock solution with water to 100 ml. Each ml of standard lead solution contains the equivalent of 10 mg of lead. A control comparison solution prepared with 2 ml of standard lead solution contains, when compared to a solution representing 1 g of the substance being tested, the equivalent of 20 parts per million of lead.

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

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

Method A

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

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

Procedure : to each of the cylinders containing the *standard solution* and *test solution* respectively add 10 ml of freshly prepared *hydrogen sulphide solution,* mix, dilute with *water* to

50 ml, allow to stand for five minutes, and view downwards over a white surface; the colour produced in the *test solution. n*ot darker than that produced in the *standard solution.*

Method B

Standard Solution : Proceed as directed under Method A.

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

Method C

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

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

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

2.3.4 Limit Test for Iron

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

Method

Dissolve the specified quantity of the substance being examined in 40 ml of water, or use 10

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

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

2.3.5 Limit Test for Lead

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

Special Reagents -

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

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

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

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

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

Add *dilute hydrochloric acid* unitl the solution is pink and then dilute with sufficient water to produce 100 ml.

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

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

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

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

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

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

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

Method

Transfer the volume of the prepared sample directed in the monograph to a separator, and unless otherwise directed in monograph, add 5 ml of *ammonium citrate solution Sp.,* and 2 ml of *hydroxylamine hydrochloride solution Sp.,* (For the determination of lead in iron salts use 100 ml of *ammonium citrate solution Sp.)* Add two drops of *phenol red solution* and make the solution just alkaline (red in colour) by the addition of *strong ammonia solution.* Cool the solution if necessary, and add 2 ml of *potassium cyanide solution Sp.* Immediately extract the solution with several quantities each of 5 ml of *dithizone extraction solution,* draining off each extract into another separating funnel, until the dithizone extraction solution retains its green colour. Shake the combine and discard the chloforom layer. Add to the acid solution exactly 5 ml of *standard*

dithizone solution and 4 ml of *ammonia-cyanide solution Sp.* and shake for 30 seconds; the colour of the chloroform layer is of no deeper shake of violet than that of a control made with a volume of *dilute standard lead solution* equivalent to the amount of lead permitted in the sample under examination.

2.3.6 Limit Test for Sulphates

Reagents -

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

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

Method

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

APPENDIX 3

3.1 PHYSICAL TESTS AND DETERMINATIONS

3.1.1 Determination of Boiling or Distilling Range

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

Apparatus --

Use an apparatus consisting of the following:

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

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

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

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

Method

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

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

heating to in a regular distillation rate of 4 to 5 ml per minute. Record the temperature when the drop of liquid evaporates from the bottom of the flask or when the specified entage has distilled over. Correct the observed temperature readings for any variation le barometric pressure from the normal (760 torr) using the following expression:

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

where

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

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

3.1.2 Determination of congealing range of temperature

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

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

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

Apparatus --

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

Method

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

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

3.1.3 Determination of pH Values

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

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

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

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

TABLE 1 - pH of Reference Solutions at various Temperatures.

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

ÄpH/Ät

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 (ë =589.3 ìm) at 25°C, on a layer dim thick. It is expressed in degrees.

The *specific optical rotation* $(\propto)^{D25}$ of a solid substance is the angle of rotation œ of the plane of polarisation at the wavelength of the D line of sodium (ë -589.3 mm) measured at 25^0 C calculated with reference to 1.0 dm thick layer of the liquid, and divided by the specific gravity.

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

Apparatus

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

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

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

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

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

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

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

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

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

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

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

Concentration (g/100 ml)	Angle of Rotation (+) at 25^0
10.0	13.33
20.0	26.61
30.0	39.86
40.0	53.06
50.0	66.23

Method

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

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

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

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

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

id

25

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

Where

a = corrected observed rotation, in degrees, at 25°C
D = D line of sodium light (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° (± 0.5) with reference to the wavelength of the $_D$ line of sodium (ë. = 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	-0.00057
Toluene	-0.00056
a-Methylnaphthalene	-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_2 O.

Ferric Ammonium Sulphate - 0.1 N Fe $NH_4(SO_4)_2$ 12 H_2O = 482.18; 48.22g in 1000ml.

Dissolve 50g of *ferric-ammonium sulphate* in a mixture of 300ml of *water* and 6ml of *sulphuric acid.* Dilute with water to 1000ml , and mix. Standardize the solution as follows:-

Measure accurately about 30 ml of the solution into a glass-stoppered flask, add 5ml of *hydrochloric acid,* mix, and add a solution of 3g of *potassium iodide* in 10 ml of water. Insert the stopper, allow to stand for ten minutes in the dark, then titrate the liberated *iodine* with standardized 0.1 *N Sodium thiosulphate*, adding 3 ml of *starch solution* as the end-point is approached. Perform a blank determination and make any necessary correction. Each ml of 0.1 *N Sodium thiosulphate* is equivalent to 0.04822 g of Fe (NH_4) (SO_4)$_2$ 12 H_2 O.

NOTE - Store 0.1 N Ferric Ammonium Sulphate in tightly-closed, light resistant containers.

Ferric Chloride - Anhydrous Ferric Chloride; Ferric Chloride ; $FeC1_3$ = 162.22

Description - Greenish-black crystals or a crystalline powder, free from the orange colour of the hydrated salt, which is readily acquired by exposure to atmospheric moisture.

Solubility - Soluble in water, yielding an orange coloured opalescent solution.

Ferrous Salts - Dissolve 2 g in 100 ml of water, add 2 ml of *phosphoric acid* and titrate with 0.1 *N potassium permanganate* until a pink colour is produced, no more than 0.1 ml is required.

Free Chloride - Dissolve 5 g in 10 ml of *water* and boil the solution; no blue colour is produced on a starch iodide paper exposed to the vapours.

Ferric Chlordie Solution - Contains not less than 14.25 per cent and not more than 15.75 per cent w/v of $FeC1_3$.

Description - Clear, Yellowish-brown liquid.

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

Ferrous Sulphate - $FeSO_4 \ 7H_2O = 278.0$

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

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

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

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

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

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

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

Ferrous Sulphate Solution must be freshly prepared.

Ferrous Sulphate Solution, Acid - A 0.45 per cent w/v solution of *ferrous sulphate* in freshly boiled and cooled *water* containing 0.5 ml of *hydrochloric acid.*

Formaldehyde Solution - Formalin ; HCHO = 30.03.

Formalidehyde Solution is a solution of *formaldehyde* in *water* with *methyl alcohol* added to prevent plymerisation. It contains not less than 34.0 per cent w/w/ and not more than 38 per cent w/w of CH_2O.

Description - Colourless liquid; odour, characteristic, pungent and irritating; taste, burning. A slight white cloudy deposit is formed on long standing, especially in the cold, due to the separation of paraformaldehyde. This white deposit disappears on warming the solution.

Solubility - Miscible with *water*, and with *alcohol*.

Acidity - To 10 ml add 10 ml of *carbon dioxide free water* and titrate with 0.1 *N sodium hydroxide* using *bromothymol blue solution* as indicator; not more than 5 ml of 1 *N sodium hydroxide* is required.

Wt. per ml. - At 20°C, 1.079 g. Appendix 3.1.8.

Assay - Weigh accurately about 3 g and add to a mixture of 25 ml of *hydrogen peroxide solution* and 50 ml of *N sodium hydroxide*, warm on a water bath until effervescence ceases and titrate the exces of alkali with *N sulphuric acid* using *phenolphthalein solution* as indicator. Repat the experiment with the same quantities of the same reagents in the same manner omitting the *formaldehyde solution*. The difference between the titrations represents the sodium hydroxide required to neutralise the formic acid produced by the oxidation of the *formaldehyde*. Each ml of *N sodium hydroxide* is equivalent to 0.03003 g of CH_2 O.

Storage - Preserve Formaldehyde Solution in a well-closed container preferably at a temperature not below 15°C.

Formaldehyde Solution, Dilute.

Dilute 34 ml of *formaldehyde solution* with sufficient water to produce 100 ml.

Glycerin - C_3 H_8 O_3 =82.09.

Description - Clear, colourless liquid of syrupy consistancy; odourless, taste sweet followed by a sensation of warmth. It is hygroscopic.

Solubility - Miscible with *water* and with *alcohol*; practically, insoluble in *chloroform*. In *solvent-ether* and in fixed oils.

Acidity - To 50 ml of a 50 per cent w/v solution add 0.2 ml of *dilute phenolphthalin solution*; not more than 0.2ml of 0.1 *N sodium hydroxide* is required to produce a pink colour.

Wt. per ml. - Between 1.252 g and 1.257g, Appendix-3.1.8, corresponding to between 98 per cent and 100 per cent w/w of C_3 H_8 O_3 .

Refractive Index - Between 1.470 and 1.474 determined at 20°C. Appendix 3.1.7

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

Copper - To 10 ml add 30 ml of *water*, add 1 ml of *dilute hydrochloric acid,* add 10 ml of *hydrogen sulphide solution;* no colour is produced.

Iron - 10g complies with the *limit test for iron,* Appendix 2.3.4.

Heavy Metals - Not more than 5 parts per million, determined by Method A on a solution of 4g in 2 ml of 0.1 *N hydrochloric acid* and sufficient *water* to produce 25ml. Appendix 2.3.3.

Sulphate - 1 ml complies with the *limit test for sulphates,* Appendix 2.3.6

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

Acraldehyde and Glucose - Heat strongly; it assumes not more than a faint yellow and not a pink colour. Heat further; it burns with little or not charring and with no odour of burnt sugar.

Aldehydes and Related Substances - To 12.5 ml of a 50 per cent w/v solution in a glass-stoppered flask add 2.5 ml of *water* and 1 ml of *decolorised magenta solution.* Close the flask and allow to stand for one hour. Any violet colour produced is not more intense than that produced by mixing 1.6ml of 0.1 *N potassium permaganate* and 250 ml of water.

Sugar - Heat 5 g with 1 ml of *dilute sulphuric acid* for five minutes on a water-bath. Add 2 ml of *dilute sodium hydroxide solution* and 1 ml of *coppr sulphate solution.* A clear, blue coloured solution is produced. Continue heating on the water-bath for five minutes. The solution remains blue and no precipitate is formed.

Fatty Acids and Esters - Mix 50 g with 50 ml of freshly boiled *water* and 50.0 ml of 0.5 *N sodium hydroxide*, boil the mixute for five minutes. Cool, add a few drops of *phenolphthalein solution* and *nitrate* the excess alkali with 0.5 *N hydrochloric acid*. Perform a blank determination. Not more than 1 ml of 0.5 *N sodium hydroxide* is consumed.

Sulphated Ash - Not more than 0.01 per cent, Appendix 2.2.11

Storage - Store in tightly-closed containers.

Glycerin Solution - Dilute 33 ml of *glycerin* to 100 ml with water and add a samll piece of camphor or liquid phenol.

Hexamine $(CH_2)_6 \ N_4 = 140.2$
Analytical reagent grade.

Hydrazine Hydrate - $NH_2 \ NH_2 \ H_2 \ O = 50.06$.
Analytical reagent grade.
A colourless liquid with an ammonical odour; weight per ml. about 1.03 g.

Hydrochloric Acid - HC1=36.46
Concentrated Hydrochloric Acid.

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

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

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

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

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

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

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

Sulphated Ash - Not more than 0.01 percent, Appendix 2.2.11

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

Storage - Store in glass- stoppered containers at a temperature not exceeding 30^0

Hydrochloric Acid, x N - Solution of nay normality x N may be prepared by diluting 84Xml of *hydrochloric acid* to 1000 ml with *water*.

Hydrochloric Acid - (1 percent w/v).

Dilute 1 g of *hydrochloric acid* to 100 ml with *water*.

Dilute Hydrochloric Acid

Description - Colourless liquid.

Arsenic Heavy Metals - *Bromide and iodide; sulphate; Free chlorine*-Complies with the tests described under *Hydrochloric acid,* when three times the quantity is taken for each test.

Assay - Weigh accurately about 10 g and carry out the Assay described under Hydrochloric Acid.

Storage - Store in stoppered containers of glass or other inert material, at temperature below 30^0.

Hydrochloric Acid: N: HCI=36.46
36.46 g in 1000 ml

Dilute 85 ml of *hydrochloric acid* with *water* to 1000 ml and standardize the solution as follows:

Weigh accurately about 1.5 g of *anhydrous sodium carbonate* P.S., previous heated at about 270^0 for one hour. Dissolve it in 100 ml of *water* and add two drops of *methyl red solution*. Add the acid slowly from a burette with constant stirring, until the solution becomes faintly pink. Heat again to boiling and titrate further as necessary until the faint pink colour no longer affected by continued boiling. Each 0.5299 g of *anhydrous* and *sodium carbonate* is equivalent to 1 ml of *N. hydrochloric acid*.

Hydrochloric Acid Iron free- Hydrochloric acid which complies with the following additional test.

Evaporate 5 ml on a water-bath nearly to dryness, add 40 ml of *water*, 2 ml of a 20 percent w/v solution of *citric acid* and two drops of *thioglycollic acid*, mix, make alkaline with *dilute ammonia solution*, and dilute to 50 ml with *water*; no pink colour is produced.

Hydrogen Peroxide Solution- (20 Vol.) H_2O_2=34.02

Analytical reagent grade of commerce or *hydrogen peroxide solution* (100 Vol) diluted with 4 volumes of water.

A colourless liquid containing about 6 percent w/v of H_2O_2 ; weigh per ml. about 1.02 g.

Hydrogen Sulphide- H_2S=34.08

Use laboratory cylindergrade, or prepared the gas by action of *hydrochloric acid*, diluted with an equal volume of *water*, on iron sulphide, the resulting gas is washed by passing it through *water*.

A colourless, poisonous gas, which a characteristic unpleasant odour.

Hydrogen Sulphide Solution – A recently prepared, saturated solution of hydrogen sulphide in water at 20^0.

Hydrogen Sulphide solution contains about 0.45 percent w/v of H_2s.

Hydroxylamine Hydrochloride; Hydroxylamonium Chloride:- NH_2.OH,HC1 = 69.49.

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

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

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

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

Sulphated ash – Not more than 0.2 percent, Appendix 2.2.11

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

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

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

Analytical regent grade.

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

Indigo Carmine Solution – To a mixture of 10 ml of *hydrochloric acid* and 990 ml of a 20 percent w/v solution of *sulphuric acid* in *water*, add sufficient indigo carmine to produce a solution which complies with the following test.

Add 10 ml to a solution 1.0 mg of *potassium nitrate* in 10 ml of *water*, add rapidly, 20 ml of *sulphuric acid* and heat to boiling; the blue colour is just discharged in one minute.

***Indian ink** – General purpose grade:
Iodine : I_2 = 253.8

Description - Heavy, bluish-black, brittle, rhombic prisms or plates with a metallic lustre; odour characteristic; volatile at ordinary temperatures.

SOLUBILITY - Very slightly soluble in *water*; soluble in *alcohol* freely soluble in *carbon disulphide* and *in chloroform in solvent ether*; *in carbon tetrachloride* and in concentrated aquous solutions of iodides.

Chloride Bromide - Triturate 3.5 g thoroughly with 35 ml of *water*, filter and decolorise the filtrate by the addition of a little *zinc powder*. To 25 ml of the filtrate so obtained, add 5 ml of *dilute ammonia solution*, and then 5 ml of *silver nitrate solution* added gradually, filter; dilute the filtrate to 50 ml, and acidify gradually with 4 ml of *nitric acid*; the opalescence in the *limit test for chloride*, Appendix 2.3.2.

Cyanides - To 5 ml of the filtrate obtained in the test for *Chloride and bromide* add a few drops of *ferrous sulphate solution* and 1 ml of *sodium hydroxide solution*, warm gently and acidify with *hydrochloric acid*, no blue or green colour is produced.

Non-Volatile Matter - Leaves not more than 0.1 percent as residue when volatilized on a water-bath.

Assay - Weigh accurately about 0.5 g and dissolve in a solution of 1 g of *potassium iodide* in 5 ml of *water*. Dilute to 250 ml with *water*, add 1 ml of *dilute acetic acid*, and titrate with 0.1N *sodium thiosulphate*, using starch solution as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.01269 g of 1.

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

Iodine, 0.IN: I=126.90; 12.69 g in 1000 ml

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

Weigh accurately about 0.15 g of *arsenic trioxide* P.S., previously dried at 1050 for one hour, and dissolve in 20 ml of *N sodium hydroxide* by warming, if necessary. Dilute with 40 ml of *water*, add two drops of *methyl orange solution* and follow with *dilute hydrochloric acid* until the yellow colour is changed to pink. Then add 2 g of *sodium bicarbonate*, dilute with 50 ml of water, and add 3 ml of *starch solution*, slowly add the *iodine solution* from a burette until a permanent blue colour is produced. Each 0.004946 g of *arsenic trioxide* is equivalent to 1 ml of 0.1 N iodine.

Iodine solution- Dissolve 2.0 g of *iodine* and 3 g of *potassium iodide* in *water* to produce 100 ml.

Kieselguhr- A natural diatomaceous earth, purified by heating with dilute hydrochloric acid, washing with water and drying.

Lactic Acid - $CH_3CHOH.COOH$-90.08
Analytical reagent grade of commerce

Lactophenol – Dissolve 20 g *phenol* in a mixture of 20 g of *lactic acid*, 40 g of *glycerol,* and 20 ml of *water.*

Lead Acctate - Sugar of lead; $(CH_3CO_2)_2Pb$, $3H_2O$=379.33

Contains not less than 99.5 percent and not more than the equivalent of 104.5 percent of $C_4H_6O_4Pb,3H_20$.

Description - Small, white, transparent, monoclinic prisms, or heavy, crystalline bases; odour, acetous, taste, sweet and astringent. Efflorescent in warm air. Becomes basic when heated.

Solubility - Freely soluble in *water*, and in *glycerin*; sparingly soluble in *alcohol.*

Water Insoluble Matter - Dissolve 1 g in 10 ml of recently boiled and cooled *water* solution is produced which is at most faintly opalescent and becomes clear on the addition of one drop of *acetic acid*.

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

Copper, Iron, Silver and Zinc – Dissolve 0.5 g in 10 ml of *water*, add 2 ml of *dilute sulphuric acid*, allow to stand for thirty minutes, and filter, to the filtrate add an excess of potassium ferrocyanide solution no precipitate or colour is produced.

Assay - Weigh accurately about 0.8 g and dissolve in a mixture of 100 ml of *water* and 2 ml of *acetic acid*, add 5 g of hexamine, and titrate with 0.05 *M disodium ethylenediaminetertraacetate,* using 0.2 ml of *xylenol orange solution* as indicator, until the solution becomes pale bright yellow. Each ml of 0.05 *M disodium ethylenediaminetertraacetate* is equivalent to 0.01897 g of $C_4H_6O_4Pb,3H_20$.

Storage - Preserve lead acetate in a well closed container.

Lead acetate solution- A 10 percent w/v solution of *lead acetate in carbon dioxide-free water.*

Lead nitrate: $Pb(NO_3)_2$=331.21

Contains not less than 99 percent of $Pb(NO_3)_2$

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

Solubility - Soluble in *water*, forming a clear, colourless solution.

Assay - Weigh accurately about 0.3 g and dissolve in 150 ml of *water*, add 5 ml of *dilute acetic acid*, heat to boiling, add a slight excess of *potassium chromate* solution, and boil gently until the precipitate becomes granular; collect the precipitate in a Gooch crucible, wash it with hot *water*, and dry to constant weight at 120^0 each g of residue is equivalent to 1.025 g of $Pb(NO_3)_2$.

Lead solution standard - See limit test for heavy metals. Appendix, 2.3.3.

Liquid paraffin- General reagent grade.

Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility -Practically insoluble in water, and in alcohol, soluble in chloroform, in solvent either and in volatile oils.

Wt. per ml. - At 25^0C, 0.860 to 0.904 g Appendix 3.1.8

Litmus- Fragments of blue pigment prepared from various species of *Rocella lacanora* or other lichens. It has a characteristic odour.

Partly soluble in water and in alcohol. Gives a red colour with acids and a blue colour with alkalies (pH range, 5.0 to 8.0).

Litmus solution - Boil 25 g of coarsely powered litmus with 100 ml of *alcohol* (90 percent) under a reflux condenser for one hour, and pour away the clear liquid; repeat this operation using two successive quantities, each of 75 ml, of *alcohol* (90 percent). Digest the extracted litmus with 250 ml of water.

Litmus paper, blue - Boil 10 parts of coarsely powdered litmus under reflux for one hour with 100 parts of *alcohol*, decant the *alcohol* and discard. Add to the residue a mixture of 45 parts of alcohol and 55 parts of water. After two days decant the clear liquid. Impregnate the strips of filter paper with the extract and allow to dry the paper complies with the following test.

Sensitivity - Immerse a strip measuring 10 mmX60 mm in 100 ml of a mixture of 10 ml of 0.02 *N hydrochloric acid* and 90 ml of *water*. On shaking the paper turns red within forty five seconds.

Liquid paraffin- General reagent grade.

Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility - Practically insoluble in *water*, and in *alcohol*, soluble in *chloroform*, in *solvent ether* and in volatile oils.

Wt. per ml - At 25^0, 0.860 to 0.904 g Appendix 3.1.8

Litmus paper, red - To the extract obtained in the preparation of blue litmus paper add 2 *N hydrochloric acid* drop-wise until the blue colour becomes red. Impregnate strips of filter paper with the solution and allow to dry.

The paper complies with the following test:

Sensitivity- Immerse a strip measuring 10 mmX60mm in 100 ml of 0.002 *N Sodium hydroxide*. On shaking the paper turns blue within forty-five minutes.

Magenta Basic: CI 42510: Funchsin; Rosaniline hydro-chloride; $[(H_2NC_6H_4)_2C{:}C_6H_3(CH_3){:}NH_2+]CI=337.85$

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

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

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

Sulphated Ash - Not more than 5 percent, Appendix 2.3.6

Magenta solution, Decolorized- Dissolve 1 g of *basic magnenta* in 600 ml of *water* and cool in an ice-bath; add 20 g of *sodium sulphite* dissolved in 100 ml of *water*; cool in an ice-bath and add, slowly with constant stirring, 10 ml of *hydrochloric acid*; dilute with *water* to 1000 ml.

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

Decolourised Magenta Solution should be protected from light.

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

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

Magnesium Sulphate: $MgSO_4$. $7H_2O$-246.47

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

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

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

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

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

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

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

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

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

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

Storage - Store in well-closed container.

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

Analytical reagent grade of commerce.

Magnesium Sulphate, Dried, $MgSO_4$aq

Dried, general reagent grade of commerce.

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

Mercuric chloride: $HgCI_2$=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^{0}C to 205^{0}C, 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 processis 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.

WEIGHTS AND MEASURES

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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