THE AYURVEDIC PHARMACOPOEIA OF INDIA

THE AYURVEDIC PHARMACOPOEIA OF INDIA

PART-I

VOLUME-I

First Edition

GOVERNMENT OF INDIA
MINISTRY OF HEALTH AND FAMILY WELFARE
DEPARTMENT OF INDIAN SYSTEMS OF MEDICINE & HOMOEOPATHY

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FOREWORD

The Drugs and Cosmetics Act 1940 was amended in 1964 to bring within its purview the drugs of Indian Systems of Medicine (Anyurveda, Unani and Siddha). For the implementation of the Act and Rules framed thereunder it was considered necessary to work out the standards for the drugs of Indian Systems of Medicine.

To lay down the standards of the drugs of Ayurveda, Unani and Siddha Systems of Medicine in the country, the Pharmacopoeial Laboratory for Indian Medicine (P.L.I.M.) at Ghaziabad was established as the subordinate office of the Ministry of Health & Family Welfare (Department of Health) in 1970 to be utilised as :—

(a) Drug standardisation and testing Unit;

(b) Drug Depot; and

(c) Herbarium and Reference Museum.

The Pharmacopoeial Laboratory for Indian Medicine, Ghaziabad started standardisation work on those drugs of plant origin which are included in the First Part of the Ayurvedic Formulary of India comprising of 444 compound formulations published by the Ministry of Health and Family Welfare, Govt. of India, New Delhi in the year 1978. The Drug Standardisation Unit of the Central Council for Research in Ayurveda & Siddha are also engaged in Drug Standardisation and these Units have made significant contribution in this regard.

The Ministry of Health and Family Welfare, Government of India have pleasure in presenting the Ayurvedic Pharmacopoeia of India, Part 1, Vol. 1 on the Single Drugs of plant origin used in Ayurveda, containing 80 monographs. The subsequent volumes will be published from time to time as the experimental data becomes available. For laying down the Pharmacopoeial Standards of Single Drugs of plant origin, every attempt has been made to utilise the best of the Laboratory skill as correct as p ossible according to the parameters approved by the Ayurvedic Pharmacopoeia Committee.

In the last, the Ministry of Health & Family Welfare, Government of India, expresses its thanks and appreciation to the Chairman, Members and Experts of the Ayurvedic Pharmacopoeia Committee, Organisations which have supplied the authentic samples of crude drugs and also to the Staff of the Pharmacopoeial Laboratory and technical staff of the Ministry of Health and Family Welfare who unsparingly gave their best to this task.

Government is always aware of the fact that this being the first effort of its kind there will always be room for improvement. Suggestions and comments in this behalf from experts working in this field, are welcome, as these will help us in bringing out the subsequent editions as faultless as possible.

Sd/- S.S. DHANOA
Secretary to the Govt. of India
Ministry of Health & Family Welfare

NEW DELHI
Dated : 9-12-1986.

CONTENTS

LEGAL NOTICES

In India there are laws dealing with certain of the drugs which are the subject of monographs which follow. These monographs should be read subject to the restrictions imposed by these 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 and, the Poisons Act, 1919 and the rules framed thereunder should be consulted.

Under the Drugs & Cosmetics Act, the Ayurvedic Pharmacopoeia of India (A.P.I.), Part-I, Vol. 1, is the book of standards for single drugs included therein and the standards prescribed in the Ayurvedic Pharmacopoeia of India, Part-I, Vol. 1 would be official. If considered necessary these standards can be amended and the Chairman of the Ayurvedic Pharmacopoeia Committee is authorised to issue such amendments. Whenever such amendments are issued the Ayurvedic Pharmacopoeia of India, Part-I, Vol. 1, would be deemed to have been amended accordingly.

GENERAL NOTICES

Title.—The title of the book is "Ayurvedic Pharmacopoeia of India", Part-I, Vol. I. Wherever the abbreviation A.P.I. is used, it may be presumed to stand for the same and the supplements thereto.

Names of the drugs.—The name given on the top of each monograph of the drug is in Sanskrit as mentioned in the Ayurvedic classics and/or, in the Ayurvedic Formulary of India, Part-I and will be considered official. These names have been arranged in English alphabetical order. The Latin name (taxonomical nomenclature) of each of the drug as found in the latest authentic 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 will also be considered as legal name.

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.

Synonyms.—Synonyms of each of the drug appearing in each monograph in Sanskrit, English, Hindi, Urdu and other Indian regional languages have been mentioned as found in the classical texts. Ayurvedic Formulary of India, Part-I and as procured from the experts, scholars of Ayurveda and officials in the field from different States.

Italics.—Italic type has been used for scientific name of the drug appearing in the introductory paragraph of each monograph as also for chemicals and reagents, substances or processes described in Appendix.

Odour and taste.—Wherever the specific odour has been found it has been mentioned but the description as "odourless' or "no odour" has in many cases been avoided in the descriptions as large number of drugs have got a specific woody odour. The "Odour" is examined by directly smelling 25g of the powdered drug contained in a package or freshly powdered. If the odour is discernible the sample is rapidly transferred to an open container and reexamined after 15 minutes. If the odour persist so be discernible and it not the common woody smell, it is described as having odour.

The "Taste" of a drug is examined by taking a small quantity of 85 mesh powder by a tip of moist glass rod applying it on blank tongue previously rinsed with water.

Mesh number.—Wherever the powdering of the drug has been required the sieve "Mesh Number 85" has been used. This will not apply for the drugs containing much of oily substance.

Weights and Measures.—The metric system of weights and measures is employed.

Weights are given in multiples or fractions of a gramme (g) or of a milligram (mg).

Fluid measures are given in multiples or fractions of millilitre (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°c.

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

Identity, purity and strength.—Under the heading "Identification" 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 of lead, arsenic and heavy metals, and showing no abnormal odour, colour, sliminess, mould or other evidence of deterioration.

Wherever Sodhana (Treatment) of a drug has been specified, it should be subjected to the process as specified in the Appendix.

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The quantitative tests e.g. total ash, acid-insoluble ash, water-soluble 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 the pharmacopeial method. Insuitable instance the methods of micro-analysis, if of equivalent accuracy, may be substituted for the tests and assays described. However, in the event of doubt or dispute the methods of analysis of the Pharmacopoeia are alone authoritative.

Quantities to be weighed for assays and tests—In all descriptions quantity of the substance 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 weighings do not differ by more than 1.0 mg per g of the substance taken for the determination, the second weighing following an additional hour of drying of further ignition.

Constituents.—Under this head only the names of important chemical constituents, groups of constituents reported in research 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 four meanings. In order that the meaning to be attached to the expression in each instance may be clear, the following notations are used.

Per cent w/w (Percentage weight in weight) expresses the number of grammes of active substance, in 100 grammes of product.

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

Per cent v/v (percentage volume in volume) express the number of millilitres of active substance in 100 ml of product.

Per cent v/w (percentage volume in weight) expresses the number of millilitres of active substance in 100 grammes of product.

Percentage of alcohol.—All statements of percentage of alcohol ($C_2 H_5 OH$) refer to percentage by volume at 15.56° c.

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

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

Reagents and Solutions.—The chemicals and reagents required for the tests in pharmacopoeia are described in Appendices.

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

Statements of solubilities which are expressed as a precise relation of weights of dissolved substance to volume of solvent, at a stated temperature, are intenteded 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, fibres. 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 millilitre of a liquid is soluble in that number of millilitres 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 indicated its solubility.

The following table indicates the meaning of such terms :—

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

Therapeutic uses and important formulations.—Therapeutic uses and important formulations mentioned in this pharmacopoeia are, as provided in the recognised Ayurvedic classics and in the Ayurvedic Formulary of India, Part-I.

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

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

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

m	Meter
l	Litre
mm	Millimeter
cm	Centimetre
μ	Micron (0.001 mm)
Kg	Kilogram
g	Gramme
mg	Milligram
ml	Millilitre
IN	Normal solution
0.5 N	Half-normal solution
0.1N	Decinormal solution
IM	Molar solution
Fam	Family
PS	Primary Standard

Abbreviations used for languages

Sansk.	Sanskrit
Assam.	Assamese
Beng.	Bengali
Eng.	English
Guj.	Gujrati
Kan.	Kannad
Kash.	Kashmiri
Mal.	Malaylam
Mar.	Marathi
Ori.	Oriya
Puj.	Punjabi
Tam.	Tamil
Tel.	Telgu

PREFACE

India, due to its unique variety of geographical and climatic factors, had had a rich and varied flora of medicinal plants since the vedic period. No wonder that out of a total number of over 15,000 plant species in India about 2000 are known to have medicinal properties and some of them are used even as home-remedies in the rural and remotest parts of the country.

2. The vastness of the country with its inadequate means of communication and facilities for transport of drugs, coupled with diverse regional languages, resulted into a multitude of synonyms (the names in regional languages). Further, Ayurveda being a science put into professional practice, with umpteen occasions to try newer drugs locally available, led to the successful use of several other drugs with therapeutic values similar to those of the classical drugs and were originally equated with the classical Ayurvedic drug, but later assumed the name of the very classical drug and continued to be locally collected, sold and used in the name of the main drugs since the main classical drug was famous yet locally unavailable and substitution was a necessity. Later in the first half of the century, while scientifically identifying the drugs in vogue, in different regions, the scientists found that there were more than one species, belonging even to different families of plants, claiming the same classical name of the Ayurvedic drug. 'Brahmi' could be cited as a good example. This created a sensation that there existed a great controversy about the identity of Ayurvedic drugs and that there were more than one independent drug claiming its classical name of drug and one drug therefore having different scientific identities. This innocent impression of scientists was further exaggerated during the alien rule to run down the claim of Ayurveda as a science and confuse the intelligentia, who loved Ayurveda as a cultural heritage of India out of patriotism. All such drugs with a multiple claim on a classical name in different provinces, were stamped as controversial drugs without going into their genesis basically as therapeutic equivalents.

3. Ayurveda had never been static. Its practitioners had been innovative and dynamic in the therapeutic practice and carried on clinical trials out of the local flora and discovered newer medicine with same therapeutic values as the classical drugs which might have been then either locally un-available or perhaps demanding heavy prices. These newer drugs have been accepted by the then practising profession as substitutes. In fact on study of Ayurvedic literature, one comes across several references of permitting the use of a substitute drug when the classical drug is not available. This is based on its therapeutic equivalence and clinical efficacy.

4. Then there were certain classical drugs of Himalayan origin whose supply was limited and seasonal. They were not or perhaps could not be grown on plains and hence their use was restricted to the traders. By the time efforts were made to identify these drugs, their supply had dwindled and commercial substitution started. These few drugs were rightly stamped as "Sandigdha Dravyyas" (or drugs of doubtful identity) of which 'Ashta Varga" could be cited as a glaring example.

5. It was again during the last 100 years of the alien rule, that the social and economic conditions in India changed, that the process of urbanisation began and the growth of forests neglected. It was during this period that the Ayurvedic physicians took to cities and lost their contact with forests and drug sources. It was during this period that as a consequence of better transport facilities, the crude supplying agencies came up and commercial manufacture of Ayurvedic Medicines on mass scale in factories started. These were the inevitable consequences of the socio-economic changes in the country. The new economic set up was such that the Ayurvedic practitioner could no longer process and prepare his own medicines but had to depend on the big pharmaceutical houses run commercially and on the suppliers of crude drugs to whatever extent he needed them. There was in a way a forced division of labour where he had no choice to choose his drugs and no means to ascertain the authenticity of the medicines and formulations offered to him by the pharmaceutical houses, nor was there any Governmental control on the manufacture to ensure the quality of the medicines marketed, prescribed and administered to his patients.

6. The conditions prevailing in India for compilation of Ayurvedic Formulary and the Ayurvedic Pharmacopoeia were quite discouraging under the alien rule. Not only no efforts were made to investigate the efficacy and potency of Ayurvedic drugs, but there was a systematic policy to discourage such moves and project Ayurveda as an out-dated and unscientific native system of treatment. Its drugs were publicised to be crude, poisonous and detrimental to health. The influence of this canard unfortunately still continues to lurk in some quarters. It was under these circumstances that some of the rationalist Indian Scientists and Scholars of Ayurveda dedicated themselves to the renaissance of Ayurveda. It was a part of the overall movement for independence of the country. But it gave the necessary momentum and after independence, not only Ayurvedic education but Ayurvedic drugs and their marketing was looked into.

7. As an outcome of the first Health Minister's Conference of 1946, a Committee under the Chairmanship of Lt. Col. R. N. Chopra was appointed in 1946 by the Government of India. It was the Chopra Committee that had first gone into the question of need for proper identification of Ayurvedic medicinal plants, control over collection and distribution of crude drugs and made positive recommendations for compilation of Ayurvedic Pharmacopoeia. Thereafter the Dave Committee (1955) has reiterated the recommendations for compilation of the Ayurvedic Pharmacopoeia.

8. The Government of Bombay, was specially interested in the survey of resources of Ayurvedic Drugs, their collection, cultvation, farming, distribution and standardization. They, therefore had appointed a Committee for Standard and Genuine Ayurvedic herbs and Drugs in 1955 and subsequently after receiving its report with fresh set of terms of reference, appointed a second committee called the Committee for Standard Ayurvedic Herbs and Drugs in 1957 both under the Chairmanship of Vaidya Bapalal Shah, of which I had the privilege to be the Members Secretary. The Bapalal Committee has very elaborately recommended the compilation of the Ayurvedic Pharmacopoeia as an urgent pre-requisite for effective control of Ayurvedic Drugs to ensure quality assurance. Finally Government of India appointed the "Ayurvedic Research Evaluation Committee", under the Chairmanship of Dr. K.N. Udupa 1953) which has strongly highlighted the urgency of compilation of Ayurvedic Pharmacopoeia.

9. In compliance with some of these recommendations, the Union Government as also some of the State Governments had started taking positive steps. The Government of Bombay State established its Board of Research in Ayurveda, Bombay in 1951, which was subsequently reconstituted in 1955 and 1958. The Government of India established CCRIMH in 1969 for research in all aspects including drug standardisation in Indian Medicine & Homoeopathy. This Council was divided into 4 research councils in 1978 and the research work in Ayurveda & Siddha was entrusted to the Central Council for Research in Ayurveda & Siddha. The P.L. I.M., at Ghaziabad was established in 1970 for testing and standardisation of single drugs and compound Formulations. Under the auspices of the Central Council for Research in Ayurveda and Siddha, several survey units in different States were established and work of standardisation of single drugs and compound medicines as also composite research work was initiated. The first Ayurvedic Pharmacopoeia Committee was constituted in 1962 under the Chairmanship of Col. Sir Ram Nath Chopra. The Committee was reconstituted in 1972 under the Chairmanship of Prof. A.N. Namjoshi which took over the work of compilation of the Ayurvedic Formulary of India as a pre-requisite for undertaking the work of Ayurvedic Pharmacopoeia of India.

10. After publication of the first part of the Ayurvedic Formulary of India, the press copy of part II of Ayurvedic Formulary consisting of 190 formulations was prepared for publication and part III of the Formulary is under preparation. A list of single drugs which enter into these formulations, emerged and the Commitee could apply its mind to the task of collection of data from the published material vailable as also to entrust experimental work and produce data necessary to supplement the information already available as also to experimentally verify some of the information previously submitted.

11. The first part of the Ayurvedic Formulary of India comprising some 444 formulations cover 351 single drugs of plant origin many of which having been repeated in the second part. This takes up to a list of about 500 priority drugs of plant origin to come within the ambit of the Ayurvedic Pharmacopoeia of India.

12. As against the above land-marks of growing interest in the renaissance of Ayurveda and a systematic efforts to investigate into the merits of this ancient science during the post-independence period it is interesting to note that the western or modern system of medicine which was all along proud of their armoury of mostly synthetic drugs, the chemo-therapeutic agents and later the anti-biotics, slowly realised their power of devastation of several human systems by their side effects and toxicity and an inestimable damage to the intestinal flora. The western world slowly started realising the goodness of the herbal medicines, having minimum side reactions and the basic comprehensive philosophy of Ayurveda, though initially appearing to be rather abstract and difficult to interpret in terms of the modern material sciences.

13. With the introduction of a uniform system of Ayurvedic education all over the country, a process initiated some 45 years ago, there has got to be some uniformity in the Ayurvedic medicines marketed, in so far as their identity, purity and strength are concerned with the physician and the patient need be assured of the quality of the medicine through proper drug control measures. The efforts to publish an Ayurvedic Formulary of India and to compile the Ayurvedic Pharmacopoeia of India have been well scheduled as to serve the profession and the public through proper quality assurance.

14. The Union Government have brought the Ayurvedic Drugs under the perview of the Drugs and Cosmetics Act 1940 from 15-9-1964. The publication of the Ayurvedic Formulary of India and the Ayurvedic Pharmacopoeia of India would give Government a base for fuller enforcement of the Act in respect of standards.

15. In the absence of technical information officially published by Government for statutory purposes, the Indian Pharmaceutical Industry in general and the Ayurvedic Pharmaceutical Industry in particular have been experiencing a great handicap in imposing standards as a part of their own internal discipline, as whatever standards they would lay down would be only arbitrary and subjective.

16. To meet the acute need of the hour felt by the academic institutions, the Ayurvedic Pharmacists and Pharmaceutical Industry and the Drugs and Cosmetic Act implementing authorities the Ayurvedic Pharmacopoeia Committee has made a modest effort to lay down some norms of single drugs based on experimental data worked out at the P. L. I. M. Ghaziabad and some of the units of the Central Council for Research in Ayurveda and Siddha, supplemented by the published scientific literature on the subject after due verification wherever found necessary and additions wherever possible.

17. The western countries did pass through this phase years ago and had to codify their medicine and their characteristics, methods of preparation and determining criteria of their identity, purity and strength Endeavours to determining the above were made by researchers all over the world and out of this common pool of scientific data the pharmacopocial monographs of single drugs and formulations were drafted And the result of these efforts are the several pharmacopoeias of the modern world with considerable commonness of approach and information, thus while for compilation of the modern pharmacopoeia universal need of information and scientific data was available for the compilation of the Ayurvedic Pharmacopoeia little information and published data existed and the Ayurvedic Pharmacopoeia Committee had to begin from a scratch.

18. While incorporating the experimental data like macrospopic pharmacognostic descriptions and chemical norms one must admit that the modern pharmacognosy had its gensis in Texts of Ayurvedic Nighantus where entire drug and drug plant have been minutely studied and eloquent sanskrit term used to describe the parts of plant that it projects a convincing picture of the drug and drug plant before the reader. The description of Casteroil plant—Ricinus communis. Linn. given by Bhav-parkash and of Guduchi (Tinospora cordifolia (Willd). Miers. are typical examples. Thus when we insist on the pharmacognostic study of each drug, we are really extending and expanding the Ayurvedic Pharmacognosy.

19. The Ayurvedic Pharmacopoeia of India Part-I, Vol I comprises of 80 monographs of Ayurvedic single drugs of plant origin, which go into one or more formulations enlisted in the Ayurvedic Formulary of India Part I. In compiling the monogaphs the title of each drug has been given in Sanskrit as already obtained in the Ayurvedic Formulary of India. Then comes the definition of the drug giving its identity in scientific nomenclature and very brief information about its source, occurrence, distribution and precautions in collection if any, etc.

20. This is followed by a list of synonyms in Sanskrit and also other Indian regional Languages The monograph then records the detailed gross or *Microscopic* description of the drug and its *Microscopi* tissue structures mentioning thickenings of the elements, deposition of crystals, starch grains hairy out growths etc, each having a pharmacognostic value in identification especially when the drug in powder form.

21. The monograph then gives norms and limits under "Identity, Purity and Strength" like tolerance of foreign matter, total ash, acid insoluble ash, alcohol soluble extractive, water soluble extractive volatile oil contents etc, some of them have a direct bearing on the purity and strength while others enable to detect substitution or adulteration, if any. Where possible, assay of one constituent or group of constituents like total alkaloids or total volatile oils has been given. However, under the heading constituents one or more constituents or group of constituents like oleoresins, essential oils, alkaloids have been mentioned which only have an informative value based on published research work in phytochemistry. In the case of water soluble or alcohol soluble extractives specification of lower limit have an added relevance to the maturity of the drug in addition to its authenticity. It will however, be worth mentioning that there is always a fair variation in crude drugs (raw materials)of Plant origin in respect of their chemical findings due to varied climatic conditions, geographical distribution, source and season of collection and lack of scientific methods of storage and preservation. Therefore, the variation of chemical findings created a great difficulty in fixing the standards of single drugs. However, the data has been fixed up by working out as many samples as possible procured from different sources.

22. Since the effort is to compile pharmacopoeial monographs of Ayurvedic drugs, the accent on the classical attributes of respective drugs according to the doctrine of Rasa, Guna, Virya, Vipaka and Karma has not been lost sight of, though some of them appear to be abstract and subjective in the absence of an established experimental methods to quantify them.

23. The Legal Notices and General Notices have been given for guidance of the analysts the Pharmaceutical suppliers and manufacturers and the research workers engaged in this field. Details about the apparatus, Reagents and solutions, tests, methods of preparation of specimens for microscopical examinations have been given in the appendices.

24. The Committee hopes that with the publication of the Ayurvedic Pharmacopoeia of India Part I, Vol. I, comprising of 80 single drugs of vegetable origin, the format and procedure has been laid down and the different research units under the Ministry of Health & Family Welfare in the I.S.M. Division would plan their research enquiries such that the output of work would be accelerated. At the same time, these 80 drugs would provide basic information and norms about these drugs to those research institutions which would be interested in an in-depth study of these drugs, the outcome of which might provide further data for incorporation to the extent it would be relevant to the second edition of the pharmacopoeia.

25. The Committee urges the Government of India to recommend the adoption of these monographs for the purposes of identity, purity and strength of drugs for use in their Government Semi-Government and Government aided institutions and voluntary public organisations. The Ayurvedic Pharmacopoeia of India, 1986, Vol. I, may also be notified by Government as a book of reference for implementation of the Drugs and Cosmetics Act, 1940, all over India.

26. On behalf of the Ayurvedic Pharmacopoeia Committee, I feel it my duty to place on records our sincere thanks and appreciation to the Government of India, State Governments, Institutions Councils and Scientists and Ayurvedic Scholars for their whole hearted co-operation in prepraring the monographs on Single Drugs. I thank all members of the Ayurvedic Pharmacopoeia Committee without whose co-operation this Volume would not have seen the light of the day. I sincerely thank Vaidya S.K. Mishra, Adviser (Ay. & Siddha) and Member-Secretary of the Committee and his collegues like Vaidya, Satish Chander Sharma ex-Deputy Adviser (Ay.) presently Managing Director, I.M.P.C.L., Mohan Dr. C.H.S. Sastry, Deputy Adviser (Ay.) and Dr. (Smt.) Santosh Arora, Asstt. Adviser (Ay.) ; Shri R.U., Ahmed. ex-Pharmacognosist (APC) and presently Senior Scientific Officer (Pharmacogonosy), P.L.I.M. Ghaziabad, ; Dr. Y.K.S. Rathore, Chemist (APC); Dr. G.C. Gaur, S.T.A. (Ayurveda); Dr. Chhote Lal R.A. (Ayurveda), Dr. A.K.S. Bhadoria, R.A. (Ayurveda); Shri Tansi, Ul-haq Haqqi, R.A. Botany); Shri Ashok Kumar, R. A. (Chemistry) for their sincere work in completing this task. Shri D.M. Sahni, ex-Asst. Secretary (APC); Shri J.L. Sharma, present Asstt. Secretary (APC); Shri H.S. Dahiya, Assistant; Shri Harish Chander, U.D.C.; Shri Yashwant Singh, U.D.C.; Shri Murli Dhar Sharma, Steno; Shri Rais Ahmed, Mrs. Surinder Mehmi, Shri P.V.S. Rao (L.D.C.), and other office collegues have done wonderful task in convening the meetings of the Committee and completion of this work, deserve my sincere thanks.

Dr. M.S. Ansari, Director, P.L.I.M., Ghaziabad and his collegues namely Dr. P.C., Srivastava and Dr. Janardhan Pandey have carried out major scientific work in preparing this Pharmacopoeia without whose active co-operation it would have been impossible to bring out this Volume.

Dr. V.N. Pandey, Director; Dr. K. Raghunathan, Deputy Director; Dr. Ramdas, Asstt. Director and Dr. O.P. Gupta, Asstt. director of C.C. R.A. S. have made significant contribution in completion of this task so I sincerely thank them also.

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

PROF. A.N. NAMJOSHI
Chairman
Ayurvedic Pharmacopoceia Committee

NEW DELHI
Dated

INTRODUCTION

1. The Ayurvedic system of medicine is prevalent in India since the Vedic period and as early as the dawn of human civilization. Though Ayurveda has undergone many changes in the course of its long history, it still remains the mainstay of medical relief to a large section of population of the nation. Due to urbanisation and dwindling of forests, the Vaidya by and large is no longer a self contained unit collecting and preparing his own medicines as before. He has now to depend on the newly developed agencies like one collecting and supplying the crude drugs and the other undertaking mass production of medicines in the Ayurvedic Pharmaceutical units run on commercial scale.

2. In view of the new trend in Ayurvedic Pharmaceutical field, Government of India considered it expedient to utilise the existing Drug and Cosmetics Act 1940, to also control to a limited measure the Ayurvedic, Siddha and Unani drugs by amending the Act.

3. The Act was accordingly amended in 1964, to ensure only a limited control over the production and sale of these medicines namely :—

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

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

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

4. To start with, development of standards for the identity purity and strength of single drugs and of formulations at a later stage, assumed importance for the effective enforcement of the provision of the Act, If the raw materials to be used in a medicine and stage by stage processes of manufacturer standardised, the final product namely, the compound formulations could be expected to confirm to uniform standards. The requirements that the list of ingredients bye displayed on the label will enable anlaysts in important cases to verify label claims and to that extent will bind the manufacturer to atrue claim. Arrangements to evolve and lay down physical, chemical and biological tests, where necessary, to identiy the drugs and ascertain their quality and to detect adulterations, are an urgent necessity of the profession. Setting up of Drug Standardisation Units, Research Centres, Drugs Testing Institutes and Central Drug Laboratories for Ayurvedic Medicines both at the All-India and Regional levels for this purpose are, therefore, essential. The several Committee appointed by the Government of India to assess and evaluate the status and practice of Ayurvedic Medicine have stressed the importance of preparing an Ayurvedic Pharmacopoeia.

5. Having regard to all these considerations, the Central Council of Ayurvedic Research recommended the constitution of Ayurvedic Pharmacopoeia Committee consisting of experts on Ayurveda and other sciences. The Government of India accepted the recommendations of the Central Council of Ayurvedic Research and constituted the First Ayurvedic Pharmacopoeia Committee vide their letter No. 14-8/62-ISM, dated the 20th September, 1962 for a period of three years with effect from the date of its first meeting under the Chairmanship of Col. Sir R. N. Chopra with the following members:—

1. Col Sir Ram Nath Chopra, Drugs Research Laboratory, Srinagar — *Chairman*
2. Vaidya B. V. Gokhale, 29/14-15, Erandavane, Deccan Gymkhana, Poona-4. — *Member*
3. Vaidya D. A. Kulkarni, Principal, Post Graduate Training Centre, in Ayurveda, Jamnagar. — *Member*
4. Kaviraj B. N. Sircar, 779-780, Nicholson Road, Kashmere Gate, Delhi-6. — *Member*
5. Shri A. N. Namjoshi, Navyug Mansion, 19-A Sleater Road, Bombay-7 — *Member*
6. Dr. B. B. Gaitonde, Professor of Pharmacology, Grant Medical College, Bombay. — *Member*
7. Dr. C. G. Pandit, Director, Indian Council of Medical Research, New Delhi. — *Member*
8. Dr. G. K. Karandikar, Dean, Medical College, Aurangabad. — *Member*

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9. Dr. G. S. Pande, Honorary Director, Indian Drug Research Association. 955-Sadashiv, Lakshmi Road, Poona-2. *Member*

10. Dr. M. V. Venkataraghava, Chellakoti, Nungabakkum, Madras-34. *Member*

11. Ayurvedacharya Kaladi K. Parameswaran Pillai, Laksmivilasam Vaidyasala, Vanchiyur, Trivandrum. *Member*

12. Dr. V. Narayanaswamy, 70, Tana Street, Vepery, Madras-7. *Member*

13. Vaidya P. V. Dhamankar Shastri, Pardeshi Lane, Panvel, District Kolaba, Bombay. *Member*

.S. K. Borkar, Drug Controller (India), Directorate General of Health Services, New Delhi. *Member*

15. Shri Bapalal G. Vaidya, Principal, O. H. Nazar Ayurveda Mahavidyalaya, Surat. *Member*

16. Kumari Savita Satakopan, Drugs Control Laboratory, Near Polytechnic, Highway 8, Baroda. *Member*

17. Vaidya Vasudev M. Dwivedi, Director of Ayurveda, Government of Gujarat, Ahmedabad. *Member*

18. Shri P. V. Bhatt, M. Sc., Chemist, The Ayurvedic Rasashala, Deccan Gymkhana, Poona-4. *Member*

19. Vaidya Ram Sushill Singh, Assistant Director of Ayurveda, Director of Medical Services, (Ayurveda), Govt. of U. P. *Member*

20. Dr. Y. Kondal Rao, Secretary, Indian Medical Practitioner's Co-operative Pharmacy & Stores Limited, Adyar, Madras-20. *Member*

21. Dr. V. Srinivasan, M. Sc., M.B.B.S., Ph. D., Director, Sarabhai Chemicals Research Institute, Shahibag, Ahmedabad-4. *Member*

22. Dr. C. Dwarakanath, Adviser in Indian System of Medicine, Ministry of Health, New Delhi. *Member-Secretary*

The Committee was assigned the following functions :—

1. To prepare an official Formulary in 2 parts :—
   (a) Single drugs, of whose identity and therapeutic value there is no doubt; and
   (b) Compound preparations which are frequently used in Ayurvedic practice throughout the country.

2. To provide standards for drug and medicines of therapeutic usefulness or pharmaceutical necessity sufficiently used in the Ayurvedic practice.

3. To lay down tests for identity, quality and purity.

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

5. To provide all other information regarding the distinguishing characteristics, methods of preparation, dosage, method of administration with various anupanas or vehicles and their toxicity.

6. As a first step in this direction the Ayurvedic Pharmacopoeia Committee started preparing the official Formulary of Ayurveda in two parts as mentioned under the assigned furnctions of the Committee. Since the work of preparation of Ayurvedic Formulary was in progress after the completion of first three years, the Government of India extended the term of the Committee by another three years vide their notification No. F. 20-1/66-RISM, dated 14th January, 1966, and gain for a further period of three years vide their notification No. F. 1-1/69-APC, dated 9th January, 1969.

7. The Government of India reconstituted the Ayurvedic Pharmacopoeia Committee with Prof. A. N. Namjoshi as Chairman in 1972 with the following members:

1. Prof. A. N. Namjoshi, M.Sc. MLA, Minister of Education & Sports, Maharashtra State, Sachivalaya, Bombay—32-Br. *Chairman*

2. Vaidya Vasudev M. Dwivedi, "Maruti", 1, Master Society, Rajkot—2 *Vice-Chairman*

3. The Drugs Controller (India) Ex-officio. .....

4. Kaviraj Purushotam Dev, Deputy Director (Ayurveda), Indian Medicine Pharmacy Buildings, Charminar, Hyderabad-2. *Member*

5. Shri S. Bhattacharya, Principal, Government Ayurvedic College, Gauhati. *Member*

6. Vaidya, R.R. Pathak, C/o Shri Baidyanath Ayurved Bhavan, (Private) Limited, Baidyanath Bhavan Road, Patna-1. *Member*

7. Kumari Savita Satakopan, Drugs Laboratory, National Highway No. 8, Baroda-2. *Member*

8. Dr. M. N. Kesavan Pillai, Hony, Director, Central Reseach Institute for Ayurveda Cheruthuruthy, VIA Shoranur, Kerala. *Member*

9. Dr. R. D. Jaiswal, Joint Director of Ayurveda, Government of Madhya Pradesh, Bhopal. *Member*

10. Dr. B. M. Sharma Principal Government College of Indian Medicine and Hospital, Bangalore-2. *Member*

11. Dr. V. T. Kasturi, Managing Editor, National Integrated Medical Association, 307, Erangere, Ashok Road, Mysore-1. *Member*

12. Pt. Keerti Sharma, Project Officer, Central Research Institute for Ayurveda, Patiala. *Member*

13. Dr. G. K. Bhatt, Officer-in-Charge, Regional Research Institute for Ayurveda, Madhovilas Palace, Amer Road, Jaipur. *Member*

14. Kaviraj K. P. Atreya, Principal's Staff Quarter, Ayurvedic Unani Tibbia College, Karol Bagh, New Delhi. *Member*

15. Kaviraj Ashutosh Majumdar, 90/8-Cannaught Circus, New Delhi-1. *Member*

16. Vaidya P. V. Sharma, Professor of Dravyaguna, Post Graduate Institute of Indian Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi. *Member*

17. Dr. V. N. Sharma, Professor of Pharmacology, S. M. S. Medical College, Jaipur (Rajasthan). *Member*

18. Shri Prajapati Joshi, Office-in-Charge, Amalgamated Units (CCRIM & H) Government Pharmaceutical Laboratory, Ranikhet. *Member*

19. Dr. (Mrs.) Assema Chatterji, Professor of Chemistry, Calcutta University, Calcutta *Member*

20. Dr. P. N. V. Kurup, Adviser, Indigenous Systems of Medicine, Department of Health, Nirman Bhavan, New Delhi-11. *Member Secretary*

The reconstituted Committee initiated the work of identification and authentication of single drugs of plant, animal and mineral sources of important ingredients of the compound preparations of the formulary, in the light of various scientific parameters and other expertise on the subject available in the country and also on the basis of genuine and authentic drug samples approved by the physicians and experts from the manufacturing side. After the completion of this responsible job of authentication and identification, the list of single drugs was approved by the Ayurvedic Pharmacopoeia Committee and was included in the Ayurvedic Formulary of India, Part-1. The Committee after through scrutiny of the compound formulations and the single drugs published the First Part of the Ayurvedic Formulary of India in 1978.

8. A considerable initial period of the Committee had to be devoted to the completion of Ayurvedic Formulary of India, which was the essential pre-requisite for compilation of the Ayurvedic Pharmacopoeia. But for feeding each monograph of a single drug, a considerable laboratory data under the approved formate was necessary. A study of published literature on the subject revealed that such comprehensive and authenticated data was not available. As a result the Committee had to turn to its own expertise available at the Pharmacopoeial Laboratory for Indian Medicine (P.L.I.M.) Ghaziabad which was established in 1970 and the several survey and Drug Standardisation units of the Central Council for Research in Ayurveda and Siddha (CCRAS), New Delhi,for working out standards and norms for the single drugs in the first instance and the compound medicines and formulations later. Knowing the fact that the technical data required for compilation of monographs was not universally available in respect of the Indian drug species, unlike the pharmacopoeia of modern drugs, the compilation had to

be based on an extensive experimental data to be produced in our own laboratories. Recommendations were therefore made to Government to strengthen the research staff at the different venues where such work was assigned.

9. Realising the need for a planned continued work and the pioneering effort that was made in the country the Government of India once again reconstituted the Ayurvedic Pharmacopoeia Committee and its 2 sub-committees vide their notification No. X. 19011/7/81-APC dated 5th December, 1981 with the following Members and assigned functions as under:—

Ayurvedic Pharmacopoeia Committee

1. Prof. A. N. Namjoshi, A-19, Navyug Mansion, N. Bharucha Road, Bombay—400007 (Maharashtra)	*Chairman*
2. Vd. Vasudev M. Dwivedi, "Maruti", 1, Master Society, Rajkot, (Gujarat).	*Member*
3. Vd. P.V. Sharma, 39 Gurdham Colony, Varansi—1.	*Member*
4. Shri Prajapati Joshi, Officer-in-Charge, Amalgamated Units of CCRAS, Govt. Pharmaceutical Laboratory, Tarikhet (Ranikhet)—263663.	*Member*
5. Kvj. A. T. Sharma, Siromani Press, Beshaja Mandir Berhampur —2(Gujarat), Orissa.	*Member*
6. Prof. P.N. Mehra, Bungalow No. 1055, Sector 27-B, Chandigarh.	*Member*
7. Dr. K. K. Purushotaman, Assistant Director, Captain Srinivasa Murti, Drug Research Institute for Ayurveda (CCRAS), A.A. Govt. Hospital Campus, Arubakam, Madras—600029. (Tamil Nadu).	*Member*
8. Vd. Hari Dutt Shastri, Director Mool Chand Khairatiram Ayurveda Hospital, Lajpat Nagar, III, New Delhi.	*Member*
9. Vd. K.S. Warrier, Chief Pysician, The Arya-Vaidya Pharmacy (cbe) Ltd. 366, Trichy Road, Coimbatore-641018 (Tamil Nadu).	*Member*
10. Dr. S.P. Gupta, Director of Ayurvedic and Unani Services, Govt. of Uttar Pradesh Lucknow.	*Member*
11. Dr. S.S. Ghotoskar- D. C. (1) D. G. H. S. New Delhi.	*Member*
12. Vd. S. K. Mishra- Advisor (Ay. & Siddha) Ministry of Health & F.W. New Delhi.	*Member*

The following seven members were further nominated and added to this Committee ;

1. Kum. Savita Satakopan Senior Scientific Officer, Food & Drugs Laboratory, Near Polytechnic, Vadodara—390002 (Gujarat)	*Member*
2. Dr. S. A. Vasavada, (Ashirvad), Opp, Pratap Vilas, Jamnagar 361001 (Gujarat).	*Member*
3. Dr. Lalitha Michael, Chief Superintendent. Govt. Central Pharmacy Ashoka pillar Circle, I Block, Jayangar, Bangalore—560011. (Karnataka).	*Member*
4. Dr. Nagesh Dwivedi, Director of Indigenous Systems of Medicine, Govt. of Bihar, Patna (Bihar).	*Member*
5. Dr. Chennabasappa, Director of Indian Systems of Medicine and Homoeopathy, Directorate of Indian Systems of Medicine & Homoeopathy, Government of Karnataka, Anandar Circle, Bangalore—9 (Karnataka).	*Member*
6. Prof. C. P. Shukla, "Anil" 3., Patel Colony, Jamnagar—361008 (Gujarat).	*Member*
7. Shri Nanak Chand Sharma, Ayurvedacharaya and Ayurved Brahaspati, Kayamaya Ayurvedic Pharmaceutical Works (Pvt.) Ltd., 8/3552, Regar Pura, Karol Bagh, New Delhi—110005.	*Member*

Functions :—(a) To prepare remaining parts of the official formulary of compound preparations which are currently used in Ayurvedic practices in the country including standardised compositions, methods of preparation, dosage, toxicity and administration with various anupanas or vehicles.

(b) To prepare a Pharmacopoeia of Ayurvedic single drugs which have been included in the official formulary.

(c) To prescribe the working standards for compound formulations including tests for identity parity and quality so as to ensure uniformity of the finished formulations.

(d) Keeping in view the time constraint, to identify such methods, procedures and plan of work as would enable the Formulary and standards of all commonly used drugs to be brought out in a phased manner within five years.

(e) The entire Pharmacopoeia should be released in convenient instalments within five years.

The Sub-Committee were reconstituted with the following members ;

(1) **Formulary Sub-Committee :**

1. Prof. A. N. Namjoshi, Bombay . . . . . *Chairman*
2. Kj. A. T. Sharma, Behrampur . . . . . *Member*
3. Vd. Vasudev Dwivedi, Rajkot . . . . . Do.
4. Vd. Hari Dutt Shastri, New Delhi . . . . . Do.
5. Vd. K. S. Warrier, Coimbatore . . . . . Do.
6. Vd. S. K. Mishra . . . . . *Member-Secretary*

Functions :

1. To suggest priority formulations to be included in next para of the Formulary.
2. To work out the details of formulations as per approved format to be included in remaining parts of the Ayurvedic Formulary.

(2) **Drug Standardisation Sub-Committee:**

1. Prof. A. N.Namjoshi, Bombay . . . . . *Chairman*
2. Vaidya Priyavrat Sharma, Varanasi . . . . . *Member*
3. Shri Prajapati Joshi, Ranikhet . . . . . Do.
4. Prof. P. N. Mehra, Chandigarh . . . . . Do.
5. Vaidya S. K. Mishra, New Delhi . . . . . *Member-Secretary*

Functions :—(a) To prepare monographs on Single Drugs (about 800 in five years period) providing information on identity, vernacular names, descriptions etc. The monographs may, if considered feasible, be limited to certain physical, chemical physico-chemical and pharmacognostical standards.

(b) To lay down standards for compound formulations.

(c) To stipulate the packaging and storage conditions.

(d) To recommend permissible colour and preservatives that may be added to individual or groups of formulations.

The reconstituted Ayurvedic Pharmacopoeia Committee has finalisd the Ayurvedic Formulary of India Part-II and the revised Hindi Version of Part-I of Ayurvedic Formulary of India which is in press.

In order to carry out functions smoothly a Working Group consisting of the following members was constituted by the A. P. C. at its meeting held on 30th & 31st of August 1982.

1. Prof. A. N. Namjoshi . . . . . *Chairman*
2. Shri Prajapati Joshi . . . . . *Member*
3. Dr. M. S. Ansari . . . . . Do.
4. Vaidya S. K. Mishra . . . . . *Member-Secretary*

Constitution of Working Group:—18 meetings of Working Group of A. P. C. were held during 1982—85 in order to authenticate technical data received from P. L. I. M. Ghaziabad Food and Drug Laboratory, Vadodara, Standardisation Units of the Central Council of Research in Ayurveda and Siddha, all State Directors of ISM including individual Vaidyas/Scientists in different regions of the country and also the information available from Universities and Ayurvedic Colleges and on the basis of the published data on the subject, before incorporating the data in the monographs. In each and every monograph Popular names, Synonyms in Indian languages, Description (Macroscopic and Microscopic), Identity, Purity and Strength, Constituents, Properties and Actions (Rasna, Guna, Virya, Vipaka, Karma and Prabhava) Important formulations, Therapeutic uses and Doses have been described in brief and in technical terms.

At its meeting held on 25th and 26th March, 1985, the Ayurvedic Pharmacopoeia Committee constituted 2 small committees. One committee was meant to approve the sanskrit references to be added as Annexure to the monographs of single drugs. This committee constituted of the following members :

1. Prof. P. V. Sharma.
2. Vaidya Nanak Chand Sharma.
3. Dr. K. Raghunathan.
4. Dr. Satyapal Gupta.

The Second Committee was meant to edit the monographs including the Introduction, General Notices, Legal Notices etc. and consisted of the following members:

1. Prof. A. N. Namjoshi.
2. Prof. P. V. Sharma.
3. Km. Savita Satakopan.
4. Shri Prajapati Joshi.

The aforesaid committees finalised the 80 monographs on Single Drugs entering into the formulations mentioned in Ist Part of the Ayurvedic Formulary of India. The working format of laying down the standard on single drugs of plant origin was prepared more or less on the pattern of different Pharmacopoeia of modern system viz. Indian Pharmacopoeia (I. P.), British Pharmacopoeia (B.P.), United State Pharmacopoeia (U.S.P.) and the State Pharmacopoeia of the Union of Soviet Socialist Republic with certain innovations. Every attempt has been made on priority basis to select for description the important drugs which are included in the Ayurvedic Formulary of India, Part-I. The present edition includes to the extent possible the scientific data/information received from authentic sources.

The Committee, while appreciating the efforts made by the Government of India to initiate the work on standardisation is aware of the fact that steps taken so far have been inadequate and need to be further accelerated. Therefore, the Committee very strongly recommends that Government will expedite the establishment of Laboratories for standardisation work and setting up of drug farms where genuine and authentic drugs may be cultivated for this purpose. As Government is aware that the vast majority of the population in the country depends and have faith on indigenous drugs, it is therefore, necessary that standardisation of drugs should be taken up on priority basis. The Committee also hopes that the Government will take suitable steps to strengthen P. L. I. M. Ghaziabad as well as different Research and Standardisation Units of C. C. R. A. S. on modern scientific lines, so that the main task of bringing out the Ayurvedic Pharmacopoeia in convenient instalments, on single drugs and compound formulations could be effectively carried.

MONOGRAPHS

AJAGAN DHĀ

Ajagandhā consists of the seeds of *Cleome gynandra* Linn. Syn. *Gynandropsis gynandra* (Linn.) Briquet (Fam. Capparidaceae); a strong smelling, somewhat foetid herb, 0.6—1 m high, found abundantly throughout warmer parts of India.

SYNONYMS—

Aansk.	:	Paśugandhā
Assam.	:	Bhutmulla
Beng.	:	Hurhuria, Shulte
Eng.	:	Dog Mustard
Guj.	:	Talvani, Dhelitalavan
Hindi	:	Hulhul, Hurhur, Kavalia
Kan.	:	Naram bele Soppu, Nayeetulasi
Kash.	:	Gandi Buti
Mal.	:	Atunari vela
Mar.	:	Tilvan, Bhatvan, Mabli, Tilavana, Tilvant
Ori.	:	Anasorisia, Anasorisa
Punj.	:	Bugra
Tam.	:	Nal valai, Nal velai
Tel.	:	Vaminta, Vayinta

DESCRIPTION—

(a) **Macroscopic**—Seeds, small, 1-2 mm in diameter, kidney shaped, surface rough, dark brown or black.

(b) **Microscopic**—Dark brown, oily; under microscope shows a number of fragments of epidermis of testa consisting of thin-walled, polygonal cells; groups of cells, resembling like stone cells, reddish-brown with non-lignified walls; a large number of oval, rounded or irregularly shaped protein bodies; starch and crystals absent.

IDENTITY, PURITY AND STRENGTH—

Foreign matter — Not more than 2 per cent, Appendix 2·2·2.

Total ash — Not more than 7 per cent, Appendix 2·2·3.

Acid-Insoluble ash — Not more than 0·4 per cent, Appendix 2·2·4.

Alcohol-soluble extractive— Not less than 16 per cent, Appendix 2·2·6.

Water-solnble extractive — Not less than 7 per cent, Appendix 2·2·7.

CONSTITUENTS— Fixed oil, essential oil and oleoresin.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Hṛdya, Dipana, Vātahara, Pittala, Śūlaghnī

IMPORTANT FORMULATIONS— Nārāyaṇa cūrṇa.

THERAPEUTIC USES— Gulma; Aṣṭhīlā; Kṛmiroga; Kaṇḍū, Karṇaroga.

DOSE— 1—3 g of the drug in powder form.

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AJAMODĀ

Ajamodā consists of dried, aromatic fruits of *Apium leptophyllum* (Pers.) F. V. M. ex Benth. (Fam. Umbelliferae); an annual herb cultivated in Andhra Pradesh, Gujarat, Madhya Pradesh and Karnataka; collected by thrashing plants on a mat and dried in shade or in drying sheds.

SYNONYMS—

Sansk.	:	Dīpyaka
Assam.	:	Bonjamani, Bonajain, Yamani, Ajowan
Beng.	:	Randhuni, Banyamani
Guj.	:	Bodi Ajamo, Ajamo
Hindi	:	Ajmuda, Ajmod
Kan.	:	Oma, Ajavana, Omakki
Kash.	:	Fakhazur, Banjuan
Mal.	:	Ayamodakum, Oman
Mar.	:	Ajmoda, Oova
Ori.	:	Banajuani
Punj.	:	Valjawain, Ajmod
Tam.	:	Omam
Tel.	:	Nuranji vamu
Urdu	:	Ajmod

DESCRIPTION—

(a) **Macroscopic**—Drug consists of small, ovoid fruit; bulk colour yellowish brown, mainly occur as entire cremocarps with pedicel attached or detached and bifid stylopod, free ends curved sometimes occurs as separate mericarps; cremocarps glabrous, ovoid to conical, about 1·5—3·0 mm long and 1·2—2·8 mm wide, yellow to yellowish green; separated mericarps broadly ovoid, more or less curved, dorsal surface convex with five equally distinct, longitudinal primary ridges; at the summit curved stylopodium, commissural surface flat, showing darker and light coloured longitudinal bands, former representing the position of vittae and vascular bundles; odour, aromatic; taste, slightly bitter giving a sensation of warmth to tongue.

(b) **Microscopic**—Transverse section of fruit shows mericarps with four large vittae on dorsal surface, two on commissural surface and four primary ridges on dorsal surface; 3—5 secondary oil canals present under each primary ridge and also between ridges; carpophore present on commissural surface; epicarp cells with thin striated cuticle, outer walls drawn into papillae; stomata, anomocytic type upto 35 μ in diameter; mesocarp consists of polygonal parenchyma with thickened and lignified cells, measuring 30—62—95μ in diameter with oval to ronud pits; collateral vascular bundles lie beneath epicarp; tracheids 25—203—388 μ in length with spiral, scalariform or reticulate thickenings; xylem parenchyma lignified, elongated with elliptical pits, measuring 52—118—176 by 13—30—44 μ, large secondary vittae towards endosperm measure upto 123μ in width and towards periphery the smallest vittae measuring 184μ in diameter.

Powder—Shows moderately thick-walled cell of epicarp exhibiting characteristic striations and occasional presence of stoma, fragments of trichomes and glandular hairs, reticulate parenchymatous cells of mesocarp, fragments of yellowish-brown vittae; fragments of endosperm thick-walled polygonal cells containing aleurone grain and microrosette crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH—

Foreign matter (including stalk)	—Not more than 5 per cent, Appendix 2·2·2.
Total ash	—Not more than 14 per cent, Appendix 2·2·3.
Acid-insoluble ash	—Not more than 4 per cent, Appendix 2·2·4.
Alcohol-soluble extractive	—Not less than 14 per cent, Appendix 2·2·6.
Water-soluble extractive	—Not less than 3 per cent, Appendix 2·2·7.
Volatile oil	—Not less than 2 per cent v/w, Appendix 2·2·10.

CONSTITUENTS—Essential oil and fixed oil.

NOTE :—*Trachyspermum roxburghianum* (DC) Sprague Syn. *Carum roxbrghianu* Benth. Hook. f. is the common marke ubstitute.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Vidāhī, Kaphavātajit, Dīpana, Rucikṛt, Kṛmijit, Śūlaghna

IMPORTANT FORMULATIONS— Ajamodārka; Ajamodādi cūrṇa.

THERAPEUTIC USES— Aruci; Ādhmāna; Gulma; Hikkā; Chardi Kṛmi roga; Śūla.

DOSE— 1—3 g of the drug in powder form.

ĀMALAKĪ (Fresh)

Āmalakī consists of fresh fruit pulp of *Emblica officinalis* Gaertn. (Fam. Euphorbiaceae); a small or medium sized tree, found in mixed deciduous forests, ascending to 1300 m on hills and cultivated in gardens and homeyards.

SYNONYMS —

Sansk.	:	Āmalaka, Amṛtaphala, Dhātrīphala
Assam.	:	Amlaku, Amlakhi, Amlakhu
Beng.	:	Amla, Dhatri
Eng.	:	Emblic Myrobalan
Guj.	:	Ambala, Amala
Hindi	:	Amla, Aonla
Kan.	:	Nellikayi
Kash.	:	Embali, Amli
Mal.	:	Nellikka
Mar.	:	Anvala, Avalkathi
Ori.	:	Anala, Ainla
Punj.	:	Aula, Amla
Tam.	:	Nellikkai, Nelli
Tel.	:	Usirika
Urdu	:	Amla, Amlaj

DESCRIPTION :—

(a) **Macroscopic**—Fruit, globose, 2.5—3.5 cm in diameter, fleshy, smooth with six prominant lines; greenish when tender, changing to light yellowish or pinkish colour when mature, with a few dark specks; taste, sour and astringent followed by delicately sweet taste.

(b) **Microscopic**—Transverse section of mature fruit shows an epicarp consisting of single layer of epidermis and 2-4 layers of hypodermis; epidermal cell, tabular in shape, covered externally with a thick cuticle and appear in surface view as polygonal; hypodermal cells tangentially elongated, thick-walled, smaller in dimension than epidermal cells; mesocarp forms bulk of fruit, consisting of thin-walled parenchymatous cells with intercellular spaces, peripheral 6-9 layers smaller, ovoid or tangentially elongated while rest of cells larger in size, isodiametric and radially elongated; several collateral fibrovascular bundles scattered throughout mesocarp consisting of xylem and phloem; xylem composed of tracheal elements, fibre tracheids and xylem fibres; tracheal elements show reticulate, scalari form and spiral thickenings; xylem fibres elongated with narrow lumen and pointed end; mesocarp contains large aggregates of numerous irregular silica crystals.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 7 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive (On dried basis)	— Not less than 40 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 50 per cent, Appendix 2.2.7.
Moisture content	— Not less than 80 per cent, Appendix 2.2.9.

CONSTITUENTS—Ascorbic acid and tannins.

PROPERTIES AND ACTION—

Rasa	:	Amla, Kaṣāya, Madhura, Tikta, Kaṭu
Guṇa	:	Rūkṣa, Laghu
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Tridoṣajit, Vṛṣya, Rasāyana, Cakṣuṣya

IMPORTANT FORMULATIONS— Cyavanaprāśa.

THERAPEUTIC USES— Raktapitta; Amlapitta; Prameha; Dāha.

DOSE— 10—20 g of the drug.
5—10 ml of fresh juice.

ĀMALAKĪ (Dried)

Āmalakī consists of pericarp of dried mature fruits of *Emblica officinalis* Gaertn. Syn. *Phyllanthus emblica* Linn. (Fam. Euphorbiaceae); mostly collected in winter season after ripening and in Kashmir in summer, a small or medium sized tree, found both in natural state in mixed deciduous forests of the country ascending to 1300 m on hills; cultivated in gardens, homeyards or grown as a road side tree.

SYNONYMS—

Sansk.	:	Āmalaka, Amṛtaphala, Dhātrīphala
Assam.	:	Amlaku, Amlakhi, Amlakhu
Beng.	:	Amla, Dhatri
Eng.	:	Emblic Myrobalan
Guj.	:	Ambala, Amala
Hindi	:	Amla, Aonla
Kan.	:	Nellikayi, Bela nelli, pottadenollikayi
Kash.	:	Embali, Amli
Mal.	:	Nellikka
Mar.	:	Anvala, Avalkathi
Ori.	:	Anala, Ainla
Punj.	:	Aula, Amla
Tam.	:	Nellikkai, Nelli
Tel.	:	Usirika
Urdu	:	Amla, Amlaj

DESCRIPTION—

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

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

Powder—Fine powder shows epidermis with uniformaly thickened straight walled, isodiametric parenchyma cells with irregular thickened walls, occassionally short fibres and tracheids.

IDENTITY, PURITY AND STRENGTH—

Foreign matter (including seed and seed coat) — Not more than 3 per cent, Appendix 2.2.2.

Total ash — Not more than 7 per cent, Appendix 2.2.3.

Acid-insoluble ash — Not more than 2 per cent, Appendix 2.2.4.

Alcohol-soluble extractive — Not less than 40 per cent, Appendix 2.2.6.

Water-soluble extractive — Not less than 50 per cent, Appendix 2.2.7.

CONSTITUENTS— Ascorbic acid and gallotannins.

PROPERTIES AND ACTION—

Rasa	:	Amla, Kaṣāya, Madhura, Tikta, Kaṭu
Guṇa	:	Rūkṣa, Laghu
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Tridoṣajit, Vṛṣya, Rasāyana, Cakṣuṣya

IMPORTANT FORMULATIONS— Cyavanaprāśa; Dhātrī lauha; Dhātryādi ghṛta; Triphalā cūrṇa.

THERAPEUTIC USES— Raktapitta; Amlapitta; Prameha; Dāha.

DOSE—3—6 g of the drug in powder form.

ĀRAGVADHA

Āragvadha consists of pulp obtained from fruits (devoid of seeds, septa and pieces of pericarp) of *Cassia fistula* Linn. (Fam. Leguminosae); a moderate sized deciduous tree, common throughout India as wild or cultivated plant; fruits collected when ripe.

SYNONYMS—

Sansk.	:	Kṛtamāla, Vyādhighāta, Śampāka, Nṛpadruma
Assam.	:	Sonaroo
Beng.	:	Sondala
Eng.	:	Indian Laburnum, Purging cassia
Guj.	:	Garamala, Garmalo
Hindi	:	Amaltas
Kan.	:	Aragvadha, Kakke, Kakke-gida, Kakkemara, Kakkedai, Rajataru
Kash.	:	Kriyangal Phali
Mal.	:	Konna, Kritamalam
Mar.	:	Bahava, Garamala, Amaltas
Ori.	:	Sunari
Punj.	:	Amaltas
Tam.	:	Sarakonrai, Sarakkonnai, Sarakkondi, Sharakkonrai
Tel.	:	Rela
Urdu	:	Khiyar Shambar

DESCRIPTION—

Macroscopic—Fruit, a many celled, indehiscent pod, 35-60 cm long and 18-25 mm in diameter, nearly straight and subcylindrical, chocolate-brown to almost black in colour; pod surface smooth to naked eye, but under lens showing minute transverse fissures; both dorsal and ventral sutures evident, but not prominent; short stalk attached to base of fruit and rounded distal end mucronate; pericarp thin, hard and woody; fruit initially divided by transverse septa about 5 mm, apart, each containing a single seed attached to ventral suture by a long dark, thread-like funicle about 8-12 by 6-8 mm, circular to oval, flattened, reddish-brown, smooth, extremely hard and with a distinct dark brown line extending from micropyle to base; seed initially embedded in a black viscid pulp consisting of black, thin, shining, circular disc like masses having central depression of seed on both surfaces or as broken pieces adhered with each other; when dipped in water, makes yellow soultion which darkness to brownish-yellow to dark brown, on keeping; pulp fills the cell but shrinks on drying and adheres to both sides of testa; seeds often lye loose in their segments; odour faint, sickly; taste, sweet.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	6 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	15 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	46 per cent, Appendix 2.2.7.

CONSTITUENTS—Sugar, mucilage, pectin and anthraquinone.

PROPERTIES AND ACTION—

Rasa	:	Madhura, Tikta
Guṇa	:	Guru
Vīrya	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Recana

IMPORTANT FORMULATIONS— Āragvadhādi kvātha cūrṇa.

THERAPEUTIC USES— Vibandha; Udāvartta; Gulma; Śūla; Udararoga; Hṛdroga; Prameha.

DOSE— 5—10 g of the drug in powder form.

Note :—The market material contains seeds, septa etc. which form the Foreign Matter and should be separated before use.

ARKA (Root)

Arka consists of dried roots of *Calotropis procera* (Ait.) R. Br. (Fam. Asclepiadaceae); found wild more or less throughout India.

SYNONYMS—

Sansk.	:	Ravi, Bhānu, Tapana
Assam.	:	Akand, Akan
Beng.	:	Akanda, Akone
Eng.	:	Madar Tree
Guj.	:	Aakado
Hindi	:	Aak, Madar, Akavana
Kan.	:	Ekka, Ekkadagida, Ekkegida
Kash.	:	Acka
Mal.	:	Erikku
Mar.	:	Rui
Ori.	:	Arakha
Punj.	:	Ak
Tam.	:	Vellerukku, Erukku
Tel.	:	Jilledu
Urdu	:	Madar, Aak

DESCRIPTION—

(a) **Macroscopic**—*Root*—rough, fissured longitudinally, corky and soft; externally yellowish-grey while internally white, central core cream coloured; bark easily separated from xylem; odour, characteristic; taste, bitter and acrid.

(b) **Microscopic**—Transverse section of root shows outer most cork tissue consisting of 4—8 rows of tangentially elongated and radially arranged cells followed by 3—6 rows of moderately thick-walled, irregular cells of secondary cortex devoid of calcium oxalate crystals and starch grains; cortex composed of large polyhedral parenchymatous cells containing abundant rounded starch grains, some cortical cells contain rosette crystals of calcium oxalate; scattered laticifer cells with brown contents; phloem consists of sieve elements and phloem parenchyama; sieve tubes thick-walled, cells more prominent towards inner region of phloem traversed by uni-to-tetraseriate medullary rays; phloem cells contain crystals of calcium oxalate, starch grains and laticifers similar to these found in cortex; cambium present just within the phloem consisting of 2—5 rows of thin-walled, tangentially elongated cells; xylem forms the central part of root composed of vessels, tracheids, fibres and xylem paren chyma; vessels present throughout xylem region and arranged radially in groups of 2—7, sometime single vessels also occur, usually cylindrical having bordered pits on their walls, xylem fibres long, lignified with wide lumen, tapering on ends and have simple pits on walls; medullary rays 1—4 seriate and triseriate in outer region and uni or biseriate in inner region; cells of medullary rays radially elongated, filled with starch similar to those presant in cortical cells.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 2 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 8 per cent, Appendix 2.2.7.

CONSTITUENTS—Glycoside (calotropin).

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphavātahṛt, Dīpana, Bhedana, Kṛmighna, Vraṇahara, Viṣaghna, Kuṣṭhaghna

IMPORTANT FORMULATIONS— Mahāviṣagarbha taila; Dhānvantara ghṛta.

THERAPEUTIC USES— Kaṇḍū; Kuṣṭha; Kṛmiroga; Gulma; Udararoga; Vraṇa; Śvāsa.

DOSE— 1—3 g of the drug for decoction.

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ARKA (Leaf)

Arka consists of dried leaves of *Calotropis procera* (Ait.) R.Br. (Fam. Asclepiadaceae); found wild more or less throughout India.

SYNONYMS—

Sansk.	:	Ravi, Bhānu, Tapana
Assam.	:	Akand, Akan
Beng.	:	Akanda, Akone
Eng.	:	Madar Tree
Guj.	:	Akado
Hindi	:	Aak, Madar, Akavana
Kan.	:	Ekka, Ekkadagida, Ekkegida
Kash.	:	Acka
Mal.	:	Erikku
Mar.	:	Rui
Ori.	:	Arakha
Punj.	:	Ak
Tam.	:	Vellerukku, Erukku
Tel.	:	Jilledu
Urdu	:	Madar, Aak

DESCRIPTION—

(a) **Macroscopic**—Sub-sessile, 6—15 cm by 4.5—8 cm, broadly ovate, ovate-oblong, elliptic or obovate acute, pubescent when young and glabrous on both sides on maturity.

(b) **Microscopic**—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 21 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 5 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 24 per cent, Appendix 2.2.7.

CONSTITUENTS—Glycoside (Calotropin).

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu, Sara, Snigdha
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Vātahṛt, Dīpana, Kṛmighna, Śopha, vraṇahara, Viṣaghna, Bhedana, Śvāsahara

IMPORTANT FORMULATIONS— Arkalavaṇa.

THERAPEUTIC USES— Śotha; Kaṇḍū; Kuṣṭha; Vraṇa; Kṛmiroga; Gulma; Śleṣmodara roga; Plīhāroga; Arsa; Śvāsa.

DOSE— 250—750 mg of the drug in powder form.

ASANA

Asana consists of heart-wood of *Pterocarpus marsupium* Roxb. (Fam. Leguminosae); a moderate to large sized, deciduous tree, upto 30 m high and 2.5 m in girth, with straight clear bole; found mostly throughout Gujarat, Madhya Pradesh Bihar and Orissa.

SYNONYMS—

Sansk.	:	Bījaka, Pītasāra, Asanaka, Bījasāra
Assam.	:	Aajar
Beng.	:	Piyasala, Pitasala
Eng.	:	Indian Kino Tree
Guj.	:	Biyo
Hindi	:	Vijayasara, Bija
Kan.	:	Bijasara, Asana
Kash.	:	Lal Chandeur
Mal.	:	Venga
Mar.	:	Bibala
Ori.	:	Piashala
Punj.	:	Chandan Lal, Channanlal
Tam.	:	Vengai
Tel.	:	Yegi, Vegisa
Urdu	:	Bijasar

DESCRIPTION :—

(a) **Macroscopic**—Drug occurs as irregular pieces of variable size and thickness, golden yellowish-brown with darker streaks; on soaking in water gives yellow colour solution with blue fluorescence strong, tough, very hard, moderately heavy; fracture, difficult to break but brittle; taste, astringent.

(b) **Microscopic**—Transverse section shows alternating bands of larger and smaller polygonal cells consisting of tracheids, fibre tracheids, xylem parenchyma and traversed by xylem rays; numerous xylem vessels distributed throughout, in singles or in groups of 2—3, showing tyloses filled with tannin; in isolated preparations, vessels, drum or barrel shaped with well-marked perforation rims and bordered pits; tracheids numerous, long, thick-walled with tapering ends and simple pits; fibre tracheids elongated, thick-walled with narrow lumen and simple pits; xylem parenchyma rectangular with simple pits, paratracheal, surrounding vessels; xylem rays uni-to-biseriate, 3—5—7 cells high; prismatic crystals of calcium oxalate present in crystal fibres; starch absent.

Powder—Brown to chocolate colour; under microscope shows vessels with bordered pits; fibre tracheids, tracheids, fragments of xylem rays and few crystal fibres; starch absent.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	2 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	7 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	5 per cent, Appendix 2.2.7.

CONSTITUENTS—Alkaloids and resin.

PROPERTIES AND ACTION—

Rasa : Kaṣāya, Kaṭu, tikta.

Guṇa : Laghu, Rūkṣa

Vīrya; : Uṣṇa

Vipāka : Kaṭu

Karma : Kaphapittaśāmaka; Galadoṣaghna, Keśya, Tvaccya, Stambhana, Kuṣṭhaghna, Rasāyana, Raktaśodhana

IMPORTANT FORMULATIONS— Nyagrodhādi cūrṇa; Asanabilvādi taila.

THERAPEUTIC USES— Pāṇḍu; Prameha; Medodoṣa; Kuṣṭha; Kṛmiroga.

DOSE— 50—100 g of the drug for decoction.

AŞOKA

Aśoka consists of dried stem bark of *saraca asoca* (Rosc.) Dc. Willd. Syn. *Saraca indica* Linn. (Fam. Leguminosae); collected in spring from mature, wild or cultivated trees; found in Central and Eastern Himalayas, Western Ghats and Deccan.

SYNONYMS—

Sansk.	:	Kaṅkeli
Assam	:	Ashoka
Beng.	:	Ashoka
Eng.	:	Asok Tree
Guj.	:	Ashoka
Hindi.	:	Ashoka
Kan.	:	Ashokadamara, Ashokamara, Kankalimara
Kash.	:	Ashok
Mal.	:	Asokam
Mar.	:	Ashok
Ori.	:	Ashoka
Punj.	:	Asok
Tam.	:	Asogam, Asogu, Asokam
Tel.	:	Ashokapatta

DESCRIPTION—

(a) **Macroscopic**—Bark channelled, externally dark green to greenish grey; smooth with circular lenticels and transversely ridged, sometimes cracked, internally reddish-brown with fine longitudinal strands and fibers; fracture splintery exposing striated surface; a thin whitish continuous layer is seen beneath the cork layer; taste, astringent.

(b) **Microscopic**—Transverse section of stem bark shows periderm consisting of a wide layer of cork, radially flattened, narrow cork cambium; secondary cortex wide with one or two continuous layers of stone cells with many patches of sclereids; parenchymatous tissue contains yellow masses and prismatic crystals; secondary phloem consists of phloem parenchyma, sieve tubes with companion cells and phloem fibres occuring in groups; crystal fibres present.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol (90 per cent) soluble extractive	— Not less than 15 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 11 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannins and a crystalline glycoside.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya, Tikta
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Grāhī, Varṇya, Hṛdya, Śothahara, Viṣaghna

IMPORTANT FORMULATIONS—Aśokāriṣṭa; Aśokaghṛta.

THERAPEUTIC USES— Asṛgdara; Apacī; Dāha; Raktadoṣa; Śotha.

DOSE— 20—30 g of the drug for decoction.

AŚVAGANDHĀ

Aśvagandhā consists of dried mature roots of *Withania somnifera* Dunal. (Fam. Solanaceae); a perennial shrub, found in waste land, cultivated field and open grounds throughout India; widely cultivated in certain areas of Madhya Pradesh and Rajasthan; roots collected in winter, washed and cut into short pieces.

SYNONYMS—

Sansk.	:	Hayagandhā, Vājigandhā
Assam.	:	Ashvagandha
Beng.	:	Ashvagandha
Guj.	:	Asgandha
Hindi	:	Asgandh
Kan.	:	Angarberu, Hiremaddina-gida
Kash.	:	Asagandh
Mal.	:	Amukkuram
Mar.	:	Asagandha, Askagandha
Ori.	:	Aswagandha
Punj.	:	Asgandh
Tam.	:	Amukkaramkizangu
Tel.	:	Pennerugadda
Urdu	:	Asgand

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	7 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	1 per cent, Appendix 2.2.4.
Alcohol (25 per cent) soluble extractive	— Not less than	15 per cent, Appendix 2.2.6.

ASSAY—Aswagandha consists of not less than 0.2 per cent of total alkaloids, when assayed as follows :—

Take about 30g accurately weighed of the powdered drug, cover with *Alcohol* (90 per cent) and allow to stand overnight. Extract for 6 hours so wet apparatus and concentrate to a syrup residue. Trea with 25, 20, 15 and 10 ml portions of 5 per cent **Sulphuric Acid** until complete extraction of alkaloid is affected.

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

CONSTITUENTS—Alkaloids and withanolides.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu
Vīrya	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Vātakaphāpaha, Balya, Rasāyana, Vājīkaraṇa

IMPORTANT FORMULATIONS— Aśvagandhādyariṣṭa; Aśvagandhādi leha; **Balāśvagandha** lākṣādi taila.

THERAPEUTIC USES— Kṣaya; Daurbalya; Vātaroga; Śotha; Klaibya.

DOSE— 3—6 g of the drug in powder form.

AŚVATTHA

Aśvattha consists of dried bark of *Ficus religiosa* Linn. (Fam. Moraceae); a large perennial tree, glabrous when young, found throughout the plains of India upto 170 m altitude in the Himalayas; largely planted as an avenue and roadside tree especially near temples.

SYNONYMS—

Sansk.	:	Pippala
Assam.	:	Ahant
Beng.	:	Asvattha, Ashud, Ashvattha
Eng.	:	Pipal tree
Guj.	:	Piplo, Jari, Piparo, Pipalo
Hindi	:	Pipala, Pipal
Kan.	:	Arlo, Ranji, Basri, Ashvatthanara, Ashwatha, Aralimara, Aralegida, Ashvathamara, Basari, Ashvattha
Kash.	:	Bad
Mal.	:	Arayal
Mar.		Pipal, Pimpal, Pippal
Ori.	:	Aswatha
Punj.	:	Pipal, Pippal
Tam.	:	Ashwarthan, Arasamaram, Arasan, Arasu, Arara
Tel.	:	Ravichettu

DESCRIPTION—

(a) **Macroscopic**—Bark occurs in flat or slightly curved pieces, varying from 1.0—2.5 cm or more in thickness; outer surface brown or ash coloured; surface uneven due to exfoliation of cork; inner surface smooth and somewhat brownish; fracture, fibrous; taste, astringent.

(b) **Microscopic**—Transverse section of bark shows compressed rectangular to cubical, thick-walled cork cells and dead elements of secondary cortex, consisting of masses of stone cells; cork cambium distinct with 3—4 rows of newly formed secondary cortex, mostly composed of stone cells towards periphery; stone cells found scattered in large groups, rarely isolated; most of parenchymatous cells of secondary cortex contain numerous starch grains and few prismatic crystals of calcium oxalate; secondary phloem a wide zone, consisting of sieve elements, phloem fibres in singles or in groups of 2 to many and non-lignified; numerous crystal fibres also present; in outer region sieve elements mostly collapsed while in inner region intact; phloem parenchyma mostly thick-walled; stone cells present in single or in small groups similar to those in secondary cortex; a number of ray-cells and phloem parenchyma filled with brown pigments; prismatic crystals of calcium oxalate and starch grains present in a number of parenchymatous cells; medullary rays uni to multiseriate, wider towards outer periphery composed of thick-walled cells with simple pits; in tangential section ray cells circular to oval in shape; cambium when present, consists of 2—4 layers of thin-walled rectangular cells.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 7 per cent, Appendix 2.2.3
Acid-insoluble ash	— Not more than 0.3 per cent, Appendix 2.2.4
Alcohol-soluble extractive	— Not less than 8 per cent, Appendix 2.2.6
Water-soluble extractive	— Not less than 9 per cent, Appendix 2.2.7

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CONSTITUENTS—Tannins.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya
Guṇa	:	Guru, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Kaphapittavināśī, Varṇya, Saṁgrāhī, Bhagnasandhānakara, Mūtrasaṁgrahaṇīya

IMPORTANT FORMULATIONS— Nyagrodhādi kvātha cūrṇa; Nyagrodhādi cūrṇa.

THERAPEUTIC USES— Vātarakta; Raktapitta; Vraṇa; Yonidoṣa; Prameha.

DOSE— 20—30 g of the drug for decoction.

ATASI

Atasi consists of dried, ripe seeds of *Linum usitatissimum* Linn. (Fam. Linaceae); an erect annual herb, 0.6—1.2 m high, extensively cultivated throughout the plains of India upto an altitude of 800 m; capsule ripen by end of June, dried seeds separated from capsule by thrashing.

SYNONYMS—

Sansk.	:	Umā, Kṣumā
Assam.	:	Tisi, Tusi
Beng.	:	Masina, Atasi
Eng.	:	Linseed,
Guj.	:	Alshi, Arasi
Hindi	:	Alsi
Kan.	:	Agasebeeja, Semeagare, Agasi
Kash.	:	Alsi
Mal.	:	Agastha, Agasi, Cheru charm
Mar.	:	Atshi
Ori.	:	Atushi
Punj.	:	Ali
Tam.	:	Ali, Virai
Tel.	:	Avisa
Urdu	:	Alsi, Katan

DESCRIPTION—

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

(b) **Microscopic**—Transverse section of seed shows testa consists of isodiametric cells with mucilaginous outer walls, collenchymatous cells of middle layer of seed coat cylindrical; single layered, yellowish brown, longitudinally elongated, about 120—190 μ long and 14—17 μ wide, thick, lignified and with pitted walls; single layer of flattened polygonal pigment cells with reddish-brown contents; aleurone grains in the cotyledons, upto 20 μ in diameter, each with globoid and crystalloid; abundant globule of fixed oil and occasional starch grains present.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 1 per cent, Appendix 2.2.2
Total ash	— Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	— Not less than 30 per cent, Appendix 2.2.6
Water-soluble extractive	— Not less than 15 per cent, Appendix 2.2.7
Fixed oil	— Not less than 25 per cent, Appendix 2.2.8

CONSTITUENTS—Fixed oil, mucilage and protein.

PROPERTIES AND ACTION—

Rasa	:	Madhura, Tikta
Guṇa	:	Snigdha, Guru
Vīrya	:	Uṣṇa
Vīpāka	:	Kaṭu
Karma	:	Vātaghna, Acakṣuṣya

IMPORTANT FORMULATIONS— Sarṣapādi pralepa.

THERAPEUTIC USES— Śiroroga; Kṛmiroga; Kuṣṭha; Prameha.

DOSE— 3—6 g of the drug in powder form.

ATIBALĀ

Atibalā consists of root of *Abutilon indicum* (Linn.) Sweet (Fam. Malvaceae); a hairy herb or under-shrub 1.0-1.5m high; annual or more often perennial with golden yellow flowers, flowering mostly throughout the year found abundantly throughout the hotter parts of India, as a common weed on road sides and other waste places in plains and hills, upto an elevation of 600 m.

SYNONYMS —

Sansk.	:	Kankatikā, Riṣyaproktā
Assam.	:	Jayavandha, Jayapateri
Beng.	:	Badela
Eng.	:	Indian Mallow
Guj.	:	Kansaki, Khapat
Hindi	:	Kanghi
Kan.	:	Shrimudrigida, Mudragida, Turube
Mal.	:	Uram, Katuvan, Urubam, Urabam, Vankuruntott, Oorpam, Tutti
Mar.	:	Chakrabhendi, Petari, Mudra
Ori.	:	Pedipidika
Punj.	:	Kangi, Kangibooti
Tam.	:	Tutti, Thuthi
Tel.	:	Tutturubenda

DESCRIPTION—

(a) **Macroscopic** :—Tap roots, fairly long with a numbr of lateral branches; 1.5—2 cm in diameter, light brown; outer surface smooth with dot like lenticels; bark thin and can be easily peeled off; odour, feeble; taste, astringent and bitter.

(b) **Microscopic**—Transverse section of root shows a thin cork of 4-7 or more tangentially elongated rectangular cells; cork cambium, single layered, and at the lenticel regions followed by 2-3 layers of secondary cortex of thin-walled, almost cubical or rectangular cells, containing small clusters of calcium oxalate in most of cells; phellogen followed by 3—4 layers of thin-walled cells of cortex, some cells of cortex which are above the conical strands of bast, crushed; small starch grains, 6—9 μ in diameter, present in some of the cells; phloem forms the major portions of bark and present as conical strands with their bases towards the wood and with dilate distal ends of the primary medullary ray in between them; fibres, present in groups of 10-12 in these conical strands, in tangential rows, alternating with thin-walled phloem elements, towards wood fibre groups, element in between the fibres mostly consists of phloem parenchyma, some cells contain cluster crystals of calcium oxalate and a few others have starch grains, some phloem cells towards periphery appear compressed and crushed; inner to phloem, a cambium present, consisting of 1—2 rows of narrow, thin-walled, rectangular cells; wood composed of vessels, wood fibres, wood parenchyma and medullary rays, vessels vary in diameter and arranged in radial groups of 2—4, also occur in singles, some cells show tyloses formation; parenchyma thick-walled and slightly wider than fibre cells, but less thickened; single or rarely compound starch grains present; tetrarch bundle or primary xylem present at the centre of wood; medullary rays uni or biseriate widen much towards distal ends, most of the ray cells contain starch grains and some contain cluster of calcium oxalate; starch grains present in wood larger than those of bark region, a few ray cells at centre of the root contain rhomboidal crystals.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 1.2.2.
Total ash	— Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 3 per cent, Appendix 2.3.4.
Alcohol-soluble extractive	— Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 9 per cent, Appendix 2.2.7.

CONSTITUENTS—Asparagin.

Properties and action—

Rasa	:	Madhura
Guṇa	:	Snigdha
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Grāhī, Vātahara, Balya, Vṛṣya

IMPORTANT FORMULATIONS— Balā taila, Nārāyaṇa taila; Mahā nārāyaṇa taila.

Therapeutic uses— Meha; Vātarakta; Raktapitta.

DOSE— 3—6 g. of the drug in powder form.

ATIVIṢĀ

Ativiṣā consists of dried, tuberous roots of *Aconitum heterophyllum* Wall. ex. Royle (Fam. Ranunculaceae); a perennial herb, native of western Himalayas and found in Garhwal, Kumaon and Kashmir at altitude between 2,500—4,000m.

SYNONYMS —

Sansk.	:	Aruṇā, Ghuṇapriyā, Viṣā
Assam.	:	Aatich
Beng.	:	Ataicha
Eng.	:	Atis Root
Guj.	:	Ativishni Kali, Ativikhani Kali
Hindi.	:	Atis
Kan.	:	Ativisha, Athihage
Mal.	:	Atividayam, Ativitayam
Mar.	:	Ativisha
Ori.	:	Atushi
Punj.	:	Atisa, Atees
Tam.	:	Ativadayam
Tel.	:	Ativasa
Urdu	:	Atees

DESCRIPTION —

(a) **Macroscopic**—Roots, ovoid-conical, tapering downwards to a point, 2.0—7.5 cm long, 0.4—1.6 cm or more thick at its upper extremity, gradually decreasing in thickness towards tapering end, externally light ash-grey, white or grey-brown, while internally starch white, external surface wrinkled marked with scars of fallen rootlet and with a rosette of scaly rudimentary leaves on top: fracture, short, starchy, showing uniform white surface, marked towards centre by 4—7 concentrically arranged yellowish-brown dots, corresponding to end of fibrovascular bundles traversing root longitudinally taste, bitter with no tingling sensation.

(b) **Microscopic**—Transverse section of mature root shows, single layered epidermis consisting of light-brown tabular cells rupturing on formation of cork; cork consists of 5—10 rows of tangentially elongated, thin-walled cells; cork cambium single layered consisting of tangentially elongated, thin-walled cells; cortex much wider consisting of tangentially elongated or rounded, thin-walled parenchymatous cells with intercellular spaces, cells fully packed with both simple as well as compound starch-grains, compound starch grains composed of 2—4 components of spherical body; endodermis distinct composed of barrel-shaped cells; elements of vascular bundles poorly developed, vascular bundles, arranged in a ring; inter-fascicular cambium present in form of a ring composed of few layered thin-walled cells; central core consisting of thin-walled parenchymatous cells, possessing starch grains similar to those found in cortical cells.

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

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 6 per cent, Appendix 2.2.6.
Water-Soluble extractive	— Not less than 24 per cent, Appendix 2.2.7.

CONSTITUENTS—Alkaloids (atisine, dihydroatisine, hetisined and heteratisine).

PROPERTIES AND ACTION —

Rasa : Tikta, Kaṭu

Guṇa : Laghu, Rūkṣa

Vīrya : Uṣṇa

Vipāka : Kaṭu

Karma : Dīpana, Pācana, Saṁgrāhikā, Kaphapittahara

IMPORTANT FORMULATIONS— Rodhrāsava; Śivā guṭikā; Lakaṣmīnārāyaṇa rasa; Mahāviṣagarbha taila; Rāsnairaṇḍādi kvātha cūrṇa; Sudarśana cūrṇa; Pañcatikta guggulu ghṛta; Bāla chaturbhadrikā cūrṇa.

Therapeutic uses— Jvara; Kāsa; Chardi; Amātisāra; Kṛmiroga.

DOSE— 0.6—2.0 g of the drug in powder form.

BABBŪLA

Babbūla consists of dried mature stem bark of *Acacia nilotica* (Linn.) Willd. ex. Del. sp. *indica* (Benth.) Brenan, Syn. *Acacia arabica* Willd. (Fam. Leguminosae); a moderate sized, spiny, evergreen tree found throughout India.

SYNONYMS —

Sansk.	:	Bāvarī, Kinkirāta
Assam.	:	Babala
Beng.	:	Babla
Eng.	:	Babula tree, Indian gum arabic tree
Guj.	:	Baval, Kaloabaval
Hindi	:	Babula, Babura, Kikar
Kan	:	Shameeruka, Kari Jali, Kari gobli, Pulai Jali
Kash.	:	Sak
Mal.	:	Velutha Karuvelan
Mar.	:	Babhul, Babhula
Ori.	:	Babula, Babala
Punj.	:	Kikkar
Tam.	:	Karuvelan, Karuvel
Tel.	:	Nallatumma, Thumma

DESCRIPTION —

(a) **Macroscopic**—Bark hard, dark brown or black, deeply fissured transversely and longitudinally; inner surface, reddish brown, longitudinally striated and fibrous, breaks with difficulty and exhibits a fibrous fracture; taste, astringent.

(b) **Microscopic**—Transverse section of mature bark shows, 15—25 layered, thin-walled, slightly flattened mostly rectangular, brown coloured cork cells; a few lenticels formed by rupturing of cork cells; secondary cortical cells ovate to elongated; many tanniferous stone cells, variable in shape and size present in large groups; secondary phloem consists of sieve tubes, companion cells, fibres, crystal fibres and phloem parenchyma; phloem fibres in many groups and thick-walled; phloem tissues filled with reddish or brown contents present; crystal fibres thick-walled, elongated, divided by transverse septa into segments, each contain a prismatic crystal of calcium oxalate; medullary rays uni to-multiseriate run almost straight; ray cells elongated to polygonal, 20—24 cells high and 2—5 cells wide, crystals of calcium oxalate found scattered amongst the stone cells, cells of secondary cortex and phloem parenchyma.

POWDER—Powder as such reddish brown coloured; under microscope many prismatic crystals of calcium oxalate, stone cells, both with narrow and wide lumen and striations and crystal fibres seen.

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 15 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 6 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 4 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannins and gum.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya
Guṇa	:	Guru, Rūkṣa, Viśada
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Grāhī, Kaphahara, Viṣaghna

IMPORTANT FORMULATIONS— Mṛtasañjīvanī surā; Babbūlāriṣṭa.

THERAPEUTIC USES— Kuṣṭha; Kṛmiroga; Atisāra; Kāsa.

DOSE — 20— 30 g of the drug for decoction.

BĀKUCĪ

Bākucī consists of dry ripe fruits of *Psoralea corylifolia* Linn. (Fam. Leguminosae); an erect, 0.3—1.8 m high annual herb, distributed throughout India, found commonly in Uttar Pradesh, Bengal and Maharashtra.

SYNONYMS—

Sansk.	:	Avalguja, Somarājī
Assam.	:	Habucha
Beng.	:	Bakuchi, Somraji, Hakucha Veeja
Guj.	:	Bavachi
Hindi	:	Bakuchi, Bavachi, Babchi
Kan.	:	Bauchige, Bhavantibeeja, Bhavanchigid, Baukuchi
Kash.	:	Babchi
Mal.	:	Karkokil
Mar.	:	Bawchi
Ori.	:	Bakuchi
Punj.	:	Babchi, Bavchi
Tam.	:	Karpokarisi, Karpogalarisi, Karbogalarisi
Tel.	:	Bavanchalu
Urdu	:	Babchi

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 13 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 11 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil, fixed oil, Psoralen, psoralidin, isopsoralen and bakuchiol.

PROPERTIES AND ACTIONS—

Rasa	:	Tikta, Kaṭu
Guṇa	:	Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Śleṣmāsrapittanut, Grāhī, Vraṇāpaha, Hṛdya

IMPORTANT FORMULATIONS— Somarājī taila; Avalgujādi lepa.

THERAPEUTIC USES— Śvitra; Kuṣṭha; Kṛmiroga; Jvara; Meha.

DOSE —3— 6 g of the drug in powder form.

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BIBHĪTAKA

Bibhītaka consists of pericarp of dried ripe fruits of *Terntinalia belerica* Roxb. (Fam. Combretaceae); a large deciduous tree, 10-12 m or more high, commonly found in plain and forests upto 900 m elevation; fruits ripen towards November.

SYNONYMS—

Sanśk.	:	Vibhīta, Akṣa, Akṣaka
Assam.	:	Bhomora, Bhomra, Bhaira
Beng.	:	Bayada, Baheda
Eng.	:	Beleric Myrobalan
Guj.	:	Bahedan
Hindi	:	Bahera
Kan.	:	Tare kai, Shanti Kayi
Kash.	:	Babelo, Balali
Mal.	:	Tannikka
Mar.	:	Baheda
Ori.	:	Baheda
Punj.	:	Bahera
Tam.	:	Thanrikkai
Tel.	:	Thanikkaya
Urdu	:	Bahera

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 7 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 8 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 35 per cent, Appendix 2.2.7.

CONSTITUENTS—Gallic acid, tannic acid and glycosides.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya
Guṇa	:	Rūkṣa, Laghu
Vīrya	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Kaphapittajit, Bhedaka, Kṛmināśana, Cakṣuṣya, Keśya, Kāsahara

IMPORTANT FORMULATIONS— Triphalā cūrṇa; Triphalādi taila; Lavaṅgādi vaṭī.

THERAPEUTIC USES— Svarabheda; Netraroga; Kāsa; Chardi; Kṛmiroga; Vibandha.

DOSE— 3—6 g of the drug in powder form.

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BILVA

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

SYNONYMS—

Sansk.	:	Śrīphala
Assam.	:	Bael, Vael
Beng.	:	Bela, Bilva
Eng.	:	Bengal Quince, Bael fruit
Guj.	:	Bill, Bilum, Bilvaphal
Hindi	:	Bela, Sriphal, Bel
Kan.	:	Bilva
Kash.	:	Bel
Mal.	:	Koovalam
Mar.	:	Bel, Baela
Ori.	:	Bela
Punj.	:	Bil
Tam.	:	Vilvam
Tel.	:	Maredu
Urdu	:	Bel

DESCRIPTION—

Macroscopic—Fruit, sub-globose, 5—18 cm in diameter, externally greenish when young, yellowish-brown when ripe, rind about 1.5 mm—3 mm thick, hard and woody, surface smooth or slightly granular bearing a circular scar at the point of attachment with peduncle; carpels, 10—15, central, each containing several hairy seeds embedded in yellowish brown, extremely sticky mucilage; seeds oblong, flat, woody, and having white hair; fresh pulp of ripe fruit, brown, of sticky shreads; dried pulp hard and pale to dark red in colour, frequently breaks away from the rind during drying, leaving a thin layer attached to it; odour, faintly aromatic; taste, mucilaginous and slightly astringent.

IDENTITY, PURITY AND STRENGTH—

Total ash	— Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 6 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 50 per cent, Appendix 2.2.7.

CONSTITUENTS—Marmalosin, tannins, mucilage, fatty oil and sugar.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta, Kaṣāya
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dīpana, Pācana, Grāhī, Pittakṛt, Vātakaphahara, Balya

IMPORTANT FORMULATIONS— Bilvādi leha; Bṛhatgangādhara cūrṇa.

THERAPEUTIC USES— Pravāhikā; Agnimāndya; Grahaṇīroga.

DOSE— 3—6 g of the drug in powder form.

CANDRAŚŪRA

Candraśūra consists of dried seeds of *Lepidium sativum* Linn. (Fam. Cruciferae) a small erect, annual herb, about 15-45 cm high, cultivated throughout India.

SYNONYMS—

Sansk.	:	Candrikā
Assam.	:	Halim
Beng.	:	Chand Shura, Halim
Eng.	:	Common Cress
Guj.	:	Aseriya, Aseliyo
Hindi	:	Chansur
Kan.	:	Allibija, Kapila
Kash.	:	Alian
Mal.	:	Asali
Mar.	:	Ahaliva, Haliv
Ori.	:	Chandasara, Chandasura
Punj.	:	Holon, Taratej
Tam.	:	Allivirai
Tel.	:	Adityalu, Aadalu
Urdu	:	Halim

DESCRIPTION—

Macroscopic—Seeds, small, oval-shaped, pointed and triangular at one end, smooth, about 2-3 mm long, 1-1.5 mm wide ; reddish brown, a furrow present on both surfaces extending upto two thirds downward; a slight wing like extension present on both the edges of seed, when soaked in water seed coat swells and gets covered with a transparent, colourless mucilage; taste, mucilaginous.

Powder—Cream-yellow with a number of reddish-brown fragments of seed coats; under microscope shows pieces of seed coat, some showing red colouring matter and others with uniformly thick walls; endosperm oily.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	—Not more than	2 per cent,	Appendix 2.2.2.
Total ash	—Not more than	8 per cent,	Appendix 2.2.3.
Acid-insoluble ash	—Not more than	0.5 per cent,	Appendix 2.2.4.
Alcohol-soluble extractive	—Not less than	13 per cent,	Appendix 2.2.6.

CONSTITUENTS—Alkaloids, essential oil, fixed oil and mucilage.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu, Rūkṣa, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Balapuṣṭivivardhana, Vātaśleṣmahṛt

IMPORTANT FORMULATIONS— Kastūryādi (Vāyu) guṭikā.

THERAPEUTIC USES— Hikkā; Atisāra; Vātarakta.

DOSE— 3—6 g of the drug in powder form.

CITRAKA

Citraka consists of dried mature root of *Plumbago zeylanica* Linn. (Fam. Plumbaginaceae) ; a large perennial sub-scandent shrub, found throughout India in wile state and occasionally cultivated in gardens.

SYNONYMS—

Sansk.	:	Agni, Vahni, Jvalanākhya, Kṛśāṇu, Huṭāśa, Dahana, Hutabhuk, Sikhī
Assam.	:	Agiyachit, Agnachit
Beng.	:	Chita
Eng.	:	Lead war
Guj.	:	Chitrakmula
Hindi	:	Chira, Chitra
Kan.	:	Chitramula, Vahni, Bilichitramoola
Kash.	:	Chitra, Shatranja
Mal.	:	Vellakeduveli, Thumpokkoduveli
Mar.	:	Chitraka
Ori.	:	Chitamula, Chitoparu
Punj	:	Chitra
Tam.	:	Chitramoolam, Kodiveli
Tel.	:	Chitramulam
Urdu	:	Sheetraj Hindi, Cheetah

DESCRIPTION—

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

(b) Microscopic—Transverse section of root shows outer most tissue of cork consisting of 5—7 rows of cubical to rectangular dark brown cells; secondary cortex consists of 2-3 rows of thin-walled, rectangular, light brown cells, most of the cortex cells contain starch grains; secondary cortex followed by a wide zone of cortex, composed of large polygonal to tangentially elongated parenchymatous cells, varying in size and shape, containing starch grains and some cells with yellow contents; fibres scattered singly or in groups of 2—6; phloem a narrow zone of polygonal, thin-walled cells, consisting of usual elements and phloem fibres; similar to cortical zone, phloem fibres usually in groups of 2—5 or more but occasionally occuring singly, lignified with pointed ends and narrow lumen, similar in shape and size to those of secondary cortex; cambium indistinct; xylem light yellow to whitish; vessels radially arranged with pitted thickenings; medullary rays straight, 1—6 seriate, cells radially elongated and filled with starch grains; stone cells absent.

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than 3 per cent,	Appendix 2.2.2.
Total ash	— Not more than 3 per cent,	Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent,	Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 12 per cent,	Appendix 2.2.6.
Water-soluble extractive	— Not less than 12 per cent,	Appendix 2.2.7.

CONSTITUENTS—Plumbagin.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu
Guṇa	:	Laghu, Rūkṣa, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dīpana, Pācana, Grāhī, Kaphavātahara, Arśohara, Śūlahara, Śothahara

IMPORTANT FORMULATIONS— Citrakādi vaṭī; Citrakaharītakī ; Citrakādi cūrṇa.

THERAPEUTIC USES— Agnimāndya ; Grahaṇī roga; Arśa, Udara śūla; Gudaśotha.

DOSE— 1—2 g of the drug in powder form.

NOTE :—Śodhana of this drug is to be done before use as described in the appendix.

DHĀNYAKA

Dhānyaka consists of dried ripe fruits of *Coriandrum sativum* Linn. (Fam. Umbelliferae) ; a slender, glabrous, branched, annual herb, cultivated all over India, 30-90 cm high, giving characteristic aroma when rubbed; crop matures in 2-3 months after sowing; herb is pulled out with roots, after drying, fruits threashed out and dried in sun, winnowed, and stored in bags.

SYNONYMS—

Sansk.	:	Dhanika, Dhānya, Vitunnaka, Kustumburu
Assam.	:	Dhaniya
Beng.	:	Dhane, Dhania
Eng.	:	Coriander fruit
Guj.	:	Dhana
Hindi	:	Dhaniya
Kan.	:	Havija, Kothambari bija
Kash.	:	Dhaniwal, Dhanawal
Mal.	:	Malli, Kothampatayari
Mar.	:	Dhane, Kothimbir
Ori.	:	Dhania
Punj.	:	Dhania
Tam.	:	Kottamalli virai, Dhaniya
Tel.	:	Dhaniyalu
Urdu	:	Kishneez

DESCRIPTION—

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

(b) **Microscopic**—Transverse section of fruit shows pericarp with outer epidermis, when present with slightly thickened anticlinal wall; a few stomata, many cells with small prisms of calcium oxalate; trichomes absent; outer layer of mesocarp parenchymatous with inner cells in wavy longitudinal rows and degenerated vittae as tangentially flattened cavities; middle layer of mesocarp sclerenchymatous forming a thick layer of fusiform, pitted cells in very sinuous rows, layers often crossing at right angles with definite longitudinal strands in the secondary ridges; sinuous primary costae with some spiral vessel; inner cells of mesocarp, large, hexagonal with rather thin, lignified walls; inner epidermis of very narrow thin-walled cells slightly sinuous anticlinal wall showing parquetry arrangement; two or rarely more, normal vittae occurring on commissural side of each mesocarp containing volatile oil; endosperm of thick-walled cellulosic parenchyma containing much fixed oil, numerous-aleurone grains, about 4-8 in diameter containing micro-rosettes of calcium oxalate ; split carpophore passing at apex of each mericarp into raphe, adjacent to which a large cavity and on inner side of this a flattened vascular strand; carpophore consisting of fibres surrounded by spiral vessels.

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent,	Appendix 2.2.2.
Total ash	— Not more than 6 per cent,	Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1.5 per cent,	Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 10 per cent,	Appendix 2.2.6.
Water-soluble extractive	— Not less than 19 per cent,	Appendix 2.2.7.
Volatile oil	— Not less than 0.3 per cent v/w,	Appendix 2.2.10.

CONSTITUENTS—Essential oil (coriandrol).

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Madhura, Tikta, Kaṣāya
Guṇa	:	Laghu, Snigdha
Vīrya	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Dīpana, Pācana, Grāhī, Tridoṣanut, Mūtrala, Cakṣuṣya, Hṛdya

IMPORTANT FORMULATIONS— Dhānyapañcak akvātha cūrṇa.

THERAPEUTIC USES— Jvara; Tṛṣṇā; Chardi; Dāha; Ajīrṇa; Atisāra.

DOSE — 1—3 g of the drug in powder form.

DHĀTAKĪ

Dhātaki consists of flowers of *Woodfordia fruticosa* (Linn.) Kurz. (Fam. Lythraceae); much branched, semi deciduous, undershrub or shrub, 1-3 m high, rarely upto 3 m, found throughout India, ascending to 1500 m in Himalayas and also in the Gangetic plains ; also cultivated in gardens.

SYNONYMS—

Sansk.	:	Bahupuṣpī, Tāmrapuṣpī, Vahnijvālā
Assam.	:	Dhaiphool
Beng.	:	Dhaiphul
Eng.	:	Fire flame bush
Guj.	:	Dhavadi, Dhavani
Hindi	:	Dhai, Dhava
Kan.	:	Dhataki, Tamrapushpi
Mal.	:	Tattiripuvu, Tatire
Mar.	:	Dhayati, Dhavati
Ori.	:	Dhaiphula, Dhatuki
Punj.	:	Davi, Phul Dhava
Tam.	:	Kattattipoo, Kattati, Kattathi.
Tel.	:	Aarl Puruvu

DESCRIPTION—

(a) **Macroscopic**—Flower, about 1.2 cm long, occurs as single or in bunches of 2-15 ; calyx 1.0-1.6 cm long, ridged and glabrous, bright red when fresh but fades on drying, with campanulate base and oblique apex having 6 triangular and acute teeth; each tooth being, 2-2.5 mm long; 6, very minute accessory sepals attached outside at the juncture of calyx tooth and deeper in colour ; petals 6, attached inside the mouth of calyx-tube, slightly longer than calyx tooth, alternating with calyx-tooth pale rose or whitish, thin, papery, lanceolate, acuminate ; stamens 12, united at the base, about 1.5-2 cm long, filament filiform, curved at the apex, keeping anthers inside calyx-tube ; anthers dorsifixed, brown, almost rounded or broadly ovate ; carpels 2, united, ovary superior, style filiform, longer than ovary and stamens ; taste, astringent.

(b) **Microscopic**—Transverse section of sepal shows, single layered cuticularised epidermis, provided with both glandular and covering trichomes ; glandular trichomes, multicellular, long, consisting of a stalk and a globose, thin-walled, multicellular head; covering trichomes, unicellular thick-walled, broad at base and pointed at the apex; ground tissue consisting of thin-walled, parenchymatous cells surface view of petal shows thin-walled, parenchymatous cells, provided with very few sparsely distributed covering trichomes; transverse section of filament shows, epidermis consisting of single layered, tangentially elongated cells, covered with a very thick-cuticle; ground tissue consisting of thin-walled parenchymatous cells with intercellular spaces, surrounding a central vascular cylinder of spirally thickened vessels; transverse section of anther shows, single layered epidermis, covered with cuticle followed by several layers of thickened cells, surrounding both the pollen-sacs having numerous pollen grains; pollen grains roughly tetrahedral with three pores, measuring 12-16 μ approximately; central region consisting of thin-walled cells emboding vascular bundles.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 10 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 7 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 28 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannin and glucoside.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya, Kaṭu
Guṇa	:	Laghu
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Grāhī, Viṣaghna, Garbhasthāpana, Kṛminut, Sandhānīya

IMPORTANT FORMULATIONS— Bṛhat gangādhara cūrṇa.

THERAPEUTIC USES— Atisāra; Tṛṣṇā; Visarpa; Vraṇa ; Raktapitta.

DOSE— 3—6 g of the drug in powder form.

ERAṆḌA (ROOT)

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

SYNONYMS—

Sansk.	:	Gandharvahasta, Vātāri, Pañcāṅgula, Citrā, Urubu, Rubu
Assam.	:	Eda, Era
Beng.	:	Bherenda
Eng.	:	Castor oil plant
Guj.	:	Erandio, Erando
Hindi.	:	Arand, Erand, Andi, Rend
Kan.	:	Haralu, Oudala gida
Kash.	:	Aran, Banangir
Mal.	:	Avanakku
Mar.	:	Erand
Ori.	:	Jada, Gaba
Punj.	:	Arind
Tam.	:	Amanakku
Tel.	:	Amudapu veru
Urdu.	:	Bedanjir, Arand

DESCRIPTION—

(a) Macroscopic—Root light in weight almost straight with few rootlets, outer surface dull yellowish brown, nearly smooth but marked with longitudinal wrinkels, some places whitish-yellow and soft; odourless; taste, acrid.

(b) Microscopic—Transverse section of root shows thin layers of cork of squarish to tangentially elongated, thin-walled cells ; beneath cork, secondary cortex of thin-walled, tangentially elongated cells, narrow cortex of rounded to tangentially elongated thin-walled parenchymatous cells, some containing large oil globules, rosettes of calcium oxalate crystals and round simple or compound starch grains; phloem a broad zone, consisting of sieve tubes, phloem parenchyma and phloem fibres; fibres long, mostly septate, highly thicknened, having narrow lumen, some fibres surrounded by concentric rows of cells containing crystals of calcium oxalate; sieve tubes, thin-walled with companion cells and phloem parenchyma in the inner region of phloem more prominent ; some phloem parenchyma cells contain crystals of calcium oxalate ; cambium 3-5 layered, cells rectangular in shape ; xylem occupies major part of root, pentarch, five groups of primary xylem distinct in the centre of the wood, xylem consists of vessels, parenchyma and fibres ; vessels uniformly scattered throughout the xylem region, either solitary or in groups, larger in size towards phloem, with bordered pits ; xylem parenchyma less in number around vessels containing strach grains ; xylem fibres long and thick-walled; medullary rays uni-to-biseriate, more or less straight, 4-5 seriate rays, sometimes found near protoxylem groups, ray cells, thin-walled, slightly radially elongated in phloem region, thick-walled in xylem region, all ray cells contain starch grains.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 9 per cent, Appendix 2.2.7.

CONSTITUENTS—Alkaloid (ricinine).

PROPERTIES AND ACTION—

Rasa	:	Madhura
Guṇa	:	Guru, Snigdha
Vīrya	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Vṛṣya, Vātahara, Āmapācana

IMPORTANT FORMULATIONS— Gandharvahastādi kvātha cūrṇa; Vātāri guggulu; Gandharvahasta taila.

THERAPEUTIC USES— Āmavāta; Śotha ; Vastiśūla ; Kaṭiśūla; Udararoga ; Jvara.

DOSE— 20—30 g of the drug for decoction.

GAMBHĀRĪ

Gambhārī consists of dried, mature root and root bark of *Gmelina arborea* Roxb. (Fam. Verbenaceae) ; tree about 18 m high, with a clear bole of 6-9 m and a girth of 1.5—2.1 m, found in the lower Himalayas, the Nilgiris and the East and West Coasts of India.

SYNONYMS—

Sansk.	:	Kāśmarī, Kāśmarya
Assam	:	Gamari
Beng.	:	Gambhar, Gamar
Eng.	:	Candhar Tree
Guj.	:	Shivan
Hindi	:	Gambhar, Khambhari
Kan.	:	Shivanigida, Shivani
Kash.	:	Kashmari
Mal.	:	Kumizhu, Kumpil
Mar.	:	Shivan
Ori.	:	Gambhari
Punj.	:	Gumhar, Kumhar
Tam.	:	Kumishan, Kumizhan
Tel.	:	Peggummudu, Peggummadi

DESCRIPTION—

(a) **Macroscopic—Root**—occurs in pieces with secondary and tertiary branhes, root pieces nearly cylindrical with uneven surface, greyish brown, fracture somewhat tough in bark, brittle and predominent in woody portion.

Root bark—mature root bark when fresh, yellowish in colour; dry pieces curved and channelled, thinner ones forming single quills, external surface rugged due to presence of vertical cracks, ridges, fissures and numerous lenticels ; fracture short and granular ; taste, mucilaginous, sweetish with slight bitterness.

(b) **Microscopic—Root**—transverse section of root shows 6-8 layers of cork cells, secondary cortex, including primary and secondary phloem about two third consisting of wood; cork brownish, cells arranged in tangential direction and broken at places towards upper layers; cortex characterised by the presence of thin-walled parenchymatous cells with starch grains ; resin ducts present in abundance throughout cortex; scattered stone cells fibre like or elongated common ; fibres present, occuring mostly in singles; cells of cortex also contain rosette crystals of calcium oxalate and oil globules; primary phloem characterised by the presence of sieve tubes with companion cells, phloem parenchyma, soft bast fibres and ray cells ; phloem fibres occur singly and scattered cortical cells 40-70 μ by 25-35 μ and bast fibres, 300-1000 μ by 10-15 μ development of cork takes place in second or third layer of primary cortex; wood consists of simple pitted wood parenchyma and medullary rays; wood cells mainly composed of vessels and tracheids and inner wood consists of a major portion of fibres together with a few vessels, vessels numerous and form almost a ring near the periphery of xylem cylinder and somewhat spares, being scattered in groups or singly nearer the central region; lumen of vessels somewhat large, dimensions of vessels 130-250 μ by 50-100 μ and those of the tracheids 175-300 μ by 30-50 μ; wood fibres abundant and with simple pits ; cambium distinct ; medullary rays generally 1-2 celled thick with abundant starch grains cells oblong to rectangular.

Root bark—transverse section of mature root bark shows cork represented by 10-18 layers of tangentially elongated rectangular cells; secondary cortex composed of parenchyma and groups of stone cells; secondary phloem consists of parenchyma, groups of stone cells, sieve tube elements and medullary rays.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 0.3 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 7 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 20 per cent, Appendix 2.2.7.
CONSTITUENTS	— Alkaloids and lignans (arboreal, isoarboreal and related lignans).

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Guru
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dīpana, Pācana, Bhedana, Medhya, Tridoṣajit, Śothahara, Viṣaghna, Jvarahara

IMPORTANT FORMULATIONS :—Daśamūlāriṣṭa ; Daśamūlaharītakī ; Daśamūla ghṛta; Daśamūla ṣaṭpalaka ghṛta.

THERAPEUTIC USES :—Jvara ; Tṛṣṇā; Dāha ; Arśa ; Śotha.

DOSE—20—30 g of the drug for decoction.

GOKṢURA (ROOT)

Gokṣura consists of root of *Tribulus terrestris* Linn. (Fam. Zygophyllaceae): an annual prostrate herb, rarely perennial common weed of the pasture lands, road sides and other waste land, chiefly growing in hot, dry and sandy regions throughout India and upto 3,000 m in Kashmir.

SYNONYMS—

Sansk.	:	Gokṣuraka, Trikaṇṭa, Śvadaṁṣṭrā, Traikaṇṭaka
Assam.	:	Gokshura, Gukhurkata
Beng.	:	Gokshura, Gokhri
Eng.	:	Caltrops root
Guj.	:	Be tha gokharu, Nana gokharu, Mithogokharu
Hindi	:	Gokhru
Kan.	:	Sannanaggilu, Neggilamullu, Neggilu
Kash.	:	Michirkand, Pakhda
Mal.	:	Nerinjil
Mar.	:	Sarate, Gokharu
Ori.	:	Gukhura, Gokhyura
Punj.	:	Bhakhra, Gokhru
Tam.	:	Nerinjil, Nerunjil
Tel.	:	Palleruveru
Urdu	:	Khar-e-Khasak Khurd

DESCRIPTION—

(a) **Macroscopic**—Drug consists of root, 7—18 cm long and 0.3—0.7 cm in diameter, slender, cylindrical, fibrous, frequently branched bearing a number of small rootlets, tough, woody and yellow to light brown in colour; surface becomes rough due to presence of small nodules; fracture fibrous; odour aromatic; taste, sweetish and astringent.

(b) **Microscopic**—Transverse section of primary roots show a layer of epidermis followed by 4-5 layers of thin-walled parenchymatous cortex, endodermis distinct; pericycle enclosing diarch stele, in mature root, cork 4-6 layered, cork cambium single layered followed by 6-14 layers of thin-walled parenchymatous cells with varying number of fibres, distributed throughout; some secondary cortex cells show secondary wall formation and reticulate thickening; fibres found in groups resembling those of phloem; secondary phloem divided into two zones, outer zone characterised by presence of numerous phloem fibres with a few sieve tubes slightly collapsed, inner zone frequently parenchymatous, devoid of fibres often showing sieve tubes and companion cells; phloem rays distinct, few cells get converted into fibres in outer region; cambium 3-5 layered; wood composed of vessels, tracheids, parenchyma and fibres and traversed by medullary rays; vessels scattered, arranged in singles or doubles towards inner side, in groups of three to four on outer side having bordered pits; tracheids long, narrow with simple pits; xylem parenchyma rectangular or slightly elongated with simple pits and reticulate thickening; xylem fibres few; trachieds elongated with simple pits; medullary rays heterogenous, 1-4 cells wide; starch grains and rosette crystals of calcium oxalate present in secondary cortex, phloem and medullary rays cells; few prismatic crystals also present in xylem ray cells.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 13 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 3 per cent, Appendix, 2.2.4.
Alcohol-soluble extractive	— Not less than 4 per cent, Appendix 2.2.6.
Water-Soluble extractive	— Not less than 10 per cent, Appendix—2.2.7.

CONSTITUENTS—Alkaloids and saponins.

PROPERTIES AND ACTION—

Rasa	:	Madhura
Guṇa	:	Guru, Snigdha
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Vātanut, Vṛṣya, Bṛṁhaṇa, Mūtrala

IMPORTANT FORMULATIONS— Sahacarādi taila; Daśamūla kvātha cūrṇa; Daśamūlakaṭutraya kvātha cūrṇa; Daśamūlapañcakolādi kvātha cūrṇa.

THERAPEUTIC USES— Kāsa; Śvāsa; Śūlaroga; Hṛdroga; Vātaroga; Mūtrakṛcchra; Aśmarī.

DOSE— 20—30 g of the drug for decoction.

GOKṢURA (FRUIT)

Gokṣura consists of dried, ripe, entire fruit of *Tribulus terrestris* Linn. (Fam Zygopyllaceae); an annual, rarely pernnial common weed of the pasture lands, road sides and other waste places, chiefly in hot, dry and sandy regions; grows throughout India as prostrate herb and upto 3,000 m in Kashmir.

SYNONYMS—

Sansk.	:	Gokṣuraka, Trikaṇṭa , Śvadaṁṣṭrā, Traikaṇṭaka
Assam.	:	Gokshura, Gokhurkata
Beng.	:	Gokshura, Gokhri
Eng.	:	Caltrops fruit
Guj.	:	Bethagokharu, Nanagokharu, Mithagokhru
Hindi	:	Gokhru
Kan.	:	Sannaneggilu, Neggilamullu, Neggilu
Kash.	:	Michirkand, Pakhda
Mal.	:	Nerinjil
Mar.	:	Sarate, Gokharu
Ori.	:	Gukhura, Gokhyura
Punj.	:	Bhakhra, Gokhru
Tam.	:	Nerinjil, Nerunjil
Tel.	:	Palleru Kaya
Urdu	:	Khar-e-Khasak Khurd

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 15 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 6 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 10 per cent, Appendix 2.2.7.

CONSTITUENTS—Potassium nitrate, sterols, sapogenin with pyroketone ring (diosgenin), gitogenin and hecogenins.

PROPERTIES AND ACTION—

Rasa	:	Madhura
Guṇa	:	Guru, Snigdha
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Vātanut, Vṛṣya, Bṛṁhaṇa, Aśmarīhara, Vastiśodhana

IMPORTANT FORMULATIONS—Gokṣurādi guggulu; Traikaṇṭaka ghṛta; Drākṣadi crūṇa.

THERAPEUTIC USES—Kāsa; Śvāsa; Aśmarī; Mūtrakṛcchra; Prameha; Arśa; Śūlaroga; Hṛdroga; Daurbalya.

DOSE— 3—6 g of the drug in powder form.
20—30 g of the drug for decoction.

GUḌŪCI

Guḍūcī consists of dried, matured pieces of stem of *Tinospora cordifolia* (Willd.) Miers. (Fam. Menispermaceae); a perennial climber found throughout Tropical India; drug collected during summer preferably in the month of May; drug is used in fresh form also.

SYNONYMS—

Sansk.	:	Amṛtavallī, Amṛtā, Madhuparṇī, Guḍūcikā, Chinnodbhavā
Assam.	:	Siddhilata, Amarlata
Beng.	:	Gulancha
Guj.	:	Galac, Garo
Hindi	:	Giloe, Gurcha
Kan.	:	Amrutaballi
Kash.	:	Amrita, Gilo
Mal.	:	Chittamrutu
Mar.	:	Gulvel
Ori.	:	Guluchi
Punj.	:	Gilo
Tam.	:	Seendal, Seendil kodi
Tel.	:	Thippateega
Urdu	:	Gilo

DESCRIPTION—

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

(b) **Microscopic**—Transverse section of stem shows outer-most layer of cork, differentiating into outer zone of thick-walled brownish and compressed cells, inner zone of thin walled colourless, tangentially arranged 3—4 rows of cells; cork broken at some places due to opening of lanticels, followed by 5 or more rows of secondary cortex of which the cells of outer rows smaller than the inner one; just within the opening of lenticels, groups of sclereids consisting of 2—10 cells found in secondary cortex region, outer zone of cortex consists of 3—5 rows of irregularly arranged, tangentially elongated chlorenchymatous cells; cortical cells situated towards inner side, polygonal in shape and filled with plenty of starch grains, simple, ovoid, or irregularly ovoid-elliptical, occasionally compound of 2—4 components; several secretory cells; found scattered in the cortex; pericyclic fibres lignified with wide lumen and pointed ends, associated with a large number of crystal fibres containing a single prism in each chamber; vascular zone composed of 10—12 or more wedge-shaped strips of xylem, externally surrounded by semi-circular strips of phloem, alternating, with wide medullary rays; phloem consists of sieve tube, companion cells and phloem parenchyma of polygonal or tangentially elongated cells, some of them contain crystels of calcium oxalate; cambium composed of one to two layers of tangentially elongated cells in each vascular bundle; xylem consists of vessels, tracheids, parenchyma and fibres; in primary xylem, vessels comparatively narrow devoid of tyloses; secondary xylem elements thick-walled, lignified, vessels cylindrical in shape bearing bordered pits on their walls some large vessels possess several tyloses and often contain transverse septa; meduallry rays 15—20 or more cells wide containing rounded, hemispherical, oblong, ovoid, with faintly marked concentric striations and central hilum appearing like a point, starch grains of 5-5—11.20 μ in diameter and 6—11.28μ in length; pith camposed of large, thin-walled cells mostly containing starch grains.

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IDENTITY, PURITY AND STRENGTH—

For dried drug :—

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

Total ash — Not more than 16 per cent, Appendix 2.2.3.

Acid-insoluble ash — Not more than 3 per cent, Appendix 2.2.4.

Alcohol-soluble extractive — Not less than 3 per cent, Appendix 2.2.6.

Water-soluble extractive — Not less than 11 per cent, Appendix 2.2.7.

For fresh drug:—

Foreign matter — Nil Appendix 2.2.2.

Moisture content — 75 per cent, Appendix 2.2.9.

CONSTITUENTS—Terpenoids and alkaloids.

PROPERTIES AND ACTION—

Rasa : Tikta, Kaṣāya

Guṇa : Laghu

Vīrya : Uṣṇa

Vipāka : Madhura

Karma : Tridoṣaśāmaka, Saṁgrāhī, Balya, Dīpana, Rasāyana, Raktaśodhaka, Jvaraghna

IMPORTANT FORMULATIONS—Amṛtāriṣṭa; Amṛtottara kvātha cūrṇa; Guḍūcī taila; Guḍūcyādi cūrṇa; Guḍūcī sattva; Chinnodbhavādi kvātha cūrṇa.

THERAPEUTIC USES—Kuṣṭha; Vātarakta; Jvara; Kāmalā; Pāṇḍu; Prameha.

DOSE— 3—6 g of the drug in powder form.
20—30 g of the drug for decoction.

GUGGULU

Guggulu consists of exudate of *Commiphora wightii* (Arn.) Bhand; Syn. *Balsamodendron mukul* Hook. ex Stocks (*Con.miphora mukul* Engl.), (Fam. Burseraceae); a small perennial tree or shrub upto 1.2—1.8 m high, occuring in rocky tracts of Rajasthan, Gujarat; exudate is collected during winter season by making the incisions in the bark or in summer, falling from the bark itself.

SYNONYMS—

Sansk.	:	Purā, Mahiṣākṣa, Kauśika, Palaṅkaṣā
Assam.	:	Guggul
Beng.	:	Guggula
Eng.	:	Gum-gugul, Indian Bdellium
Guj.	:	Gugal, Guggal, Gugar
Hindi	:	Gugal; Guggul
Kan.	:	Kanthagana, Guggala, Mahishaksha guggulu, Guggulugida, Guggulu
Kash.	:	Guggal Dhoop, Kanth Gan
Mal.	:	Gulgulu, Guggulu
Mar.	:	Guggul, Mahishaksh
Ori.	:	Guggulu
Punj.	:	Guggal
Tam.	:	Mahisaksi Guggalu
Tel.	:	Makishakshi guggulu, Guggipannu
Urdu	:	Muqil (Shihappu)

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 4 per cent, Appendix 2.2.2.
Total ash	— Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 27 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 53 percent, Appendix 2.2.7.
Volatile oil	— Not less than 1 per cent, v/w, Appendix, 2.2.10.

CONSTITUENTS—Essential oil, gum, resin, steroids.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṭu, Kaṣāya
Guṇa	:	Laghu, Sara, Viśada
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Vātabalāsajit, Rasāyana, Varṇya, Balya, Bhagnasandhānakṛt, Medohara

IMPORTANT FORMULATIONS— Yogarāja guggulu; vātāri guggulu; Siṁhanāda guggulu; Kaiśora guggulu; Mahāyogarāja guggulu; Candraprabhā vaṭī.

THERAPEUTIC USES— Vātavyādhi; Āmavāta; Granthi; Śopha; Gaṇḍamālā; Medoroga; Prameha; Kuṣṭha.

DOSE - 2— 4 g of the drug.

GUÑJĀ (SEED)

Guñjā consists of seeds of *Abrus precatorius* Linn. (Fam. Leguminosae); a climber met with all along Himalayas ascending to 900 m, spreading throughout plains; flowering in August-September, and fruits ripen during winter.

SYNONYMS—

Sansk.	:	Raktikā, Kākaṇantī
Assam.	:	Rati
Beng.	:	Kunch, Shonkainch
Eng.	:	Jequirity
Guj.	:	Rati, Chanothee
Hindi	:	Ratti, Ghungchi
Kan.	:	Galuganji, Gulagunjee
Mal.	:	Kunni, Cuvanna Kunni
Mar.	:	Gunja
Ori.	:	Kainch
Punj.	:	Ratti
Tam.	:	Kuntri, Kunrimani, Kundamani
Tel.	:	Guriginja, Gurivinda
Urdu	:	Ghongcha, Ratti

DESCRIPTION—

(a) **Macroscopic**—Characterised by smooth, glossy surface and bright scarlet colour with black patch hilum; ovoid or sub-globular, 5-8 mm long, 4—5 mm broad.

(b) **Microscopic**—Transverse section of seed shows testa about 75 μ thick, greater parts being formed by epidermis, composed of radially, much elongated cells, arranged irregularly and measure 45—50 μ in length; inner region of thin testa consists of collapsed cells forming a hyaline layer about 25μ thick; endodermis composed of thick-walled cellulosic parenchyma, isodiametric cells larger towards inside, walls mainly of hemicellulose and swell considerably in water, outer one or two layers of cells of endodermis (pseudoepidermis) formed of rather smaller cells, walls of which swell to less extent in water.

IDENTITY, PURITY AND STRENGTH—

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

CONSTITUENTS—An albuminous substance (abrine and abralin).

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Rūkṣa, Laghu, Tīkṣṇa
Vīrya	;	Uṣṇa
Vipāka	;	Kaṭu
Karma	:	Vātapittajvarāpaha, Keśya, Kaṇḍūghna, Vraṇāpaha, Garbhanirodhaka

IMPORTANT FORMULATIONS— Mṛtasañjīvanī guṭikā, Guñjābhadra rasa.

THERAPEUTIC USES— Kuṣṭha; Vraṇa; Vātavyādhi; Indralupta.

DOSE— 60—180 mg of the drug in powder form*.

NOTE :—Śodhana of this drug is to be done before use as described in the Appendix.
The dose should not exceed the higher limits.

HARIDRĀ

Haridrā consists of the dried and cured rhizomes of *Curcuma longa* Linn. (Fam. Zingiberaceae); a perennial herb extensively cultivated in all parts of the country; crop is harvested after 9—10 months when lower leaves turn yellow rhizomes carefully dug up with hand-picks between October-April and cured by boiling and dried.

SYNONYMS—

Sansk.	:	Rajanī, Niśā, Niśi, Rātri, Kṣaṇadā, Doṣā
Assam.	:	Haldhi, Haladhi
Beng.	:	Halud, Haldi
Eng.	:	Turmeric
Guj.	:	Haldar
Hindi	:	Haldi, Hardi
Kan.	:	Arishina
Kash.	:	Ledar, Ladhir
Mal.	:	Manjal
Mar.	:	Halad
Ori.	:	Haladi
Punj.	:	Haldi, Haldar
Tam.	:	Manjal
Tel.	:	Pasupu
Urdu	:	Haldi

DESCRIPTION—

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

(b) **Microscopic**— Transverse section of rhizome shows epidermis with thick-walled, cubical cells of various dimensions; cortex characterised by the presence of mostly thin-walled, rounded parenchyma cells scattered collateral vascular bundles; a few layers of cork developed under epidermis and scattered oleo-resin cells with brownish contents; cork generally composed of 4—6 layers of thin-walled, brick-shaped parenchyma; cells of ground tissue contain starch grains of 4—15 μ in diameter; oil cell with suberised walls containing either orange-yellow globules of volatile oil or amorphous resinous matter, vessels mainly spirally thickened, a few reticulate and annular.

IDENTITY, PURITY AND STRENGTH—

Identification—(1) On the addition of *Concentrated Sulphuric acid* or a mixture of *Concentrated Sulphuric acid* and *alcohol* to the powdered drug, a deep crimson colour is produced.

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2
Total ash	— Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	— Not less than 8 per cent, Appendix 2.2.6
Water-soluble extractive	— Not less than 12 per cent, Appendix 2.2.7
Volatile oil	— Not less than 4 per cent v/w, Appendix 2.2.10

CONSTITUENTS—Essential oil and a colouring matter (curcumin).

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṭu
Guṇa	:	Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphapittanut, Viṣaghna, Varṇya, Kuṣṭhaghna, Kṛmighna, Pramehanāśaka

IMPORTANT FORMULATIONS— Haridrā Khaṇḍa.

THERAPEUTIC USES—Viṣavikāra; Kuṣṭha; Vraṇa; Tvagroga; Prameha; Pāṇḍu; Śītapitta; Pīnasa.

DOSE—1—3 g of the drug in powder form.

HARĪTAKĪ

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

SYNONYMS—

Sansk.	:	Abhayā, Kāyasthā, Śivā, Pathyā, Vijayā (Not Bhaṅgā)
Assam.	:	Shilikha
Beng.	:	Haritaki
Eng.	:	Myrobalan
Guj.	:	Hirdo, Himaja, Pulo-harda
Hindi	:	Harre, Harad, Harar
Kan.	:	Alalekai
Kash.	:	Halela
Mal.	:	Katukka
Mar.	:	Hirda, Haritaki, Harda, Hireda
Ori.	:	Harida
Punj.	:	Halela, Harar
Tam.	:	Kadukkai
Tel.	:	Karaka, Karakkaya
Urdu	:	Halela

DESCRIPTION—

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

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

(c) **Powder**—Brownish in colour; under microscope shows a few fibres, vessels with simple pits and groups of sclereids.

IDENTITY, PURITY AND STRENGTH—

Foreign matter — Not more than 1 per cent, Appendix 2.2.2

Total ash — Not more than 5 per cent, Appendix 2.2.3.

Acid-insoluble ash — Not more than 5 per cent, Appendix 2.2.4.

Alcohol-soluble extractive — Not less than 40 per cent, Appendix 2.2.6.

Water-soluble extractive — Not less than 60 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannins, anthraquinones and polyphenolic compounds.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya, Kaṭu, Tikta, Amla, Madhura
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Sarvadoṣapraśamana, Rasāyana, Cakṣuṣya, Dīpana, Anulomana, Hṛdya, Medhya

IMPORTANT FORMULATIONS— Abhayāriṣṭa; Agastya harītakī rasāyana; Citraka harītakī; Dantī harītakī; Daśamūla harītakī; Brāhma rasāyana; Triphalā cūrṇa; Triphalādi taila; Abhayā lavaṇa; Pathyādi lepa.

THERAPEUTIC USES—Vibandha; Aruci; Udāvarta; Gulma; Udararoga; Arśa; Pāṇḍu; Śotha; Jīrṇajvara; Viṣamajvara; Prameha; Śiroroga; Kāsa; Tamaka śvāsa; Hṛdroga.

DOSE—3—6 g of the drug in powder form.

HIṄGU

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

SYNONYMS —

Sansk.	:	Rāmaṭha, Sahasravedhi
Assam.	:	Hin
Beng.	:	Hing
Eng.	:	Asfoetida
Guj.	:	Hing, Vagharni
Hindi	:	Hing, Hingda
Kann.	:	Hingu, Ingu
Kash.	:	Eng.
Mal.	:	Kayam
Mar.	:	Hing, Hira, hing
Ori.	:	Hengu, Hingu
Punj.	:	Hing
Tam.	:	Perungayam
Tel.	:	Inguva
Urdu	:	Hitleet, Hing

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

IDENTITY, PURITY AND STRENGTH —

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

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

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

Foreign matter—	Not more than	2 per cent,	Appendix 2.2.2.
Total ash—	Not more than	15 per cent,	Appendix 2.2.3.
Acid-insoluble ash—	Not more than	3 per cent,	Appendix 2.2.4.
Alcohol (90 per cent)—soluble extractive—	Not less than	50 per cent,	Appendix 2.2.6.
Water-soluble extractive—	Not less than	50 per cent,	Appendix 2.2.7.

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

NOTE :—Śodhana of this drug is to be done before use as described in the Appendix.

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CONSTITUENTS—Essential oil, gum and resin.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu
Guṇa	:	Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Rucya, Dīpana, Pācana, Anulomana, Kṛmighna, Vātakaphapraśamana, Hṛdya

IMPORTANT FORMULATIONS—Hiṅgvāṣṭaka cūrṇa; Hiṅgvādi cūrna; Hiṅguvacādi cūrṇa.

THERAPEUTIC USES— Āgnimāndya; Ādhmāna; Ānāha; Gulma; Śūlaroga; Udararoga; Hṛdroga; Kṛmiroga.

DOSE— 125 —500 mg of the drug.

JAṬĀMĀṀSĪ

Jaṭāmāṁsī consists of dried rhizome of *Nardostachys jatamansi* DC.(Fam. Valerianaceae); an erect perennial herb, 10-60 cm high growing at an altitude of 3000-5000 m on the sub-alpine Himalayan tracts.

SYNONYMS —

Sansk.	:	Māṁsī, Jaṭā Jaṭilā
Assam.	:	Jatamansi, Jatamangshi
Beng.	:	Jatamamsi
Eng.	:	Nardus root
Guj.	:	Baalchad, Kalichad
Hindi	:	Balchara
Kan.	:	Bhootajata, Ganagila maste
Kash.	:	Bhutijata
Mal.	:	Manchi, Jatamanchi
Mar.	:	Jatamansi
Ori.	:	Jatamansi
Punj.	:	Billilotan, Balchhar, Chharguddi
Tam	:	Jatamanji
Tel.	:	Jatamamsi
Urdu	:	Sumbul-ut-teeb

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH —

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

Foreign matter—	Not more than 5 per cent, Appendix 2.2.2.
Total ash—	Not more than 9 per cent, Appendix 2.2.3.
Acid-insoluble ash—	Not more than 5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive—	Not less than 2 per cent, Appendix 2.2.6.
Water-soluble extractive—	Not less than 5 per cent, Appendix 2.2.7.
Volatile oil—	Not less than 0.1 per cent, v/w Appendix 2.2.10.

CONSTITUENTS—Essential oil and resinuous matter.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Tridoṣanut, Medhya, Varṇya, Nidrājanana, Kuṣṭhaghna.

IMPORTANT FORMULATIONS— Jaṭāmāṁsyarka.

THERAPEUTIC USES— Kuṣṭha; Dāha; Visarpa; Mānasaroga; Anidrā.

DOSE— 2 –3 g of the drug in powder form.

5—10 g of the drug for decoction.

JĀTĪPHALA

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

SYNONYMS—

Sansk.	:	Jātiśasya, Jātīphala
Assam.	:	Jaiphal, Kanivish
Beng.	:	Jaiphala, Jaitri
Eng.	:	Nutmeg
Guj.	:	Jaiphala, Jayfar
Hindi.	:	Jaiphal
Kan.	:	Jadikai, Jaykai, Jaidikai
Kash.	:	Jafal
Mal.	:	Jatika
Mar.	:	Jaiphal
Ori.	:	Jaiphal
Punj.	:	Jaiphal
Tam.	:	Sathikkai, Jathikkai, Jatikkai, Jadhikai, Jadhikkai
Tel.	:	Jajikaya
Urdu	:	Jauzbuwa, Jaiphal

DESCRIPTION

(a) **Macroscopic**—Seed ellipsoid, 20-30 mm long and about 20 mm broad; externally greenish-brown sometimes marked with small irregular dark brown patches or minute dark points and lines slightly furrowed reticulately; a small light-coloured area at one end indicating the position of the radicle; a groove running along the line of raphe to the darker chalaza at the opposite end; surrounded by a thin layer of perisperm with infoldings appearing as dark ruminations in the abundant greyish-brown endosperm; embryo, in an irregular cavity, small with two widely spreading crumpled cotyledons and a small radicle; odour, strong and aromatic; taste, pungent and aromatic.

(b) **Microscopic**—Transverse section of endosperm shows peripheral perisperm, of several layers of strongly, flattened polyhederal cells with brown contents, or containing prismatic crystals; inner layer of perisperm of thin-walled parenchyma about 40 μ thick, infolding into the tissue of the endosperm to form the ruminations containing numerous, very large oil cells with brown cell walls, vascular strands; in the peripheral region, numerous small spiral vessels; large celled, endosperm, parenchymatous with occasional tannin idioblasts, with thin brown walls, containing numerous simple, rounded and compound starch grains, with upto about 10 components usually 2-8, individual grains, upto 20 μ in diameter present, most of the cells with crystalline fat and often a large aleurone grain in each cell, containing a rhombic protein crystal upto 12 μ and small aleurone grains with less regular crystalloids; embryo, of shrivelled and collapsed parenchyma.

IDENTITY, PURITY AND STRENGTH

Foreign matter—	Not more than	1 per cent, Appendix 2.2.2.
Total ash—	Not more than	3 per cent, Appendix 2.2.3.
Acid-insoluble ash—	Not more than	0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive—	Not less than	11 per cent Appendix 2.2.6.
Water-soluble extractive—	Not less than	7 per cent, Appendix 2 .2.7.
Ether-soluble extractive—	Not less than	25 per cent v/w Appendix 2.2.8.
Volatile oil—	Not less than	5 per cent v/w Appendix 2.2.10.

CONSTITUENTS—Essential oil and fixed oil.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṭu
Guṇa	:	Laghu, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dīpana, Grāhī, Mukhakledanāśaka, Mukhadaurgandhyanāśaka, Kaphavātāpaha, Vṛṣya

IMPORTANT FORMULATIONS— Jātīphalādi cūrṇa.

THERAPEUTIC USES— Atisāra; Grahaṇī; Chardi; Mukharoga; Pīnasa; Kāsa; Śvāsa; Śukrameha.

DOSE— 0.5—1.0 g of the drug in powder form.

KAMPILLA

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

SYNONYMS —

Sansk.	:	Rajanaka, Kampillaka
Assam.	:	Lochan
Beng.	:	Kamlagudi
Eng.	:	Kamala
Guj.	:	Kapilo
Hindi	:	Kabila
Kan.	:	Chandrahettu, Kapila, Kapilathettu
Kash.	:	Kameelak
Mal.	:	Kampippala, Kampipalu
Mar.	:	Shendri, Kapila
Ori.	:	Kamalagundi
Punj.	:	Kamila
Tam.	:	Kamala, Kampila
Tel.	:	Kampillamu
Urdu	:	Kamila

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter—	Not more than 2 per cent, Appendix 2.2.2.
Total ash—	Not more than 6 per cent, Appendix 2.2.3.
Acid-insoluble ash—	Not more than 4 per cent, Appendix 2.2.4.
Alcohol-soluble extractive—	Not less than 50 per cent, Appendix 2.2.6.
Water-soluble extractive—	Not less than 1.0 per cent, Appendix 2.2.7.

CONSTITUENTS—Resinous colouring matter (rottlerin).

PROPERTIES AND ACTION—

Rasa	:	Kaṭu
Guṇa	:	Laghu, Rūkṣa, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Virecana, Vraṇāpaha, Kṛmighna

IMPORTANT FORMULATIONS— Dhānvantara ghṛta; Miśraka sneha.

THERAPEUTIC USES— Vibandha; Kṛmiroga; Ādhmāna; Gulma; Vraṇa.

DOSE— 0.5-1.0 g of the drug in powder form.

Note—Śodhana of this drug is to be done before use, as described in Appendix.

KĀÑCANĀRA

Kāñcanāra consists of the dried, stem bark of *Bauhinia variegata* Blume (Fam Leguminosae); a medium sized tree occuring in sub-Himalayan tract extending eastwards to Assam, Eastern, Central and South India.

SYNONYMS—

Sansk.	:	Kāñcanāraka
Assam.	:	Kancan, Kanchan
Beng.	:	Kanchana, Rakta Kanchana
Eng.	:	Mountain Ebony
Guj.	:	Champakati, Kanchnar, Kachnar
Hndi	:	Kachanar, Kanchanar, Kachnar
Kan.	:	Keyu mandar, Kanchavala
Kash.	:	Kalad
Mal.	:	Chuvanna Mandharam
Mar.	:	Kanchana, Raktakancana
Ori.	:	Kachana, Kaniara
Punj.	:	Kanchnar
Tam.	:	Sigappu mandarai, Sihappu mantarai
Tel.	:	Deva, Kanchanam

DESCRIPTION—

(a) **Macroscopic**—Bark, dark brown, sometimes with silvery patches, rough, compact, exfoliating in woody strips and scales, outer surface with small transverse and longitudinal cracks, internal surface white; taste, astringent.

(b) **Microscopic**—Transverse section of mature stem bark shows a wide stratified cork; outer cork composed of thin-walled, slightly compressed, yellow brown cells followed by a number of layers of brown coloured cells, inner cork composed of transversely elongated orange brown cells; cork interrupted at certain places due to formation of rhytidoma; some secondary cortex composed of 15 or more rows of transversely elongated to circular, thin-walled, parenchymatous cells; some secondary cortex cells contain orange brown contents; groups of stone cells found scattered in this region, occasionally arranged in 1-7 or more tangential rows; pericyclic fibres, thick-walled with narrow lumen, scattered in secondary cortex in singles or in groups; secondary phloem consists of sieve tubes, companion cells, phloem parenchyma and fibres traversed by funnel shaped medullary rays; phloem fibres arranged in radial rows throughout phloem region; prismatic and rhomboidal crystals of calcium oxalate abundantly found in phloem and secondary cortex regions, very rarely found in cork cells, cluster crystals also present in secondary cortex and secondary phloem, crystal fibres also found in secondary phloem.

Powder—Powder pinkish; under microscope showing abundant crystals of calcium oxalate, sclereids in singles or in groups with wide lumen, bits of fibres, cork and secondary cortex cells, containing coloured content, and numerous crystal fibres.

IDENTITY, PURITY AND STRENGTH—

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

Total ash— Not more than 11 per cent, Appendix 2.2.3.

Acid-insoluble ash— Not more than 0.2 per cent, Appendix 2.2.4.

Alcohol-soluble extractive—Not less than 2 per cent, Appendix 2.2.6.

Water-soluble extractive— Not less than 6 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannins.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Trīdoṣahara, Grāhī, Dīpana, Gaṇḍavṛddhihara

IMPORTANT FORMULATIONS— Kāñcanāraguggulu.

THERAPEUTIC USES— Kṛmiroga; Gaṇḍamālā; Apacī; Gudabhraṁśa; Vraṇa.

DOSE—20—30 g of the drug for decoction.

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KAṄKOLA

Kaṅkola consists of mature, dried fruits of *Piper cubeba* Linn. f. (Fam. Piperaceae); woody, climbing, perennial with dioeceous flowers in spike, cultivated to a small extent in India, specially in the Karnataka state; fruits collected when mature but still unripe and carefully dried.

SYNONYMS —

Sansk.	:	Kaṅkolaka, Cinoṣaṇa, Cinatīkṣṇa, Kakkola, Kaṅkolikā
Assam.	:	Kakkol, Kababcheni
Beng.	:	Kababchini, Sugandhamaricha
Eng.	:	Cubebs, Tailed Pepper
Guj.	:	Chanakabab, Chinikabab
Hindi	:	Seetalchini, Kababchini
Kan.	:	Gandhamenasu, Balamenasu
Kash.	:	Kushfal, Kababchini
Mal.	:	Cheenamulaku, Takkolam, Valmulaku
Mar.	:	Kankol
Ori.	:	Kababchini
Punj.	:	Kababchini, Sardchini
Tam.	:	Vaali milaku, Valmilagu
Tel.	:	Chalavamiriyalu, Tokamiriyalu
Urdu	:	Kababchini

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter—	Not more than 2 per cent, Appendix 2.2.2.
Total ash—	Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash—	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive—	Not less than 14 per cent, Appendix 2.2.6.
Water-soluble extractive—	Not less than 11 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil (cubebin).

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dīpana, Pācana, Rucya, Kaphavātahara, Mukhadaurgandhyahara, Vastiśodhana

IMPORTANT FORMULATIONS— Daśamūlāriṣṭa; Kumāryāsava.

THERAPEUTIC USES— Aruci; Mūkharoga; Mūtrakṛcchra; Śūla.

DOSE— 1—2 g of the drug in powder form.

KAṄṬAKĀRI

Kaṇṭakārī consists of mature, dried whole plant of *Solanum surattense* Burm. f., Syn. *Solanum xanthocarpum* Schrad. & Wendl. (Fam. Solanaceae); perennial, very prickly diffused herb of waste land, found throughout India.

SYNONYMS —

Sansk.	:	Vyāghrī, Nidigdhikā, Kṣudrā, Kaṇṭakārikā, Dhāvanī, Nidigdhā, Dusparśā
Assam.	:	Katvaedana, Kantakar
Beng.	:	Kantakari
Eng.	:	Febrifuge plant
Guj.	:	Bharingani
Hindi	:	Katai, Katali, Ringani, Bhatakataiya, Chhotikateri
Kan.	:	Nelagulla, Kiragulla
Mal.	:	Kantakari chunda
Mar.	:	Bhauringani, Kataringani
Ori.	:	Bhejibaugana, Ankarati, Chakada Bhoji
Punj.	:	Kandiari
Tam.	:	Kandangatri, Kandankatri, Kandanghathiri
Tel.	:	Nelamulaka, Pinnamulaka, Mulaka, Chinnamulaka, Vakudu

DESCRIPTION—

(a) **Macroscopic**—

Root—10—45 cm long, few mm to two cm in diameter, almost cylindrical and tapering, bearing a number of fine longitudinal and few transverse wrinkles with occasional scars or a few lenticels and small rootlets, transversely smoothened surface shows a thin bark and wide compact cylinder of wood; fracture, short; taste, bitter.

Stem—herbaceous, prickly with prominent nodes and internodes, green when fresh, young branches, covered with numerous hairs, mature ones glabrous, furrows more prominent in young stem appearing almost circular towards basal region, stem pieces 8—10 mm thick of variable length, external surface light green, when dry, surface yellowish green and smooth, transversely smoothened surface shows a very thin bark and prominent wood, centre shows a large and distinct, pith, mature and dry stem often with hollow pith; fracture short to slightly fibrous.

Leaves—petiolate, exstipulate, ovate—oblong or elliptic, sinuate or sub-pinnatifid, sub-acute hairy; 4-12.5 cm long and 2-7.5 cm wide; green; veins and midrib full with sharp prickles; odour and taste not distinct.

Flower—ebracteate, pedicellate, bisexual, pentamerous, regular, complete, bright blue or bluish purple; calyx—persistent, gamosepalous, tube short, globose, linear—lanceolate, acute, hairy, 0.5-1.3 cm long and densely prickly; corolla—gamopetalous, lobes deltoid, acute, hairy; 1-2 cm long and purple in colour; stamens 5, epipetalous, basifixed, filament short 1—1·5 mm long; anther, oblong lanceolate, 0.7-0.8 cm long; ovary superior, ovoid, glabrous, bilocular with axile placentation having numerous ovules.

Fruit—berry, globular, measuring 0.8-1 cm in diameter, surrounded by persistent calyx at base unripe fruits variegated with green and white strips; ripe fruit shows different yellow and white shades.

Seeds—circular, flat, numerous, embedded in a fleshy mesocarp, about 0.2 cm in diameter, glabrous taste, bitter and acrid.

(b) **Microscopic**—

Root—transverse section of mature root shows cork composing of 3-6 layers of thin-walled, rectangular and tangentially elongated cells; cork cambium single layered followed by 6-15 layers of thin-walled, tangentially elongated to oval or circular parenchymatous cells; stone cells either single or in groups of 2-20 or even more present in this region; secondary phloem composed of sieve elements and phloem parenchyma traversed by medullary rays; stone cells present in

singles or in groups of 2-20 or more in outer, and middle phloem regions; phloem rays 1-4 cells wide and 2-22 cells high; cambium 3-5 layered of thin-walled rectangular cells; xylem composed of vessels, tracheids, fibre trachieds, parenchyma and trasversed by medullary rays, all elements being lignified; vessels and tracheids with bordered pits; fibres with a few simple pits; xylem parenchyama rectangular or lightly elongated with simple pits and rarely with reticulate thickening; xylem rays 1-3 cells wide and 1-20 cells high; microsphenoidal crystals of calcium oxalate as sandy masses and simple starch grains present in secondary cortex, phloem and medullary rays.

Stem—transverse section of mature stem, 1.5-2 cm thick consists of 6-12 layers of cork of thin- walled somewhat rectangular cells; epidermis remains intact for a long time; secondary cortex consists of 7-11 layers of parenchymatous cells, some cells thickened and lignified forming stone cells; primary cortex remains intact even in quite mature stage but later gets crushed; pericyclic fibre, occur singly or in small groups of 2-3; secondary phloem consists of sieve elements, parenchyama, a few fibres, stone cells and traversed by phloem rays; fibres found scattered in singles or in small groups in outer and middle phloem region; inner phloem devoid of fibres; stone cells present in singles or in small groups of 2-4; phloem rays, 1-2 or rarely 3 cells wide; cambium composed of 2-3 layers; xylem consists of vessels, tracheids, parenchyma, fibres and traversed by xylem rays; vessels vary greatly in shape and size and show bordered pits; tracheids elongated with irregular walls and bordered pits; fibres much elongated, thick-walled and lignified with tapering and pointed ends, some having truncated ends or bifurcated at one or both ends with a few simple pits; trancheids fibres smaller than fibres, with both ends tapering and have reticulate thickening; xylem parenchyma cubical to rectangular with simple or bordered pits or reticulate thickening; xylem rays conspicuous by their pitted thickenings, longer size and radial elongation of cells, 1-2 or rarely 3 cells wide and 2-25 cells high; internal phloem composed of sieve elements and parenchyma, forming more or less continuous band and embedded in perimedullary zone; a few phloem fibres similar to those of outer phloem region also present; central region occupied by a large pith; microsphenoidal crystals of calcium exalate as sandy masses and simple starch grains present in cortex, secondary cortex, phloem, medullary rays and pith cells.

Leaves—

(i) *Petiole*—transverse section of petiole shows circular to wavy outlines; epidermis single layered, covered externally by a thick cuticle; hypodermis consists of 3-4 layers of collenchymatous cells; one large-crescent-shaped, bicollateral, central vascular bundle and two small lateral bundles present; rest of tissue of petiole composed of polygonal, angular, thin-walled, parenchymatous cells; epidermis shows mostly stellate and rarely uni to tricellular hairs.

(ii) *Midrib*—transverse section of midrib shows a biconvex structure; epidermis on either side covered externally by a thick cuticle; below epidermis 3-4 layers of collenchyma present; stele composed of crescent-shaped, bicollateral, central vacscular bundle and two small lateral vascular bundles; rest of tissue composed of thin-walled, parenchyma, some stellate hair present on epidermis.

(iii) *Lamina*—transverse section shows dorsiventral structure; epidermis on either side, wavy in outline, covered externally by a thick cuticle; on upper side mesophyll composed of a single layered palisade and 4-6 layers of loosely arranged spongy parenchyma; some stellate hairs (4-8 armed) present on both sides of epidermis; anisocytic stomata present on both surfaces; vein-islet number 46-80 on lower epidermis (mean 63), 61-80 on upper epidermis (mean 70); stomatal index 20-25 (mean 22.5) on lower epidermis, 14-24 (mean 19) on pupper epidermis, palisade ratio 1.7-4 (mean 2.85).

Fruit—transverse section of mature fruit shows single layered epidermis, covered externally by a thin cuticle; 1-2 layers of collanchyma present below epidermis; mesocarp composed of thin-walled, oval to polygonal cells; some fibre vascular bundles present scattered; seed consists of thick-walled radially elongated testa, narrow endosperm with embryo; some cells of endosperm contain oil globules.

Powder—Greenish; under microscope shows single or groups of stone cells, groups of aseptate fibres with tapering ends, pitted vessels, groups of spongy parenchyma, fragments of palisade tissue, anisocytic stomata, stellate hairs and simple, rounded to oval starch grains measuring 2.75-11 μ in i

IDENTITY, PURITY AND STRENGTH—

Foreign matter	—Not more than 2 per cent, Appendix 2.2.2.
Total ash	—Not more than 9 per cent, Appendix 2.2.3.
Acid-insoluble ash	—Not more than 3 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	—Not less than 6 per cent, Appendix 2.2.6.
Water-soluble extractive	—Not less than 16 per cent, Appendix 2.2.7.

CONSTITUENTS—Glucoalkaloids and sterols.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dīpana, Pācana, Āmadoṣanāśaka, Kaṇṭhya, Śothahara

IMPORTANT FORMULATIONS— Kaṇṭakāryāvaleha; Pañcatiktaka ghṛta; Vyāghrīharītakī.

THERAPEUTICUSES— Śvāsa; Kāsa; Jvara; Aruci; Pīnasa; Pārśvaśūla; Svarabheda.

DOSE— 20—30 g of the drug for decoction.

KANYĀSĀRA

Kanyāsāra consists of dried juice of leaves of *Aloe barbadensis* Mill. Syn. *Aloe vera* Tourn. ex Linn; *Aloe indica* Royle. (Fam. Liliaceae); shrub planted in many Indian gardens and found growing throughout India.

SYNONYMS—

Sansk.	:	Kumārīrasasambhava, Sahāsāra
Assam.	:	Musabhar, Machambar
Beng.	:	Ghritakalmi
Eng.	:	Indian Aloe
Guj.	:	Eliyo, Eariyo
Hindi	:	Musabhar, Elva
Kan.	:	Karibola, Lolesara satva, Lovalsara, Lolesara
Kash.	:	Musabbar, Siber
Mal.	:	Chenninayakam
Mar.	:	Korphad
Ori.	:	Musabara
Punj.	:	Kalasohaga, Mussabar, Alua
Tam.	:	Kattazhi, Satthukkathazhai
Tel.	:	Musambaram
Urdu	:	Musabbar, Ailiva, Siber

DESCRIPTION—

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

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

IDENTITY, PURITIY AND STRENGTH—

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

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

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

Foreign matter	—Not more than 2 per cent, Appendix 2.2.2.
Total ash	—Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	—Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	—Not less than 80 per cent, Appendix 2.2.6.
Water-soluble extractive	—Not less than 60 per cent, Appendix 2.2.7.
Moisture content	—Not more than 10 per cent of its weight when dried to constant weight at 105°, Appendix 2.2.9.

CONSTITUENTS—Anthraquinone, glycoside.

PROPERTIES AND ACTION—

Rasa	:	Tikta
Guṇa	:	Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Bhedī, Pittanirharaṇa, Rajahpravartaka, Jvaranut

IMPORTANT FORMULATIONS— Rajahpravartinī vaṭi; Cukkumtippalyādi guṭikā.

THERAPEUTIC USES— Udararoga; Kaṣṭārtava; Jvara; Yakṛdvikāra.

DOSE— 125—500 mg of the drug in powder form.

KARAÑJA

Karañja consists of seeds of *Pongamia pinnata* (Linn.) Merr, Syn. *Pongamia glabra* Vent. (Fam. Leguminosae); a medium sized glabrous tree with a short bole and spreading crown and found almost throughout India upto an altitude of 1200 m.

SYNONYMS—

Sansk.	:	Karañjaka, Naktamāla, Naktāhva, Ghṛtakarañja
Assam.	:	Korach
Beng.	:	Nata Karanja, Dahara Karanja
Eng.	:	Smooth leaved pongamia
Guj.	:	Kanaji, Kanajo
Hindi	:	Dithouri, Karuaini
Kan.	:	Honge, Hulagilu
Mal.	:	Avittal, Ungu, Unu, Pungu
Mar.	:	Karanja
Ori.	:	Karnja
Punj.	:	Karanj
Tam.	:	Pungan, Pongana
Tel.	:	Lamiga, Kanuga
Urdu	:	Karanj

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	—Not more than	1 per cent, Appendix 2.2.2.
Total ash	—Not more than	3 per cent, Appendix 2.2.3.
Acid-insoluble ash	—Not more than	0.1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	—Not less than	23 per cent Appendix 2.2.6.
Water-soluble extractive	—Not less than	13 per cent Appendix 2.2.7.

CONSTITUENTS—Fixed oil, flavones and traces of essential oil.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphavātaghna, Kṛmijit, Kuṣṭhaghna, Vraṇaśodhana

IMPORTANT FORMULATIONS— Āragvadhādi kvāth cūrṇa; Pathyādilepa.

THERAPEUTIC USES—Vraṇa; Kṛmi; Kuṣṭha.

DOSE— 0.25 g of the drug in powder form
5—10 g of the drug for decoction.

KARVĪRA

Karavīra consists of dried leaves of *Nerium indicum* Mill. Syn. *Nerium odorum* Soland (Fam.Apocynaceae); a large evergreen woody shrub with milky juice, found throughout the year in upper Gangetic plains, Himalayas, from Nepal to Kashmir upto 2000 m, Central and Southern India; also cultivated near temples and gardens.

SYNONYMS—

Sansk.	:	Hayamāraka, Harapriya, Aśvamāra
Assam	:	Karbira, Karavi, Karvir
Beng	:	Karavi, Kalkephul
Eng.	:	Indian Oleander
Guj.	:	Kanera, Karena, Karen
Hindi	:	Kaner
Kan.	:	Kanagalu, Kanagile
Kash.	:	Gandeela, Gandula
Mal.	:	Kanave eram, Arali, Kattalari
Mar.	:	Kanher
Ori.	:	Kaniara, Kaniar
Punj.	:	Kaner
Tam.	:	Arali, Alari, Aatrulari
Tel.	:	Ganneru
Urdu	:	Kaner

DESCRIPTION—

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

(b) **Microscopic**—

Petiole—transverse section of petiole shows a single layer of epidermis covered externally by thick cuticle, epidermal cells elongate to form unicellular, non-lignified and non-glandular hairs; a wide zone of cortex, composed of 4—7 layers of collenchymatous cells and a wide zone of parenchyma follows the epidermis; parenchymatous cells thin-walled, more or less isodiametric with intercellular spaces, some cells contain rosette crystals of calcium oxalate; petiole receives three vascular bundles from stem, central one large and crescent shaped while other two much smaller and somewhat circular present on each side of central vascular bundle; phloem present on upper side and xylem on lower side with usual elements.

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

NOTE—Śodhana of this drug is to be done before use as described in the appendix.

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

INDENTITY, PURITY AND STRENGTH—

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

Total ash — Not more than 9 per cent, Appendix 2.2.3.

Acid-insoluble ash — Not more than 1 per cent, Appendix 2.2.4.

Alcohol-soluble extractive — Not less than 20 per cent, Appendix 2.2.6.

Water-soluble extractive — Not less than 20 per cent, Appendix 2.2.7.

CONSTITUENTS—Cardiac glucoside (oleandrin).

PROPERTIES AND ACTION—

Rasa : Kaṭu, Tikta, Kaṣāya

Guṇa : Tīkṣṇa, Laghu, Rūkṣa

Vīrya : Uṣṇa

Vipāka : Kaṭu

Prabhāva : Hṛdya

Karma : Jvarāpaha, Cakṣuṣya, Kuṣṭhaghna, Kaṇḍūghna, Kṛmighna, Vraṇāpaha, Śvāsahara

IMPORTANT FORMULATIONS— Kāsīsādi taila.

THERAPEUTIC USES— Jvara; Vraṇa; Kuṣṭha; Kaṇḍū; Kṛmiroga; Netraroga; Tamakaśvāsa; Hṛdroga.

DOSE*— 30—125 mg of the drug in powder form.

*Dose should not exceed the higher limit.

KARKAṬAŚṚṄGI

Karkaṭaśṛṅgī consists of gall-like excrescences formed by insects on the leaves, petioles and branches of the plant *Pistacia chinensis* Burgo, *Pistacia integerrima* Stew. ex Brandis, *Rhus succedanea* Linn. (Fam. Anacardiaceas) during autumn season, growing on the steps of Western Himalayas from Indus to Kumaon at an altitude of 350-2400 m, often cultivated in Punjab plains.

SYNONYMS—

Sansk.	:	Śṛṅgī, Viṣāṇī, Karkaṭa
Assam.	:	Kakiasrngi
Beng.	:	Kankda Shringi
Eng.	:	Crab's claw
Guj.	:	Kakada shing, Kakada singi
Hindi	:	Kakadasingi, Kakarasingi, Gheekadava
Kan.	:	Kakadasingi, Karkatakasringi
Kash.	:	Kakkar, Kamaladina
Mal.	:	Karkatasringi
Mar.	:	Kakadshingi
Ori.	:	Kakadashrungi, Kakadashringi
Punj.	:	Kakar, Kakarsingi
Tam-	:	Karkata singi
Tel.	:	Kakarsingi, Karkatakashrungi
Urdu	:	Kakrasinghi

DESCRIPTION—

(a) Macroscopic—Dried galls hard, hollow, horn-like, thin-walled, generally cylindrical, tapering at both the ends, greyish brown externally and reddish brown internally; size varies from 2.5—30.0 cm or more, each gall contains numerous dead insects; odour, terebinthine; taste of powdered galls, strongly astringent and slightly bitter.

(b) Microscopic— Transverse section of gall shows the collapsed epidermis on both the sides, epidermal cells thin-walled; tangentially elongated; ground tissues thin-walled and oval or circular, the outer two layers tangentially elongated while between vascular bundles radially elongated, outer few layers and some of cells of ground tissue filled with yellowish brown contents; vascular bundles scattered throughout the ground tissues in two rows, consist of phloem accompanied by a large tannin sac in each vascular bundle.

Powder—Powder greyish brown; under microscope, shows orange yellow colour isolated or associated fragments of xylem vessels and ground tissues.

IDENTITY, PURITY AND STRENGTH—

Foreign Matter	— Not more than 2 per cent, Appendix	2.2.2.
Total ash	— Not more than 7 per cent, Appendix	2.2.3.
Acid-insoluble ash	— Not more than 0.2 per cent, Appendix	2.2.4.
Alcohol-soluble exctrative	— Not less than 30 per cent, Appendix	2.2.6.
Water-soluble extractive	— Not less than 30 per cent, Appendix	2.2.7.

CONSTITUENTS—Essential oil, tannins and resinous matters.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya, Tikta
Guṇa	:	Guru
Vīrya	:	Uṣṇa
Vīpāka	:	Kaṭu
Karma	:	Kaphavātahara, Kāsahara, Ūrdhvavātajit, Hikkānigrahaṇa

IMPORTANT FORMULATIONS— Bālacaturbhadrikā cūrṇa.

THERAPEUTIC USES— Jvara; Śvāsa; Kāsa; Hikkā; Kṣaya; Aruci; Chardi.

DOSE— 3—6 g of the drug in powder form.

KĀRPĀSA

Kārpāsa consists of seeds (devoid of lint) of *Gossypium herbaceum* Linn. (Fam. Malvaceae); an annual or perennial shrub, 0.6—2.4 m high, extensively cultivated in India.

SYNONYMS—

Sansk.	:	Tuṇḍakeśī
Assam.	:	Karpasa, Tula
Beng.	:	Cotton plant seed
Eng.	:	Bona, Kapasia
Hindi	:	Kapasa, Binaula
Kan.	:	Hati, Arale
Mal.	:	Karpasi, Panji Karpasam
Mar.	:	Sarki
Tam.	:	Parutti kkoottam
Tel.	:	Patti ginga
Urdu	:	Pambadana, Habb-ul-Qutn

DESCRIPTION—

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

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	5 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	0.1 per cent, Appendix 2.2.4.
Alcohol-Soluble extractive	— Not less than	14 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	8 per cent, Appendix 2.2.7.

CONSTITUENTS—Fixed oil, resin and sterols.

PROPERTIES AND ACTION—

Rasa	:	Madhura
Guṇa	:	Snigdha, Guru
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Stanyajanana, Vṛṣya, Kaphakara, Hṛdya

IMPORTANT FORMULATIONS— Kārpāsāṣṭhyādi taila.

THERAPEUTIC USES— Dāha; Śrama; Bhrānti; Mūrcchā; Stanyakṣya.

DOSE— 3—6 g of the drug in powder form.

KAŚERU

Kaśeru consists of rhizome of *Scirpus kysoor* Roxb. (Fam. Cyperaceae); a weed commonly found on the margins of ponds and swampy places throughout India.

SYNONYMS—

Sansk.	:	Kaśeruka
Assam.	:	Kaheru
Beng.	:	Keshura
Eng.	:	Water chestnut
Guj.	:	Kasela, Kasola
Hindi		Kaseru
Kan.	:	Kasure gadd, Kaseruva, Kothigadde
Mal.	:	Kazhi Muthanga
Mar.	:	Kasara, Kachera, Kachora
Ori.	:	Kasaru Kawda, Kasaru Kanda
Punj.	;	Kaseru
Tam.	:	Gundatigagaddi
Tel.	:	Guntatungagaddi
Urdu	:	Kaseru

DESCRIPTION—

(a) Macrosopic—Rhizomes, oval to cylindrical, often branched having a number of transverse rings; black coloured roots and rounded scars; black externally and cream coloured internally; odour, aromatic; taste, bitter.

(b) Microscopic—Tranverse section of rhizome shows epidermis of collapsed and brown coloured cells; hypodermis, 4—8 cells with thick brown cell walls, followed by a wide zone of cortical ground tissue of oval to rounded, thin-walled, parenchymatous cells, filled with oval to spherical starch grains; encircled by sclerenchymatous sheath; vascular bundles, found scattered throughout cortical ground tissue; endodermis consists of brown coloured cells with heavy thickenings on thier walls, enclosing a wide central stelar ground tissue with a number of scattered vascular bundles of closed, collateral type, encircled by sclerenchymatous sheath; stelar ground tissues of rounded to oval, thin-walled and parenchymatous cells, containing oval to spherical starch grains; a number of secretory cells with orgage-brown contents found throughout cortical and stelar ground tissue.

Powder—Light brown; under microscope shows abundant round to oval starch grains and orange-yellow pigments; fragments of xylem vessels with annular thickenings and thin-walled, parenchymatous tissue.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent Appendix 2.2.2.
Total ash	— Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 3 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 4 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 9 per cent, Appendix 2.2.7.

CONSTITUENTS—Starch, saponins, sugars and progesterone.

PROPERTIES AND ACTION—

Rasa	:	Madhura, Kaṣāya
Guṇa	:	Guru
Vīrya	:	Śita
Vipāka	:	Madhura
Karma	:	Pittaghna, Dāhaghna, Śukrakara, Stanyakara, Cakṣuṣya, Grāhī, Rucikara

IMPORTANT FORMULATIONS— Saubhāgyaśuṇṭhī.

THERAPEUTIC USES— Dāha; Netraroga; Aruci; Atisāra; Śukrakṣya; Stanyakṣaya; Daurbalya.

DOSE— 5—10 g of the drug in powder form.

KETAKĪ

Ketakī consists of dried, underground roots of *Pandanus tectorius* Soland. ex-Parkinson (Fam. Pandanaceae); a densely branched shrub, rarely erect found along the coast of India and Andaman Island and sometimes cultivated in gardens also.

SYNONYMS—

Sansk.	:	Sūcikāpuṣpa
Assam.	:	Katki
Beng.	:	Katki
Eng.	:	Screw pine
Guj.	:	Kevado
Hindi	:	Kevada
Kan.	:	Kadajlmudu, Talehuvu
Mal.	:	Pookaitha
Mar.	:	Kewda
Ori.	:	Ketaki, Kia
Punj.	:	Keora
Tam.	:	Tazhai
Tel.	:	Mogali

DESCRIPTION—

(a) Macroscopic—Root pieces, 2—6 cm long, 0.3—2 cm in diameter, cylindrical, rusty or yellowish-brown to grey, surface smooth except for protuberances at certain places, papery cork, surface uneven, easily peelable exposing a fibrous surface; fracture, usually unbreakable.

(b) Microscopic—Transverse section of mature root shows a wide zone of stratified cork, exfoliating at places, consisting of rectangular, thin-walled, tangentially elongated, radially arranged cells, upper few layers filled with reddish-brown contents, remaining cells colourless; cortex, a wide zone of rounded cells with fibre groups towards central and middle region, cells obliterated at places; endodermis barrel-shaped, slightly thick-walled; pericycle and phloem not distinct; xylem forms bulk of root consisting of vessels, fibres and parenchyma; medullary rays not distinct; vessels show annular or pitted thickening; fibres thick-walled, elongated having a few simple pits.

Powder—Yellowish-brown; under microscope shows fragments of corks, xylem vessels and fibres.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	—	Not more than 2 per cent, Appendix 2.2.2.
Total ash	—	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	—	Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	—	Not less than 9 per cent, Appendix 2.2.6.
Water-soluble extractive	—	Not less than 16 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Madhura, Kaṭu
Guṇa	:	Laghu
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Varṇya, Keśya, Daurgandhyanāśana, Balya, Rasāyana, Dārḍhyakara, Saukhyakara, Kaphāpaha, Cakṣuṣya

IMPORTANT FORMULATIONS— Triphalādi taila.

THERAPEUTIC USES— Gulma; Kapharoga; Netraroga.

DOSE— 20—30 g of the drug for decoction.

KHADIRA

Khadira consists of dried pieces of heart-wood of *Acacia catechu* (Linn. f.) Willd. (Fam. Leguminosae); a moderate sized tree, found mostly in dry parts of India.

SYNONYMS—

Sansk.	:	Gāyatrī
Assam.	:	Kharira, Khara, Khayar
Beng.	:	Khera, Khayera
Eng.	:	Black catechu, Cutch tree
Guj.	:	Khair, Kathe, Kher
Hindi	:	Khair
Kan.	:	Kaggali, Kaggalinara, Kachinamara, Koggigida
Kash.	:	Kath
Mal.	:	Karingali
Mar.	:	Khaira, Khair
Ori.	:	Khaira
Punj.	:	Khair
Tam.	:	Karungali, Karungkali
Tel.	:	Chandra, Kaviri
Urdu	:	Chanbe Kaath

DESCRIPTION—

(a) **Macroscopic**—Heart-wood, light red, turining brownish-red to nearly black with age, attached with whitish sapwood; fracture hard; taste, astringent;

(b) **Microscopic**—Transverse section of heart-wood shows, numerous, uni-to bi-seriate medullary rays; vessels occuring isolated or in small groups of two to four; xylem fibres with narrow lumen occupying major portion of wood; xylem parenchyma usually predominantly paratracheal, forming a sheath around vessels; wood consists of crystal fibres with 14—28 segments, each having one prismatic crystal of calcium oxalate; a few tracheids with scalariform thickening; some of cells, including vessels, filled with brown content; prismatic crystals of calcium oxalate present in a number of cells throughout the wood.

Powder—Brown coloured; under microscope shows a number of xylem fibres, vessels, crystal fibres, prismatic crystals of calcium exalate.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	2 per cent. Appendix 2.2.3.
Acid-insoluble ash	— Not more than	0.2 per cent Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	1 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	3 per cent, Appendix 2.2.7.

CONSTITUENTS—Catechin, catechu-tannic acid and tannin.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Kaphapittahara, Raktaśodhaka, Kuṣṭhaghna, Medohara, Kṛmighna, Dantya

IMPORTANT FORMULATIONS— Khadirāriṣṭa; Arimedādi taila; Khadirādi guṭikā.

THERAPEUTIC USES— Kuṣṭha, Vraṇa; Śotha; Prameha.

DOSE— 20—30 g of the drug for decoction.

KIRĀTATIKTA

Kirātatikta consists of whole plant of *Swertia chirata* Buch. Ham. (Fam. Gentianaceae); a small, erect, annual, herbaceous plant, 0.6—1.25 m high, found in temperate Himalayas at an altitude between 1200—3000 m from Kashmir to Bhutan and Khasia Hills in Meghalaya; drug collected when flowering (July-October) and dried.

SYNONYMS —

Sansk.	:	Kirāta, Kirātaka, Bhūnimba, Kirātatiktaka
Assam.	:	Chirta
Beng.	:	Chirata
Eng.	:	Chireta
Guj.	:	Kariyatu, Kariyatun
Hindi	:	Chirayata
Kan.	:	Nalebevu, Chirata Kaddi, Chirayat
Kash.	:	Lose, Chiraita
Mal.	:	Nelaveppu, Kirayathu, Nilamakanjiram
Mar.	:	Kiraita, Kaduchiraita
Ori.	:	Chireita
Pun.	:	Chiretta, Chiraita
Tam.	:	Nilavembu
Tel.	:	Nelavemu.
Urdu	:	Chiraita

DESCRIPTION—

(a) **Macroscopic**—Drug consists of whole plant, a peculiar shining yellowish tinge all over the herb in fresh sample; stem upto 1 m long and 6 mm in diameter, glabrous, yellowish-brown to purplish, slightly quadrangular above and cylindrical below; large, continuous, easily separable yellow pith, leaf, opposite, cauline, broad at base, ovate or lanceolate, entire, acuminate, glabrous, usually with 5—7 prominent lateral veins; branching from the axils of the leaves which ramify further into paniculate inflorescence; flower, tetramerous, 2—3 mm wide, ovoid, with two glandular depressions near the base of each of corolla lobes; ovary, superior, bicarpellary, unilocular, ovoid and pointed; fruit, a capsule with numerous, minute reticulated seed, 0.25—0.55 mm long, 0.16—0.45 mm broad irregularly ovoid.

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

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

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter—	Not more than	2 per cent, Appendix 2.2.2.
Total ash—	Not more than	6 per cent, Appendix 2.2.3.
Acid-insoluble ash—	Not more than	1 per cent, Appendix 2.2.4.
Alcohol (60 per cent)— Soluble extractive—	Not less than	10 per cent, Appendix 2.2.6.
Water soluble extractive—	Not less than	10 per cent Appendix 2.2.7.

Absence of tannin—On additon of *Ferric Chloride* to aqueous or alcoholic extract no blue black colour develops.

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

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

CONSTITUENTS—Xanthones, xanthone glycoside and mangiferine (Flavonoid).

PROPERTIES AND ACTION —

Rasa	:	Tikta
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Jvaraghna, Vraṇaśodhana, Sāraka, Tṛṣṇāpaha, Raktaśodhaka, Kaphapittahara

IMPORTANT FORMULATIONS— Sudarśana cūrṇa; chinnodbhavādi kvātha cūrṇa.

THERAPEUTIC USES— Jvara; Tṛṣṇā; Dāha; Śotha; Kuṣṭha; Vraṇa; Kṛmiroga; Kaṇḍū; Meha.

DOSE— 1—3 g of the drug in powder form.
20—30 g of the drug for decoction.

KṚṢṆAJĪRAKA

Kṛṣṇajīraka consists of dried ripe fruits of *Carum carvi* Linn. (Fam. Umbelliferae); a biennial herb, 30-90 cm high, cultivated as a cold season crop in plains of India and as summer crop in hilly areas of Kashmir, Kumaon, Garhwal and Chamba.

SYNONYMS —

Sansk.	:	Asitajīraka
Assam.	:	Krisnjeera, Kalajira, Kaljira
Beng.	:	Kala jira
Eng.	:	Black Caraway
Guj.	:	Shahjirun
Hindi	:	Kalajira
Kan.	:	Kari jeerige, Shahajeerige
Kash.	:	Krihunzur
Mal.	:	Karunjiraka, Karinjeerakam
Mar.	:	Shahira, Shahajira
Ori.	:	Kalajira
Punj.	:	Zira Siyah, Kalajira
Tam.	:	Karamjiragam, Shimai shambu
Tel.	:	Nalla Jeelakarra
Urdu	:	Zira Siyah, Kala Zira

DESCRIPTION —

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

(b) **Microscopic**—Transverse section of fruit shows pericarp with outer epidermis of polygonal tabular cells with a thick outer wall and striated cuticle; trichomes, absent; vittae four dorsal, intercostal and two commissural extending the length of each mericarp, with an epithelium of brown cells and volatile oil in the cavity; mesocarp parenchymatous without reticulate thickening; costae five in each mericarp with vascular strand consisting of an inner group of small vessels and fibres and arched, outer group of pitted sclerenchyma with a small group of phloem on each lateral surface; on the outer margin of each vascular strand a small schizogenous canal extending into both stylopod and pedicel; inner epidermis of thin -walled, subrectangular cells, elongated tangentially, each about 8-12 μ wide and 40-100 μ long, arranged parallel with one another; endosperm o thick-walled, cellulosic parenchyma, containing much fixed oil and numerous small aleurone grains upto 10 μ in diameter, each containing one or sometimes two micro-rosette crystals of ca l cium oxalate; carpophore, when present, passing at the apex to a raphe in each mericarp, and with a small strand of sclerenchyma, the sclereids of which continue into the stylopod.

Powder—Colour fawn to brown; epidermal cells of pericarp with striated cuticle; fragments of brown endothelium of vittae, parenchymatous cells of the mesocarp without reticulate thickening; rectangular, finely pitted sclereids of mesocarp, thick-walled polygonal parenchymatous cells of endosperm containing much fixed oil; numerous small aleurone grains containing micrc-rosette crystals of calcium oxalate; trichomes, starch and parquetry layer absent; it contains nc less than 2.5 per cent of volatile oil.

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	9 per cent, Appendix 2.2.3.
Acid-in soluble ash	— Not more than	1.5 per cent, Appendix 2.2.4.
Alcochol-soluble extractive	— Not less than	2 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	12 per cent, Appendix 2.2.7.
Volatile oil	— Not less than	3.5 per cent, v/w, Appendix 2.2.10

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CONSTITUENTS—Essential oils (carvone and carvacrol).

PROPERTIES AND ACTION—

Rasa	:	Kaṭu
Guṇa	:	Laghu
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Pācana, Dīpana, Saṁgrāhī, Jvaraghna, Rucya, Cakṣuṣya, Śothahara

IMPORTANT FORMULATIONS— Jīrakādyariṣṭa; Jīrakādi modaka.

THERAPEUTIC USES— Agnimāndya; Ādhmāna; Jīrṇajvara; Grahaṇīroga; Kṛmiroga.

DOSE— 1—3 g of the drug in powder form.

KULATTHA

Kulattha consists of dry seeds of *Vigna unquiculata* (Linn.) Walp. Syn. *Dolichos biflorus* Linn. Fam Leguminosae); an annual branched, sub-erect or twining, downy or glabrescent; herb; cultivated all over India.

SYNONYMS—

Sansk.	:	Khalva, Vardhipatraka
Beng.	:	Kulattha, Kalaya
Eng.	:	Horse gram
Guj.	:	Kalathi, Kulathi
Hindi	:	Kulathi, Kurathi
Kan.	:	Huruli, Hurali
Mar.	:	Kulitha
Mal.	:	Mudiraa
Tam.	:	Kollu, Kaanam
Tel.	:	Ulavalu
Urdu	:	Kulthi

DESCRIPTION —

(a) **Macroscopic**—Seeds, hard, surface smooth, ellipsoid, flattened, greyish to reddish brown; 4-6 mm long and 4 mm wide; micropyle prominent; taste, somewhat astringent.

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

Powder—Whitish in colour; under microscope shows broken pieces of testa, parenchymatous cells and starch.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Nil, Appendix 2.2.2.
Total ash	— Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 12 per cent, Appendix 2.2.7.

CONSTITUTENTS—An enzyme (urease) and oil.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya
Guṇa	:	Laghu, Sara
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Vidāhī; Svedasaṁgrāhaka, Kṛmihara, Kaphavātahara

IMPORTANT FORMULATIONS— Saptasāra kvātha cūrṇa; Dhānvantara taila.

THERAPEUTIC USES— Aśmarī; Naṣṭārtava.

DOSE— 12 g of the drug in powder form for decoction.

KUṢṬHA

Kuṣṭha consists of dried roots of *Saussurea lappa* C.B. Clarke (Fam. Compositae; a tall, robust, perennial herb with thick roots; found in Kashmir at an altitude of 2500—3600 m; roots collected in September-October.

SYNONYMS—

Sansk.	:	Āmaya, Pākala
Assam.	:	Kud, Kur
Beng.	:	Kudo
Guj.	:	Upleta, Kath
Hindi	:	Kutha
Kan.	:	Changal Kustha
Kash.	:	Kuth
Mal.	:	Kottam
Mar.	:	Upleta, Kustha
Ori.	:	Kudha
Punj.	:	Kuth
Tam.	:	Goshtam, Koshtham, Kottam
Tel.	:	Changalva Koshtu
Urdu	:	Qust

DESCRIPTION—

(a) **Macroscopic**—Drug greyish to dull brown, thick, stout, fusiform to cylindrical, 7-15 cm long, 1.0—5.5 cm broad, thicker roots with collapsed centre, occasionally ridged, wrinkles longitudinal and anastomosed; rootlets rarely present; cut surface shows two regions, outer periderm ring thin, inner porous woody portion lighter in colour showing fine radial striations and often the central portion collapsed; fracture, short, horny; odour, strong, characteristically aromatic; taste, slightly bitter.

(b) **Microscopic**—Transverse section of thin root shows thin periderm, followed by broad zone of phloem and still broader zone of xylem traversed by wide medullary rays; cork, 3—5 layered wide, secondary cortical cells polygonal, mostly elongated; secondary phloem consists of mostly storage parenchyma, small groups of sieve tubes and companion cells and often phloem fibres, bast fibres thick-walled, lignified, upto 350 μ in length, with many simple pits associated with fibre, tracheids and parenchyma; wood fibres smaller than bast fibres; with wider lumen and obtusely tapering ends; meduallary rays multiseriate and wider in phloem region; resin canals found throughout as large cavities; some roots possess a central cylinder of sclerenchyma, while others have parenchymatous centre with scattered xylem elements; in older roots, wood parenchyma collapses and takes a spongy appearance in the centre of root; inulin present in storage parenchyma.

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2
Total ash	— Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	— Not less than 12 per cent, Appendix 2.2.6
Water-soluble extractive	— Not less than 20 per cent, Appendix 2.2.7

CONSTITUENTS—Essential oil, alkaloid (saussurine) and bitter resin.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphavātajit, Śukrala, Raktaśodhaka, Varṇya

IMPORTANT FORMULATIONS— Koṭṭamacukkādi taila.

THERAPEUTIC USES— Vātarakta; Visarpa; Kuṣṭha; Kāsa; Śvāsa.

DOSE – 0.2—1.0 g of the drug in powder form.

KUṬAJA

Kuṭaja consists of dried stem bark of *Holarrhena antidysenterica* (Roth) A. DC. (Fam. Apocynaceae); a small to medium sized tree, found throughout India; drug collected from 8—12 years old tree during the middle of rainy season (July to September) and again at the end of winter season by hewing and peeling and separated from attached wood.

SYNONYMS—

Sansk.	:	Kaliṅga, Śakra, Vatsaka
Assam	:	Dudhkuri
Beng.	:	Kurchi
Eng.	:	Ester tree, Conessi bark
Guj.	:	Kuda, Kadachhal, Kudo
Hindi	:	Kurchi, Kuraiya
Kan.	:	Kodasige, Halagattigida, Halagatti Mara
Kash.	:	Kogad
Mal.	:	Kutakappala
Mar.	:	Pandhra Kuda
Ori.	:	Kurei, Keruan
Punj.	:	Kurasukk, Kura
Tam.	:	Kudasapalai
Tel.	:	Kodisapala, Palakodisa
Urdu	:	Kurchi

DESCRIPTION—

(a) **Macroscopic**—Small recurved pieces of varying sizes and thickness, outer surface buff to brownish longitudinally wrinkled and bearing horizontal lenticels, inner surface brownish, rough and scaly fracture short and granular; taste, acrid and bitter.

(b) **Microscopic**—Transverse section of dried stem bark shows cork consisting of 4—12 rows of tangentially elongated cells, radial 15—45 μ. tangential 30—60 μ; cork cambium consists of a row of thin-walled tangentially elongated cells; secondary cortex usually wide, parenchymatous, interspersed with strands of stone cells; stone cell rectangular to oval, with numerous pits often containing prismatic crystals of calcium oxalate, non-lignified pericyclic fibres upto 52 mm thick, present in bark; secondary phloem wide consisting of sieve-tubes, companion cells, phloem parenchyma and stone cells; stone cells arranged in tangential rows in concentric manner associated with crystal sheath containing prisms of calcium oxalate; medullary rays mostly bi or triseriate rarely uniseriate becoming wide towards outer part and consist of thin-walled, radially elongated, parenchymatous cells; medullary ray cells near stone cells become sclerosed.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	7 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	1 per cent, Appendix 2.2.4
Alcohol (60 per cent) soluble extractive	— Not less than	18 per cent, Appendix 2.2.6
Water-soluble extractive	— Not less than	10 per cent, Appendix 2.2.7

Assay—Kutaja contains not less than 2 per cent of total alkaloids when assayed by the following method:— weigh accurately about 5 g in powder (No. 85 seive) and moisten with 10 ml of an Alcohol-chloroform mixture (1:3) containing 2 per cent of Ammonia solution for 15 minutes. Pack the mixture in a small glass percolator surrounded by a jacket of hot water kept at 50°. Macerate with more of the alkaline Alcohol-chloroform mixture for an hour and collect 25 ml of percolate in a receiver containing 1 g of *Oxalic acid* dissolved in 5 ml of alcohol. Stop the percolation add 10 ml of the alcohol-chloroform mixture containing 1 per cent w/v of *Sodium Hydroxide* and macerate for fifteen

minutes. Continue the percolation adding further quantities of the alcohol-chloroform mixture until the alkaloids are completely extracted. Mix the percolate well and extract by shaking with five 20 ml portions of 2 *N Hydrochloric acid*. Combine the acid extracts and make alkaline with *dilute Ammonia Solution*. Extract with four 10 ml portions of Chloroform, add 1 ml of 0.5 *N Sodium Hydroxide*, and extract again with *Chloroform*. Wash each *Chloroform* extract with the same two 10 ml portions of water contained in different separators. Combine the *Chloroform* extracts, add 20 ml of 0.1*N Sulphuric Acid* and shake well for 5 Minutes. Transfer the acid Liquid to a conical flask, wash the *Chloroform* extract with two 20 ml portions of water and add the washing to the acid liquid in the conical flask. Titrate the excess of acid with 0.1*N Sodium Hydroxide* using the mixed 3 indicator. Each ml of *0. IN Sulphuric Acid* is equivalent to 0.01657g of total alkaloids of Kutaja.

CONSTITUENTS—Conessine and related alkaloids.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Dīpana, Saṅgrāhī, Kaphapittaśāmaka

IMPORTANT FORMULATIONS— Kuṭajāriṣṭa; Kuṭajāvaleha; Kuṭajaghana vaṭī.

THERAPEUTIC USES— Pravāhikā; Atisāra; Jvarātisāra; Arśa; Kuṣṭha. Tṛṣṇā.

DOSE— 20—30 g of the drug for decoction.

LAVAṄGA

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

SYNONYMS —

Sansk.	:	Devapuṣpa
Assam.	:	Lavang, Lan, Long
Beng.	:	Lavang
Eng.	:	Clove
Guj.	:	Lavang, Laving
Hindi	:	Lavanga, Laung
Kan.	:	Lavanga
Kash.	:	Rung
Mal.	:	Karampu, Karayampoovu, Grampu
Mar.	:	Lavang
Ori.	:	Labanga
Punj.	:	Laung, Long
Tam.	:	Kirambu, Lavangam
Tel.	:	Lavangalu
Urdu	:	Qarnful, Laung

DESCRIPTION —

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

(b) **Microscopic**—Transverse section of hypanthium shows epidermis and calyx teeth composed of straight walled cells, with thick cuticle having large anomocytic stomata, hypanthium tissue spongy, clusters of calcium oxalate crystals varying in size from 6—20 μ in diameter, small number of stone cells and prismatic crystals of calcium oxalate present in stalk; stamens, each with an oil gland in the apex of the connective, triangularly centricular pollen grains, 15—20 μ in diameter anther walls showing a typical fibrous layer, schizolysigenous glands found in all parts of clove; occasional isolate pericyclic fibres present.

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

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than 2 per cent, Appendix	2.2.2.
Total ash	— Not more than 7 per cent, Appendix	2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix	2.2.4.
Alcohol-soluble extractive	— Not less than 3 per cent, Appendix	2.2.6.
Water-soluble extractive	— Not less than 9 per cent, Appendix	2.2.7.
Volatile oil	— Not less than 15 per cent, Appendix	2.2.10.

CONSTITUENTS—Essential oils (eugenalacetate and caryophyllene).

PROPERTIES AND ACTION —

Rasa	:	Tikta, Kaṭu
Guṇa	:	Laghu. Tīkṣṇa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Dīpana, Pācana, Rucya, Kaphapittaśāmaka, Śūlahara, Kāsahara.

IMPORTANT FORMULATIONS— Lavaṅgādi vaṭī; Lavaṅgādi cūrṇa.

THERAPEUTIC USES— Kāsa; Śvāsa; Hikkā; Kṣaya; Ādhmāna; Tṛṣṇā; Chardi; Amlapitta.

DOSE— 0.5—2.0 g of the drug in powder form.

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LODHRA

Lodhra consists of dried stem bark of *Symplocos racemosa* Roxb. (Fam. Symplocaceae); an evergreen tree, 6—8·5 m tall, found abundantly in plains and lower hills throughout India.

SYNONYMS —

Sansk.	:	Rodhra, Paṭṭikā lodhra, Śābara lodhra, Tirīṭa
Assam.	:	Mugam
Beng.	:	Lodha, Lodhra
Eng.	:	Symplocos bark
Guj.	:	Lodhar
Hindi	:	Lodha
Kan.	:	Lodhra
Mar.	:	Lodha, Lodhra
Mal.	:	Pachotti
Punj.	:	Lodhar
Tam.	:	Vellilathi, Vellilothram
Tel.	:	Lodhuga
Urdu	:	Lodh, Lodhpathani

DESCRIPTION —

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

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

Powder—Greyish-brown; under microscope shows fragements of cork, stone cells, fibres, prismatic and cluster crystals of calcium oxalate and starch grains.

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Nil,	Appendix 2.2.2.
Total ash	— Not more than 12 per cent,	Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent,	Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 9 per cent,	Appendix 2.2.6.
Water-soluble extractive	— Not less than 15 per cent,	Appendix 2.2.7.

CONSTITUENTS—Alkaloids (loturine and colloturine) and red colouring matter.

PROPERTIES AND ACTION —

Rasa	:	Kaṣāya
Guṇa	:	Laghu
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Kaphapittanut, Grāhī, Cakṣuṣya

IMPORTANT FORMULATIONS— Rodhrāsava (Lodhrāsava) ; Puṣyānuga cūrṇa; Bṛhat gaṅgādhara-cūrṇa.

THERAPEUTIC USES— Raktapitta; Atisāra; Śotha; Pradara; Netraroga.

DOSE— 3—5 g of the drug in powder form.
20—30 g of the drug for decoction.

MADANA

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

SYNONYMS —

Assam.	:	Maen
Beng.	:	Mainaphal, Mayanaphal
Eng.	:	Emetic nut
Guj.	:	Mindhal, Mindhol, Mindhar
Hindi	:	Manphal
Kan.	:	Mangarikai, Karigidda, Madanaphala Maggrekai, Kari, Maggare Kayi
Kash.	:	Madanfal
Mal.	:	Malankara, Malamkarakka
Mar.	:	Gal, Galphala, Giephala, Madanphala
Ori.	:	Maena, Madana
Punj.	:	Mindhal, Rara, Manphal
Tam.	:	Marukkara
Tel.	:	Mranga Kaya, Monga Kaya
Urdu	:	Mainphal, Jauz-ul-Qai

DESCRIPTION—

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

(b) **Microscopic**—

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

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

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

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	6 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	0.25 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	19 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	16 per cent, Appendix 2.2.7.

ONSTITUENTS—Essential oil, saponin, tannin and resin.

PROPERTIES AND ACTION —

Rasa : Madhura, Tikta

Guṇa : Laghu, Rūkṣa

Virya : Uṣṇa

Vipāka : Kaṭu

Karma : Vamana, Lekhana

IMPORTANT FORMULATIONS — Pippalyādi taila.

THERAPEUTIC USES — Gulma; Vidradhi; Kuṣṭha; Śleṣmajvara; Pratiśyāya.

DOSE— 0.5—1.0 g of the drug in powder form for decoction.

3—6 g of the drug for induction of vomitting.

MIŚREYĀ

Miśreyā consists of dried ripe fruits of *Foeniculum vulgare* Mill. (Fam. Umbelliferae); an erect, glabrous, aromatic herb, 1—2 m high, cultivated extensively throughout India upto 1830 m and also sometimes found wild, fruits ripen in September; stems cut with sickles and put up in loose sheaves to dry in sun; when dry, fruits are beaten out in a cloth in sun, cleaned by winnowing and collected.

SYNONYMS —

Sansk.	:	Miśi, Miṣi, Madhurikā
Assam.	:	Guvamuri
Beng.	:	Marui, Panmauri
Eng.	:	Fannel Fruit
Guj.	:	Variyali
Hindi	:	Saunf
Kan.	:	Badisompu, Doddasompu
Kash.	:	Sanuf, Badnai
Mal.	:	Kattusatakuppa, Parinjaeragum
Mar.	:	Badishop
Ori.	:	Panamadhuri
Punj.	:	Saunf
Tam.	:	Shombu
Tel.	:	Sopu
Urdu	:	Saunf

DESCRIPTION—

(a) **Macroscopic**—Fruits, usually entire with pedicel attached; mericarps, upto about 10 mm long and 4 mm broad, five sided with a wider commissural surface, tapering slightly towards base and apex, crowned with a conical stylopod, glabrous, greenish or yellowish-brown with five paler prominent primary ridges; endosperm, orthospermous.

(b) **Microscopic**—Transverse section of fruit shows pericarp with outer epidermis of quadrangular to polygonal cells with smooth cuticle and a few stomata; trichomes, absent; vittae, 4 dorsal and 2 commissural extending with length of each mericarp, intercostal, with an apithelium of brown cells and volatile oil in cavity; mesocarp, with much reticulate lignified parenchyma; costae, 5 in each mericarp, each with 1 vascular strand having 1 inner xylem strand and 2 lateral phloem strands separated by a bundle of fibres; inner epidermis of very narrow, thin-walled cells arranged parallel to one another in groups of 5—7, many of these groups with longer axis of their cells at an angle with those of adjacent groups (Parquetry arrangement); endosperm consists of thick-walled, cellulosic parenchyma containing much fixed oil, micro-rosette crystals of calcium oxalate, and numerous aleurone grains upto 5 μ in diameter; carpophore with very thick-walled sclerenchyma in two strands, often unsplit with two strands very close to each other.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	12 per cent, Appendix 2.2.3.
Acid-insoluble Ash	— Not more than	15 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	4 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	1 per cent, Appendix 2.2.7.
Volatile oil	— Not less than	1.4 per cent v/w Appendix 2.2.10.

CONSTITUENTS—Essential oil and fixed oil.

PROPERTIES AND ACTION —

Rasa	:	Madhura, Kaṭu, Tikta
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Dīpana, Vātapittahara, Balya, Anulomana, Āmadoṣahara

IMPORTANT FORMULATIONS— Miśreyārka; Pañcasakāra cūrṇa.

THERAPEUTIC USES— Agnimāndya; Śūla; Kāsa; Raktadoṣa; Pravāhikā; Arśa.

DOSE— 3—6 g of the drug in powder form.

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NYAGRODHA

Nyagrodha consists of dried mature stem bark of *Ficus bengalensis* Linn. (Fam. Moraceae); a large branching tree with numerous aerial roots occurring all over India.

SYNONYMS—

Sansk.	:	Vaṭa
Assam.	:	Vat, Ahat, Vatgach
Beng.	:	Bot
Eng.	:	Banyan tree
Guj.	:	Vad, Vadalo
Hindi	:	Badra, Bargad, Bada
Kan.	:	Aala, Aladamara, Vata
Kash.	:	Bad
Mal.	:	Peraal
Mar.	:	Vad
Ori.	:	Bata, Bara
Punj.	:	Bhaur
Tam.	:	Aalamaram, Aalam
Tel.	:	Marri
Urdu	:	Bargad, Bad

DESCRIPTION—

(a) **Macroscopic**— Mature stem bark grey with thin, closely adhered ashy white, light bluish-green or grey patches; bark flat or slightly curved, thickness varies with age of tree; externally rough due to presence of horizontal furrows and lenticels, mostly circular and prominent; fracture short in outer two thirds of bark while inner portion shows a fibrous fracture taste, astringent.

(b) **Microscopic**—Transverse section of mature bark shows compressed cork tissue and dead elements of secondary cortex consisting of mostly stone cells and thin-walled, compressed elements of cortex; cork cells rectangular, thick-walled and containing brownish content; secondary cortex wide, forming more than half of thickness of bark, composed of large groups of stone cells and parenchymatous cells; stone cells vary in shape; parenchymatous cells thin-walled and somewhat cubical to oval few in number and occur between groups of stone cells, some of cells contain prismatic crystals of calcium oxalate, starch grains and tannin; secondary phloem composed of a few sieve elements, parenchyma, fibres, stone cells and latex tubes alternating with medullary rays; sieve elements compressed in outer region of bark while intact in inner region; few thick-walled phloem parenchyma occurring in between patches of phloem fibres and stone cells; stone cells similar to those present in secondary cortex, some phloem cells contain prismatic calcium oxalate crystals also, present in fibres forming crystal fibres; medullary rays 2—5 seriate, composed of thick-walled, circular to oval cells, few cells also converted into stone cells and some have pitted walls, also containing plenty of starch grains, mostly rounded, rarely oval or semi-lunar in shape, simple as well as compound type, compound starch grains consist of 2—3 components; cambium composed of a few layers of small, rectangular, thin-walled cells.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	8 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	3 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	6 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	8 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannins, glycosides and flavonoids.

PROPERTIES AND ACTION —

Rasa	:	Kaṣāya
Guṇa	:	Guru, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Kaphapittajit, Vraṇāpaha, Varṇya, Stambhana, Mūtrasaṅgrahaṇīya, Dāhaghna Yonidoṣahṛt

IMPORTANT FORMULATIONS— Nyagrodhādi kvātha cūrṇa; Nyagrodhādi cūrṇa.

THERAPEUTIC USES— Dāha; Tṛṣṇā; Raktapitta; Vraṇa; Visarpa; Yonidoṣa; Prameha.

DOSE— 3—6 g of the drug in powder form.

PĀṢĀṆABHEDA

Pāṣāṇabheda consists of rhizomes of *Bergenia ciliata* (Haw.) Sternb., Syn. *Bergenia ligulata* (Wall.) Engl. (Fam. Saxifragaceae); a small perennial herbf found throughout temperate Himalayas from Bhutan to Kashmir at an altitude between 2000—3000 m and in Khasia hills upto 1200 m altitude.

SYNONYMS —

Sansk.	:	Aśmabhedaka, Śilābheda
Assam.	:	Patharkuchi
Beng.	:	Patharkuchi, Himasagara, Patrankur
Guj.	:	Pashanbheda, Pakhanbheda
Hindi	:	Pakhanabheda, Silphara, Patharcua, Pakhanabhed, Silpbheda
Kan.	:	Alepgaya, Pahanbhedi, Hittaga, Pasanaberu, Hittulaka
Kash.	:	Pashanbhed
Mal.	:	Kallurvanchi, Kallurvanni, Kallorvanchi
Mar.	:	Pashanbheda
Ori.	:	Pasanbhedi, Pashanabheda
Punj.	:	Kachalu, Pashanbhed
Tam.	:	Sirupilai
Tel.	:	Kondapindi

DESCRIPTION —

(a) Macroscopici :—Rhizome, solid, barrel shaped, cylindrical, 1.5—3 cm long and 1-2 cm in diameter with small roots, ridges, furrows and root scars distinct; tranversely cut surface shows outer ring of brown coloured cork, short middle cortex, vascular bundles and large central pith; odour, aromatic; taste, astringent.

(b) **Microscopic** :—Transverse section of rhizome shows cork divided into two zones, outer a few layers of slightly compressed and brown coloured cells, inner zone multilayered consisting of thin-walled tangentially elongatd and colourless cells, followed by a single layered cork cambium and 2-3 layers of secondary cortex composed of thick-walled, tangentially elongated, rectangular cells with intercellular spaces, some cells contain rosette crystals of calcium oxalate and simple starch grains; cortex a narrow-zone of parenchymatous cells containing a number of simple starch grains, most of cortical cells also contain large rosette crystals of calcium oxalate; endodermis and pericycle absent; vascular bundles, arranged in a ring, collateral, conjoint and open; phloem tissues composed of sieve elements and parenchyma, in outer region found as compressed masses while in inner region intact; a number of rosette crystals of calcium oxalate also found as crystal fibres; cambium present as continuous ring composed of 2-3 layers of thin-walled, tangentially elongated cells; xylem consist of fibres, tracheids, vessels and parenchyma; with centre occupied by large pith composed of circular to oval, parenchymatous cells, varying in size and containing starch grains with crystals of calcium oxalate similar to those found in cortical region.

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	13 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	9 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	15 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannic acid, gallic acid and glucose.

PROPERTIES AND ACTION —

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Aśmarīghna, Bhedana, Vastiśodhana, Mūtravirecanīya

IMPORTANT FORMULATIONS—Aśmarīhara kaṣāya cūrṇa; Mūtravirecanīya Kaṣāya cūrṇa.

THERAPEUTIC USES— Meha; Mūtrakicchra; Aśmarī.

DOSE— 3—6 g of the drug in powder form.

20—30 g of the drug for decoction.

PĀṬHĀ

Pāṭhā consists of roots of *Cissampelos pareira* Linn. (Fam. Menispermaceae); an extensively spreading, glabrous to softy pubescent, perennial climbing shrub with nodose stem, common in warm and dry regions of tropical and sub-tropical parts of India upto an altitude of about 1500 m.

SYNONYMS—

Sansk.	:	Ambaṣṭhakī
Assam.	:	Tuprilata
Beng.	:	Akanadi, Patha
Eng.	:	Velvet leaf
Guj.	:	Venivel, Karedhium, Kalipath, Karondhium, Karondium
Hindi	:	Patha, Padh, Akanadi
Kan.	:	Pahadavela, Agalushunthi
Kash.	:	Pad
Mal.	:	Patha
Mar.	:	Pashadvel, Paharrel, Pahadavel, Padali
Ori.	:	Kanabindhi, Patha
Punj.	:	Patha
Tam.	:	Vatta tiruppi
Tel.	:	Adivibankatiga, chiru boddi, Boddi tiga

DESCRIPTION —

(a) **Macroscopic**—Roots, cylindrical, often tortuous; 1—1.5 cm in diameter; light brown to yellowish in colour; surface rough and at places rugged due to transverse wrinkles, cracks and fissures; fracture short and splintery; odour, faint aromatic; taste, bitter.

(b) **Microscopic**—Transvarse section of root shows, 6—10 layers of thin-walled, rectangular cork cellsi secondary cortex, 1—3 layered of oval to tangentially elongated cells; discontinuous ring consisting of 2—3 rows of stone cells and group of phloem fibres; stone cells variable in shape with simple pits; vascular strands as radiating strips usually 8—12 of xylem and phloem some reaching up to the centre; phloem consists of small strands of sieve elements and parenchyma just below the ring of stone cells; xylem consists of vessels, tracheids, fibres and xylem parenchyma; vessels and tracheids show simple pits on the walls; xylem parenchyma usually thick-walled and lignified but due to delignification patches of thin-walled parenchyma appear in the xylem region; medullary rays 1—3 seriate appear to be very wide at a number of places due to addition of delignified xylem parenchymatous cells; ray cells thin-walled, a few lignified and thick-walled while some show reticulate thickening; plenty of starch grains present in some of ray cells.

Powder—Greyish-brown; under microscope shows groups of stone cells, fibres and starch grains; crystals absent.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 7 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 11 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 13 per cent, Appendix 2.2.7.

CONSTITUENTS—Alkaloids, saponin and quarternary ammonium bases, flavonol and sterol.

PROPERTIES AND ACTION —

Rasa	:	Tikta, Kaṭu
Guṇa	:	Laghu, Tikṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Tridoṣaśamana, Raktaśodhaka, Viṣaghna, Bhagnasandhānakṛt, Grāhī, Stanyaśodhana

IMPORTANT FORMULATIONS— Puṣyānuga cūrṇa; Pradarāntaka lauha; Sārasvata ghṛta; Bṛhat gangādhara cūrṇa; Stanyaśodhana kaṣāya cūrṇa.

THERAPEUTIC USES— Śūlaroga; Atisāra; Kuṣṭha; Kaṇḍū; Jvara; Chardi; Stanyaduṣṭi.

DOSE— 3—6 g of the drug in powder form.

PŪGA

Pūga consists of dried ripe seed of *Areca catechu* Linn. (Fam. Palmae); a graceful, slender, stemmed, perennial palm, trunk reaching a height of about 25 m cultivated in the coastal regions of Southern India, Bengal and Assam upto an altitude of 1000 m.

SYNONYMS —

Sansk.	:	Kramuka, Ghoṇṭā
Assam.	:	Tamol, Tamul
Beng.	:	Supari
Eng.	:	Areca nut, Betal nut
Guj.	:	Sopari
Hindi	:	Supari, Chaalia
Kan.	:	Adika
Kash.	:	Supari, Spari
Mal.	:	Adakku, Pakku
Mar.	:	Supari, Pophal
Ori.	:	Gua
Punj.	:	Supari, Spari
Tam.	:	Kamugu, Pakku, Pakhumaram
Tel.	:	Paka chekka, Vakka
Urdu	:	Fufal, Choalia

DESCRIPTION —

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

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

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

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than 1	per cent, Appendix 2.2.2.
Total ash	— Not more than 3	per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 0.4	per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 19	per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 10	per cent, Appendix 2.2.7.

CONSTITUENTS—Alkaloid (arecoline) tannins and fats.

PROPERTIES AND ACTION —

Rasa	:	Kaṣāya
Guṇa	:	Rūkṣa, Guru
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Prabhāva	:	Mohakṛt
Karma	:	Dīpana, Kaphapittajit, Kledanāśana, Malabhedī, Mukhaśodhana, Vikāsī

IMPORTANT FORMULATIONS— Pūgakhaṇḍa.

THERAPEUTIC USES— Mukhavikāra; Aruci; Yoniśaithilya; Śvetapradara.

DOSE— 1—2 g of the drug in powder form.

PUNARNAVĀ (RAKTA)

Punarnavā (Rakta) consists of dried, matured whole plant of *Boerhaavia diffusa* Linn. (Fam. Nyctaginaceae); a trailing herb found throughout India and collected after rainy season; herb is diffusely branched with stout root stock and many longe slender, prostrate or ascending branches.

SYNONYMS —

Sansk.	:	Kaṭhilla, Śophaghnī, Śothaghnī, Varṣābhu
Assam.	:	Ranga Punarnabha
Beng.	:	Rakta punarnava
Eng.	:	Horse Purslene, Hog Weed
Guj.	:	Dholisaturdi, Motosatodo
Hindi	:	Gadapurna, Lalpunarnava
Kan.	:	Sanadika, Kommeberu, Komma
Kash.	:	Vanjula Punarnava
Mal.	:	Chuvanna Tazhutawa
Mar.	:	Ghetuli, Vasuchimuli, Satodimula, Punarnava, Khaparkhuti
Ori.	:	Lalapuiruni, Nalipuruni
Punj.	:	Itcit (lal), Khattan
Tam.	:	Mukurattai (Shihappu)
Tel.	:	Atikamamidi, Erra galijeru

DESCRIPTION —

(a) **Macroscopic—**

Stem—greenish purple, stiff, slender, cylindrical, swollen at nodes, minutely pubescent or nearly glabrous, prostrate divericately branched, branches from common stalk, often more than a metre long.

Root—well developed, fairly long, somewhat tortuous, cylindrical, 0.2—1.5 cm in diameter; yellowish brown to brown coloured, surface soft to touch but rough due to minute longitudinal striations and root scars; fracture, short; no distinct odour; taste, slightly bitter.

Leaves—opposite in unequal pairs, larger ones 25—37 mm long and smaller ones 12—18 mm long ovate-oblong or suborbicular, apex rounded or slightly pointed, base subcordate or rounded, green and glabrous above, whitish below, margin entire or sub-undulate, dorsal side pinkish in certain cases, thick in texture, petioles nearly as long as the blade, slender.

Flowers—very small, pink coloured, nearly sessile or shortly stalked, 10—25 cm, in small umbells, arranged on slender long stalks, 4—10 corymb, axillary and in terminal panicles; bracteoles, small, acute, perianth tube constricted above the ovary, lower part greenish, ovoid, ribbed, upper part pink, funnel-shaped, 3 mm long, tube 5 lobed, stamen 2-3.

Fruit—one seeded nut, 6 mm long clavate, rounded, broadly and bluntly 5 ribbed, viscidly glandular.

(b) **Microscopic—**

Stem—transverse section of stem shows epidermal layer containing multicellular, uni seriate glandular trichomes consisting of 9—12 stalked cells and an ellipsoidal head, 150—220 μ long; cortex consists of 1-2 layers of parenchyma; endodermis indistinct; pericycle 1-2 layered, thick-walled often containing scattered isolated fibres; stele consisting of many smal vascular bundles often joined together in a ring and many big vascular bundles scattered in the ground tissue, intra fascicular cambium present.

Root—transverse section of mature root shows a cork composed of thin-walled tangentially elongated cells with brown walls in the outer few layers; cork cambium of 1-2 layers of thin-walled cells; secondary cortex consists of 2-3 layers of parenchymatous cells followed by cortex composed of 5—12 layers of thin-walled, oval to polygonal cells; several concentric bands of xylem tissue alternating with wide zone of parenchymatous tissue present below cortical regions; number of bands vary according to thickness of root and composed of vessels, tracheids and fibres; vessels mostly found in groups of 2—8, in radial rows, having simple pits and reticulate thickening;

tracheids, small, thick-walled with simple pits; fibres aseptate, elongated, thick-walled, spindle-shaped with pointed ends; phloem occurs as hemispherical or crescentic patches outside each group of xylem vessels and composed of sieve elements and parenchyma; broad zone of parenchymatous tissue, in between two successive rings of xylem elements composed of thin-walled more or less rectangular cells arranged in radial rows; central regions of root occupied by primary vascular bundles; numerous raphides of calcium oxalate, in single or in group present in cortical region and parenchymatous tissue in between xylem tissue; starch grains simple and compound having 2—4 components found in abundence in most of cells of cortex, xylem elements in parenchymatous tissue between xylem elements; simple starch grains mostly rounded in shape and measure 2.75—11 μ in diameter.

Leaves—Transverse section of leaf shows anomocytic stomata on both sides, numerous; a few short hairs, 3-4 celled, present on the margin and on veins; palisade one layered; spongy parenchyma 2—4 layered with small air spaces; idioblasts containing raphides; occasionally cluster crystal of calcium oxalate and orange-red resinous matter present in mesophyll.

Palisade ratio 3.5—6.5; stomatal index 11—16 ; vein islet number 9—15.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 15 per cent, Appendix 2.2.3.
Acid insoluble ash	— Not more than 6 per cent Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 1 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 4 per cent, Appendix 2.2.7.

Assay—Contains not less than 0.1 per cent of total alkaloids, when assayed by the following methods :—

Take accurately about 100 g of the drug (60 mesh powder) and moisten with dilute solution of *Ammonia*. Extract continuously in a soxhlet apparatus for 18 hours with 95 *per cent Alcohol*. Remove the alcohol by distillation. Extract the residue with five 25 ml portions of 1 *N Hydrochloric acid* till complete extraction of the alkaloid is effected. Transfer the mixed acid solutions into a separating funnel and wash with 5 ml of *Chloroform*, run off the Chloroform layer. Make the acid solution distinctly alkaline with *Ammonia* and shake with five 25 ml portions of *Chloroform* or till complete extraction of alkaloids is effected. Wash the combined chloroform extracts with two portions each of 5 ml of water. Filter the chloroform layer in tared flask and evaporate to dryness. Add to the residue 5 ml of Alcohol, evaporate to dryness, repeat the process once again and weigh the residue to constant weight in a vacuum desiccator.

CONSTITUENTS—Alkaloid (Punarnavine).

PROPERTIES AND ACTION —

Rasa	:	Madhura, Tikta, Kaṣāya
Guṇa	:	Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Vātaśleṣmahara, Mūtrala, Śothahara, Anulomana

IMPORTANT FORMULATIONS— Punarnavāṣṭaka kvātha cūrṇa; Punarnavāsava; Punarnavādi maṇḍūra; Sukumāra ghṛta; Śothaghna lepa.

THERAPEUTIC USES— Pāṇdu; Śotha.

DOSE— 20—30 g of the drug for decoction.

SAPTAPARṆA

Saptaparna consists of stem bark of *Alstonia scholaris* (Linn.) R. Br. (Fam. Apocynaceae); a tall evergreen tree, found in the Sub-Himalayan tracts ascending to 900 m from Jammu eastwards and western peninsula mostly in deciduous forests.

SYNONYMS :—

Sansk.	:	Saptacchada, Saptaparṇī, Saptāhvā
Assam.	:	Chatiyan
Beng.	:	Chatin
Eng.	:	Dita
Guj.	:	Saptaparna, Satvana
Hindi	:	Chhativan, Satawana
Kan.	:	Maddale, Hale, Eleyalaga
Mal.	:	Daivaphal, Ezilampala
Mar.	:	Satveen
Ori.	:	Chhatiana, Chatiana
Punj.	:	Sathi, Satanna
Tam.	:	Ezilampalai
Tel.	:	Edakula Ponna

DESCRIPTION —

(a) **Macroscopic**—Bark occurs in channelled or occasionally quilled pieces, 3—4 mm thick from branches and cut or broken irregularly into curved or flat pieces, about 7 mm thick from stem; externally younger bark dark grey to brown, older bark very rough, uneven and much fissured transversely and longitudinally; both marked with numerous rounded or transversely elongated, grey to whitish-brown lenticels; internally brownish-buff to dark greyish-brown; somewhat striated and indented; fracture, short and smooth; fractured surface shows a narrow, inner portion traversed by numerous, fine, medullary rays and a varying spongy outer portion.

(b) **Microscopic**—Transverse section of bark shows a multi-layered, thick and thin-walled cork; a broad zone of secondary cortex composed of thin-walled, parenchymatous cells, including many rounded latex cavities, scattered throughout tissue, containing numerous rhombic to polygonal calcium oxalate crystals, numerous stone cells forming a non-continuous layer of 4—8 cells, irregular, rounded to linear, fibre-like, blunt at both ends; internal to secondary cortex a secondary phloem cells containing many sieve tubes; cork cells brick shaped to almost square in transverse and longitudinal sections and polygonal in surface view; cork cambium forms a region of two rows of cells identical to cork cells, situated in between cork and secondary cortex; secondary phloem cells smaller in dimension than cortical cells consisting of phloem parenchyma, many sieve tubes and companion cells; fibres absent.

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	11 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	3 per cent Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	4 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	12 per cent Appendix 2.2.7.

Assay—Contains not less than 0.2 per cent of total alkaloids when assayed by the following method :—

Take 25 g in No. 60 mesh powder. Transfer to a continuous extraction apparatus and extract with 90 per cent Alcohol for 4 hours (at least 3 extractions are essential). Remove the solvent and transfer to a separating funnel with the help of a little water and 5 ml of 95 per cent Alcohol. Add about 15 ml of Water and 2 ml of solution of 20 percent Sodium Hydroxide to make the solution alkaline and extract with successive quantities of Chloroform till the extraction of alkaloid is complete. Shake the combined Chloroform extract with successive quantities of a mixture of 4 volumes of 0.2 N Sulphuric Acid and 1 volume of Alcohol until complete extraction of alkaloid is effected. Wash the mixed acid solution twice with 10 ml portion of Chloroform and then twice with 10 ml portion of Ether. Wash the combined Chloroform and Ether solution with 20 ml of 0.1 N Sulphuric

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Acid. Transfer this washed acid extract to the original acid extract, make distinctly alkaline with solution of Sodium Hydroxide and shake with successive portions of chloroform till the extraction of the alkaloids is complete. Wash the combined chloroform solution with about 5 ml of water. Remove most of the chloroform and transfer the remainder to a small open dish. When the removal of chloroform is almost complete on water bath, add about 2 ml Dehydrated Alcohol and evaporate to dryness. Dry at 100° to constant weight and weigh as total alkaloids.

CONSTITUENTS—Alkaloids (echitamine, ditamine and echitamidine).

PROPERTIES AND ACTION —

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Sara, Snigdha
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Tridoṣaghna, Dīpana, Anulomana, Raktaśodhaka, Kuṣṭhaghna, Jvaraghna

IMPORTANT FORMULATIONS— Āragvadhādi kvātha cūrṇa; Amṛtāriṣṭa; Vajraka taila.

THERAPEUTIC USES— Śūla; Gulma; Kṛmiroga; Kuṣṭha; Jvara; Sāndrameha.

DOSE— 20—30 g of the drug for decoction.

ŚAṬI

Śaṭi consists of sliced, dried rhizomes of *Hedychium spicatum* Ham. ex Smith (Fam. Zingiberaceae); a perennial rhizomatous herb, measuring upto 1 m occurs in parts of western and central regions of sub-tropical Himalayas at an altitude of 1500—2000 m, grows abundantly in Kumaon and Punjab.

SYNONYMS —

Sansk.	:	Śaṭhī, Gandhamūlikā
Assam.	:	Katuri, Sati
Beng.	:	Shati, Kachri
Eng.	:	Spiked ginger lily
Guj.	:	Kapurkachri, Kapurkachali
Hindi	:	Kapurkachri
Kan.	:	Goul Kachora, Seenakachora, Kachora
Kash.	:	Kapoorkachara
Mal.	:	Katcholam, Katchooram
Mar.	:	Kapurakachari, Gablakachari
Ori.	:	Gandhasunthi
Punj.	:	Kachur, Kachoor
Tam.	:	Poolankizangu, Kichili Kizongu
Tel.	:	Gandha Kachuralu

DESCRIPTION —

(a) **Macroscopic**—Rhizomes 15—20 cm long, 20—25 mm in diameter, externally yellowish-brown but changed to dark brown on storage, drug available in pieces of 2.5 cm diameter, edge of each piece is covered by a rough reddish-brown layer marked with numerous scars and circular rings, rudiments of root-lets visible; odour, camphoraceous; taste, bitter.

(b) **Microscopic**—Transverse section of rhizome shows an outermost thick layer of suberised, dark brown cells of outer cork consisting of 10—15 or more layers of irregular parenchymatous cells, inner cork consisting of a few layered light brown, rectangular, radially arranged cells followed by a wide zone of cortex, 30—40 cells thick; some cortical cells filled with flattened and oval-oblong starch grains; numerous oleo-resin cells also found in this region which have suberised walls containing green-yellow oil; a thin endodermal layer present beneath cortex; central cylinder distinguished by presence of peripheral plexus of irregular congested vascular bundles with poorly developed mechanical tissues; vascular bundles scattered irregularly throughout ground tissue, bundles closed and collateral possessing group of two or more xylem elements; ground tissue composed of large parenchymatous cells with abundant starch grains and oil.

IDENTITY, PURITY AND STRENGTH —

Foreign matter	— Not more than 1 per cent, Appendix 2.2.2.
Total ash	— Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 4 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 8 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta, Kaṣāya
Guṇa	:	Laghu, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphavātaghna, Mukhaśodhana, Grāhī, Śūlahara

IMPORTANT FORMULATIONS— Agastyaharītakī rasāyana; Śaṭyādi cūrṇa.

THERAPEUTIC USES— Kāsa; Śvāsa; Mukharoga; Śūla; Chardi; Kaṇḍū.

DOSE— 1—3 g of the drug in powder form

SNUHI

Snuhi consists of stem of *Euphorbia neriifolia* Linn. (Fam. Euphorbiaceae): a large branched, erect, glabrous, succulent, xerophytic shrub occurring wild on rocky ground throughout central India and extensively grown as a hedge plant.

SYNONYMS —

Sansk.	:	Sudhā, Vajradrumā, Snuk
Beng.	:	Manasa sij
Eng.	:	Milkhedge
Guj.	:	Thor, Kantalo
Hindi	:	Thuhar, Sehunda
Kan.	:	Muru Kanina Kalli
Mal.	:	Kalli, Kaikalli
Mar.	:	Nivadung
Ori.	:	Thor, Kantalothor
Punj.	:	Thohar
Tam.	:	Elaikalli, Perumbu Kalli
Tel.	:	Kadajemudu

DESCRIPTION—

(a) **Macroscopic**—Stem, green, cylindrical, showing, spiral ridge portion only; dried stem, tough with pairs of sharp stipular thorns; with hollow space in centre containing white reticulate mass, taste, acrid.

(b) **Microscopic**—Transverse section shows a single layered epidermis, composed of squarish, thin-walled, parenchymatous cells, followed by a thick zone of cortex, differentiated into two parts, outer of thin-walled, rectangular, oval and oblong parenchymatous cells of about 20 layers depth, inner wider zone, consisting of about 30—40 layers of thin-walled, oblong or ovoid, elongated parenchymatous cells, having a number of rounded and oval latex cells, some contain dark yellowish latex; the number of latex cells gradually reduce towards outer side; below cortex, about 10 layers of phloem present, containing group of fibres towards cortex; xylem consists of vessels, tracheids, fibres and xylem parenchyma; pith consists of thin-walled, rounded or oval, parenchymatous cells; starch and calcium oxalate crystals absent.

POWDER—Cream yellow; under microscope shows, vessels, fibres and cortical cells; starch and calcium oxalate crystals absent.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 8 per cent. Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 5 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 15 per cent, Appendix 2.2.7.

CONSTITUENTS—Resin, gum and triterpenes.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Guru, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Tīkṣṇavirecana, Bhedana, Āmakaphavātahara

IMPORTANT FORMULATIONS— Citrakādi taila; Abhayā lavaṇa; Avittolādi bhasma; Vajrakṣāra.

THERAPEUTIC USES— Gulma; Udararoga; Meha; Kuṣṭha; Śotha.

DOSE— 125—250 mg of the drug in powder form.

Note :—Śodhana of this drug is to be done before use as decribed in Appendix.

SŪKṢMAILĀ

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

SYNONYMS—

Sansk.	:	Truṭi, Elā
Assam.	:	Sarooplaachi
Beng.	:	Chota elaich
Eng.	:	Cardamom
Guj.	:	Elchi, Elachi, Elayachi
Hindi	:	Choti Ilayachi
Kan.	:	Elakki, Sanna Yalakki
Mal.	:	Elam, Chittelam
Mar.	:	Velloda, Lahanveldoda, Velchi
Ori.	:	Gujurati, Chotaa leicha, Alaicha
Punj.	:	Illachi, Chhoti Lachi
Tam.	:	Siruelam
Tel.	:	Chinne Elakulu, Sanna Elakulu
Urdu	:	Heel Khurd

DESCRIPTION—

(a) Macroscopic—

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

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

(b) Microscopic—Transverse section of seed shows flattened, aril, thin-walled parenchymatous cells; testa with outer epidermis of thick-walled, narrow, elongated cells, followed by a layer of collapsed parenchyma, becoming 2 or 3 layered in the region of raphe, composed of large, thin-walled ractangular cells containing volatile oil, a band of 2 or 3 layers of parenchyma and an inner epidermis of thin-walled, flattened cells; inner integument 2 layered, an outer palisade sclerenchyma with yellow to reddish-brown beaker shaped cells, 20 μ long in radial direction and 12 μ wide, thickened on inner and anticlinal walls, each cell with a small bowl shaped lumen containing a warty nodule of silica and an inner epidermis of flattened cells; perisperm cells thin-walled, packed with minute rounded polyhedral starch grains, about 1—2 to 4—6 μ in diameter and containing 1—7 small prismatic crystals of calcium oxalate, about 10—20 μ long; endosperm of thin-walled parenchyma containing protein as a granular hyaline mass in each cell; embryo, of small thin-walled cells containing aleurone grains; starch absent in endosperm and embryo; fibres sclerenchymatous; large vessels present in pericarp.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Nil, Appendix 2.2.2.
Total ash	— Not more than 6 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 4 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 2 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 10 per cent, Appendix 2.2.7.
Volatile oil	— Not less than 4 per cent, V/W, Appendix 2.2.10.

CONSTITUENTS—Essential oil.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Madhura
Guṇa	:	Laghu
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Rocana, Dīpana, Anulomana, Hṛdya, Mūtrala

IMPORTANT FORMULATIONS— Elādi modaka; Elādi cūrṇa; Sītopalādi cūrṇa.

THERAPEUTIC USES— Kāsa; Śvāsa; Aruci; Chardi; Mūtrakṛcchra.

DOSE— 250— 500 mg of the drug in powder form.

ŚUṆṬHI

Śuṇṭh consists of dried rhizome of *Zingiber officinale* Roxb.(Fam. Zingiberaceae); widely cultivated in India, rhizomes dug in January-February, buds and roots removed, soaked overnight in water, decorticated, and some times treated with lime and dried.

SYNONYMS—

Sansk.	:	Auṣadha, Mahauṣadha, Nāgara, Viśva, Viśvabheṣaja, Śṛngavera, Viśvā, Viśvauṣadha
Assam.	:	Adasuth, Aadar Shuth
Beng.	:	Suntha, Sunthi
Eng.	:	Ginger root, Ginger
Guj.	:	Sunth, Sundh, Suntha
Hindi	:	Sonth
Kan.	:	Shunthi
Kash.	:	Shonth
Mal.	:	Chukku
Mar.	:	Sunth
Ori.	:	Sunthi
Punj.	:	Sund
Tam.	:	Sukku, Chukku
Tel.	:	Sonthi, Sunti
Urdu	:	Sonth, Zanjabeel

DESCRIPTION—

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

(b) **Microscopic**—Transverse section of rhizome shows cortex of isodiametric thin-walled, parenchym with scattered vascular strands and numerous isodiametric idioblasts, about 40—80 μ in diameter containing a yellowish to reddish-brown oleo-resin; endodermis slightly thick walled, free from starch; immediately inside endodermis a row of nearly continuous collateral bundles usually without fibres stele of thin-walled, parenchyma cells, arranged radially around numerous scattered, collateral vascular bundles, each consisting of a few unlignified, reticulate or spiral vessels upto about 70 μ in diameter; a group of phloem cells, unlignified, thin-walled; septate fibres upto about 30 μ wide and 600 μ long with small oblique slit, like pits, present; numerous scattered idioblasts, similar those of cortex, and associated with vascular bundles, also present; idioblasts about 8—20 μ wide and upto 130 μ long with dark reddish-brown contents: in single or in axial rows, adjacent to vessels, present; parenchyma of cortex and stele packed with flattened, rectangular, ovate; starch grains, mostly 5-15 μ-30—60 μ long about 25 μ wide and 7 μ thick, marked by five transverse striations.

INDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 1 per cent Appendix 2.2.2.
Total ash	— Not more than 6 per cent, Appendix 2.2.3.
Water-soluble ash	— Not less than 1.5 per cent, Appendix 2.2.5.
Alcohol (90 percent) soluble extractive	— Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 10 per cent, Appendix 2.2.7.

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

PROPERTIES AND ACTION—

Rasa	:	Kaṭu
Guṇa	:	Laghu, Snigdha
Vīrya;	:	Uṣṇa
Vipāka	:	Madhura
Karma	:	Dīpana, Pācana, Anulomana, Āmadoṣahara, Vātakaphāpaha, Hṛdya

IMPORTANT FORMULATIONS— Saubhāgyaśuṇṭhī; Trikaṭu Cūrṇa; Saubhāgya vaṭī; Vaiśvānara cūrṇa.

THERAPEUTIC USES— Agnimāndya; Ādhmāna; pāṇḍu; Śvāsa; Udararoga; Āmavāta.

DOSE— 1— 2 g of the drug in powder form.

SVARṆAPATRĪ

Savrnapatī consists of dried leaves of *Cassia angustifolia* Vahl (Fam. Leguminosae); a small shrub, 60-75 cm high, found throughout the year, cultivated largely in Southern India, especially in districts of Tinnevelly, Madurai and Tiruchirapally and has also been introduced in Mysore; fully grown, thick bluish colour leaves stripped off by puṛṇ, collected and dried in shade for 7—10 days, till assume a yellowish-green colour; graded and then packed into large bales.

SYNONYMS—

Assam.	:	Sonamukhi
Beng.	:	Svarnamukhi, Sonapata
Eng.	:	Indian Senna, Tinnevelly Senna
Guj.	:	Mindhiaval, Sonamukhi
Hindi	:	Sanaya, Hindisana
Kan.	:	Nelavarika, Sonamukhi, Nelaavare, Nelavarike, Nela Aavariake
Kash.	:	Sna
Mal.	:	Sunnamukhi, Nilavaka, Chinnukki, Adapatiyan
Mar.	:	Sonamukhi
Ori.	:	Sunamukhi
Punj.	:	Sanapati, Sarnapatta, Sannamakhi
Tam.	:	Nilapponnai, Avarai
Tel.	:	Sunamukhi
Urdu	:	Sena, Barg-e-Sana

DESCRIPTION—

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

(b) **Microscopic**—Transverse section of leaflet through midrib shows an isobilateral structure; epidermal cells, straight walled, containing mucilage; both surfaces bear scattered, unicellular hair, often conical, curved near base, thick-walled, non-lignified; warty cuticle; stomata, paracytic, numerous on both surfaces; mesophyll consists of upper and lower palisade layers with spongy layer in between; palisade cells of upper surface longer than those of lower surface, the latter having wavy anticlinal walls; prismaatic crystals of calcium oxalate present on larger veins, and clusters of calcium oxalate crystals distributed throughout the palisade and spongy tissues; midrib biconvex; bundles of midrib and larger veins, incompletely surrounded by a zone pericyclic fibres and a crystal sheath of parenchymatous cells, containing prismatic crystals of calcium oxalate.

INDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 1 per cent, Appendix 2.2.2.
Total ash	— Not more than 14 per cent Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 25 per cent, Appendix 2.2.7.

CONSTITUENTS—Anthraquinone, glucoside, flavonoids, steroids and resin.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta, Kaṣāya
Guṇa	:	Laghu, Rūkṣa, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Recana

IMPORTANT FORMULATIONS— Pañcasakāra cūrṇa; Sārivādyāsava.

THERAPEUTIC USES— Vibandha; Udararoga.

DOSE— 0.5— 2 g of the drug in powder form.

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ŚVETAJĪRAKA

Śvetajīraka consists of ripe fruits of *Cuminum cyminum*, Linn. (Fam. Umbelliferae); a glabrous, annual herb, 30-90 cm nigh flowers very small, white, about 38 mm long stalk in compound umbels, mostly cultivated in plains; plants pulled out, dried, thrashed for collecting mature fruits.

SYNONYMS—

Sansk.	:	Ajājī, Jīraka, Ajājikā
Assam.	:	Jira
Beng.	:	Jira, Sadajira
Eng.	:	Cumin seed, Cumin
Guj.	:	Jirautmi, Jiru, Jiraugi, Jeeru, Jirun
Hindi	:	Jira, Safed jira
Kan.	:	Jirage, Bilejirege
Kash.	:	Safed Zoor
Mal.	:	Jeerakam
Mar.	:	Pandhare jire
Ori.	:	Dhalajeera, Dalajira, Jira
Punj.	:	Safed Jira, Chitta Jira
Tam.	:	Sheeragam, Chirakam, Jeerakam
Tel.	:	Jilakarra, Tella Jilakarra
Urdu	:	Zirah, Zirasafed

DESCRIPTION—

(a) Macroscopic—Fruit, a cremocarp, often separated into mericarps, brown with light coloured ridges, ellipsoidal, elongated, about 4-6 mm long, 2 mm wide, tapering at ends and slightly compressed laterally; mericarps with 5 longitudinal hairy primary ridges from base to apex, alternating with 4 secondary ridges which are flatter and bear conspicuous emergences; seeds orthospermous; odour, umbelliferous characteristic; taste, richly spicy.

(b) Microscopic—Transverse section of furit shows epidermis consisting of short polygonal, tabular cells densely covered with short, bristle hairs on ridges; mesocarp with few layers of parenchyma and five, vascular bundles under five primary ridges; six vittae under secondary ridges, four on dorsal and two on commissural surface; endocarp consists of polygonal cells containing fixed oil and aleurone grains; carpophore consists of slender fibres.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 7 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 15 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu
Guṇa	:	Laghu, Rūkṣa, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Rucya, Dīpana, Pācana, Grāhī, Kṛmighna, Kaphavātahara

IMPORTANT FORMULATIONS— Jīrakādyariṣṭa; Jīrakādimodaka; Hiṅgvādi cūrṇa; Hiṅguvacādi-cūrṇa.

THERAPEUTIC USES— Agnimāndya; Atisāra; Kṛmiroga.

DOSE— 1—3 g of the drug in powder form.

ŚVETA SĀRIVĀ

Śveta sārivā consists of root of *Hemidesmus indicus* (Linn.) R. Br. (Fam. Asclepiadaceae); a prostrate or semi-erect shrub found throughout India from upper Gangetic plains east-wards to Assam, throughout Central, Western and Southern India upto an elevation of 600 m.

SYNONYMS—

Sansk.	:	Anantā, Gopasutā, Sārivā
Assam.	:	Vaga Sariva
Beng.	:	Anantamul, Shvetashariva
Eng.	:	Indian Sarasa Parilla
Guj.	:	Upalsari, Kabri
Hindi	:	Anantamul
Kan.	:	Namada veru, Bili Namadaberu, Anantamool, Sogadeberu, Namadaberu
Kash.	:	Anant mool
Mal.	:	Nannari, Nannar, Naruneendi
Mar.	:	Upalsari, Anantamula
Ori.	:	Dralashvan Lai, Anantamool
Punj.	:	Anantmool, Ushbah
Tam.	:	Ven Nannari
Tel.	:	Sugandhi Pala, Tella Sugandhi
Urdu	:	Ushba Hindi

DESCRIPTION—

(a) Macroscopic—Roots occur in pieces, about 30 cm long and 3—8 mm in diameter, cylindrical, thick, hard, somewhat tortuous, sparcely branched, provided with few thick rootlets and secondary roots; external appearance dark brown, sometimes with violet-grey tinge; centre yellow, woody, surrounded by a mealy white cortical layer; bark brownish, corky, marked with transverse cracks and longitudinal fissures and easily detachable from the hard central core; odour, characteristic; taste, sweetish, slightly acrid and aromatic.

(b) Microscopic—Transverse section of root shows periderm consisting of three layers of tissues, cork, cork cambium and secondary cortex; cork cells radially flattened and rectangular in appearance filled with dark brown contents giving reactions of tannins; cork cambium, 2 or 3 layered, compressed, and filled with deep brown contents; secondary cortex, 3—4 layers of cells, similar to cork cells, with very little or no dark brown contents; secondary phloem consists of sieve elements, parenchyma, phloem ray cells alongwith several laticiferous ducts; parenchyma cells filled with starch grains, diameter 7—10 μ, occasional prismatic crystals of calcium oxalate; laticiferous ducts scattered in parenchymatous tissue; cambium very narrow: xylem traversed by narrow medullary rays; vessels and tracheids characterised by the presence of pitted markings; pith absent and central region occupied by woody tissues.

INDENTITY, 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 15 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 13 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil, saponin, resin, tannins, sterols and glucosides.

PROPERTIES AND ACTION—

Rasa	:	Madhura
Guṇa	:	Snigdha, Guru
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Tridoṣanāśana, Dīpana, Raktaśodhaka, Āmanāśana, Viṣaghna, Jvarahara

IMPORTANT FORMULATIONS— Sārivādyāsava.

THERAPEUTIC USES— Aruci; Agnimāndya; Atisāra; Kāsa; Śvāsa; Kaṇḍū; Kuṣṭha; Jvara; Rakta-vikāra.

DOSE— 20—30 g of the drug for decoction.

TAGARA

Tagara consists of predominantly dried rhizome, stolon and small portion of root of *Valeriana wallichii* Dc. (Fam. Valerianaceae); a hairy perennial herb, growing in temperate Himalayas from Kashmir to Bhutan and Khasia hills upto an altitude of 3,000 m; rhizomes dug in autumn, well washed with water and dried.

SYNONYMS—

Sansk.	:	Kālānusārī, Kālānusārikā, Nata
Assam.	:	Tagar
Beng.	:	Tagar Paduka
Eng.	:	Indian Valerian
Guj.	:	Tagar Ganthoda, Tagar Gantho, Ghodawaj
Hindi	:	Mushkbala, Sugandhabala
Kan.	:	Mandibattal, Mandyavanthu, Mandibattalu, Tagar
Kash.	:	Bala, Mushkbala
Mal.	:	Thakaram
Mar.	:	Tagar, Ganthode
Ori.	:	Tagarapaduka, Jalashiuli
Punj.	:	Mushkobala, Sugandhbala
Tam.	:	Tagarai
Tel.	:	Grandhi Tagaramu
Urdu	:	Tagar

DESCRIPTION—

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

(b) **Microscopic**—

Rhizome—transverse section of rhizome shows cork, consisting of 4—14 layers of lignified, cells occasionally containing oil globules; cortex parenchymatous containing numerous starch grains oil globules and yellowish-brown substance; outer 2 or 3 layers of cortex, collenchymatous occasional root traces appear as paler strands; endodermis single layered; pericycle, parenchymatous and within it 12—18 collateral vascular bundles, separated by dark medullary rays present; pith large, parenchymatous, lacunar, containing starch grains; starch occurs as single or occasional compound grains of two components, individual grains being 7—30 μ. mostly 10—25 μ in diameter: calcium oxalate crystals absent.

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

Roots—transverse section of root shows small, central parenchymatous pith, surrounded by tetrarch to ployarch xylem and a wide parenchymatous bark.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 12 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 10 per cent, Appendix 2.2.4.
Alcohol (60 per cent) soluble extractive	— Not more than 30 per cent, Appendix, 2.2.6.
Water-soluble extractive	— Not less than 19 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṭu Kaṣāya
Guṇa	:	Laghu, Snigdha
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Tridoṣahara, Viṣaghna, Raktadoṣahara, Mānasadoṣahara

IMPORTANT FORMULATIONS— Dhānvantara taila; Mahānārāyaṇa taila; Devadārvādyariṣṭa; Jātīphalādi cūrṇa.

THERAPEUTIC USES— Apasmāra; Unmāda; Śiroroga; Netraroga.

DOSE— 1—3 g of the drug in powder form.

TĀMALAKĪ

Tāmalakī consists of root, stem and leaf of *Phyllanthus fraternus* Webst. Syn. *Phyllanthus niruri Hook. f. non Linn.* (Fam. Euphorbiaceae); an annual herb, 20-60 cm high, found in Central and Southern India extending to Ceylon.

SYNONYMS —

Sansk.	:	Mahidhātrikā, Bhūmyāmalakī, Bahuphalā
Assam.	:	Bhuin Amla
Beng.	:	Bhumamla, Bhumi amalaki
Guj.	:	Bhoi Amali, Bhony amari, Bhonyamali
Hindi	:	Bhui Amala
Kan.	:	Nelanelli
Mal.	:	Kizanelli, Keezhanelli, Ajjhada
Mar.	:	Bhuiawali
Ori.	:	Bhuin Amla
Tam.	:	Kizhukai nelli, Kizanelli
Tel.	:	Nela usirika

DESCRIPTION—

(a) Macroscopic—

Root—small, 2.5—11.0 cm long. nearly straight, gradually tapering, with a number of fibrous secondary and tertiary roots, external surface light brown; fracture, short.

Stem—slender, glabrous; light brown, cylindrical, 20—75 cm long, branching profuse towards upper region bearing 5—10 pairs of leaves, internode, 1—3.5 cm long; odour, indistinct; taste, slightly bitter.

Leaf—compound and leaf-let arranged in two rows with a rachis; alternate, opposite and decussate almost sessile, stipulate, oblong, entire; upto 1.5 cm long and 0.5 cm wide, greenish-brown, in colour; odour, indistinct; taste, slightly bitter.

(b) Microscopic—

Root—transverse section shows, 4—6 layers of cork consisting of thin-walled, rectangular, tangentially elongated and radially arranged cells, filled with reddish-brown content; secondary cortex consists of 8—10 layers of thin-walled, tangentially elongated parenchymatous cells; secondary phloem narrow consisting of sieve elements, phloem parenchyma and traversed by narrow phloem rays; secondary xylem represented by a broad zone of tissue, composed of vessels, tracheids, fibres and parenchyma, all elements being thick-walled and lignified having simple pits; xylem rays uniseriate.

Stem—transverse section shows, a single layered epidermis composed of thick-walled, flattened, tangentially elongated cells; older stem shows 4—5 layers of cork, composed of thin-walled, tabular, tangentially elongated and radially arranged cells, filled with reddish-brown content; cortex composed of 4—6 layers of oval, tangentially elongated, thin-walled, parenchymatous cells, some cortical cells filled with yellowish-brown content; endodermis quite distinct; pericycle represented by a discontinuous ring, composed of several tangentially elongated strands of lignified fibres with thick walls and narrow lumen; secondary phloem narrow, composed of sieve elements, dispersed in mass of phloem parenchyma; secondary xylem composed of vessels, fibres, parenchyma and traversed by numerous uniseriate rays; vessels mostly simple pitted, a few show spiral thickenings; fibres narrow elongated, with narrow or sometimes blunt ends with simple pits; centre, occupied by a pith composed of thin-walled, circular to oval parenchymatous cells, occasionally cluster crystals of calcium oxalate present in parenchymatous cells of ground tissue.

Leaf—transverse section of leaf shows, a biconvex outline; epidermis on either side, single layered covered externally by a thick cuticle; a palisade layer present beneath upper epidermis, intercepted by a few parenchymatous cells in the middle; meristele composed of small strands of xylem towards upper suface and phloem towards lower surface, rest of tissue of leaf composed of thin-walled, parenchymatous cells some having cluster crystals of calcium oxalate; lamina

shows a dorsiventral structure, mesophyll differentiated into palisade and spongy parenchyma; epidermis on either side composed of thin-walled, tangentially elongated cells, covered externally by a thick cuticle; anisocytic type stomata present on both epidermises; palisade single layered; mesophyll composed of 3—5 layers of loosely arranged cells having a number of veins traversed in this region, a few cluster crystals of calcium oxalate present in spongy parenchyma.

Powder—Powder of the drug, brown coloured, under microscope shows, fragments of cork cells, vessels and fibres.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 16 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 7 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 13 per cent, Appendix 2.2.7.

CONSTITUENTS—Phyllanthin.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya, Tikta, Madhura
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Rocana, Dāhanāśanī, Pittaśāmaka, Mūtrala

IMPORTANT FORMULATIONS— Citraka harītakī; Madhuyaṣṭyddi taila; Pippalyddi ghṛta; Cyavanaprāśa; Sitavarīguda.

THERAPEUTIC USES— Tṛṣā; Kāsa; Amlapitta; Pāṇḍu; Kṣaya; Kṣata; Kuṣṭha; Prameha; Mūtraroga.

DOSE— 10—20 ml. of the drug in juice form.

3—6 of the drug in powder from.

TVAK

Tvak is the dried inner bark (devoid of cork and cortex) of the coppiced shoots of stem of *Cinnamomum zeylanicum* Blume. (Fam. Lauraceae); a moderate sized evergreen tree usually attaining a height of 6—7.5 m; cultivated on the Western Ghats and adjoining hills; bark collected during April-July and October-December.

SYNONYMS—

Sansk.	:	Dārusitā
Assam.	:	Dalcheni, Dalchini
Beng.	:	Daruchini, Darchini
Eng.	:	Cinnamon bark
Guj.	:	Dalchini
Hindi	:	Dalchini
Kan.	:	Dalchini Chakke
Kash.	:	Dalchini, Dalchin
Mal.	:	Karuvapatta, Ilavarngathely
Mar.	:	Dalchini
Ori.	:	Dalechini, Guda twak
Punj.	:	Dalchini, Darchini
Tam.	:	Lavangapattai, Karuvapattai
Tel.	:	Lavangapatta, Dalchini chekka
Urdu	:	Darchini

DESCRIPTION—

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

(b) **Microscopic**—Transverse section of bark (devoid of cork and cortex) shows except at certain places pericyclic sclerenchyma, 3 or 4 rows of isodiametric cells, sometimes tangentially elongated, inner and radial walls often being thicker than the outer, some containing starch grains; small groups of pericyclic fibres embedded at intervals in the sclerenchyma; phloem of tangential bands of sieve tissue alternating with parenchyma, and containing axially elongated secreting cells containing volatile oil or mucilage; phloem fibres with very thick walls, upto 30 μ in diameter, isolated or in short tangential rows; sieve tubes narrow with transverse sieve plates, collapsed in outer periphery; medullary rays of isodiametric cells, mostly 2 cells wide; cortical parenchyma and medullary rays containing small starch grains mostly below 10 μ in diameter; minute acicular crystals of calcium oxalate present.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 3 per cent. Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 2 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 3 per cent, Appendix 2.2.7.
Volatile oil	— Not less than 1 per cent, v/w Appendix 2.2.10.

CONSTITUENTS—Essential oil, tannin and mucilage.

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PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta, Madhura
Guṇa	:	Rūkṣa, Laghu, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphavātahara, Viṣaghna, Kaṇṭhaśuddhikara, Rucya

IMPORTANT FORMULATION— Sitopalādi cūrṇa; Caturjāta cūrṇa.

THERAPEUTIC USES— Mukhaśoṣa; Tṛṣā; Kaṇṭhamukharoga; Pīnasa; Kṛmiroga; Vastiroga; Arśa; Hṛdroga.

DOSE— 1—3 g of the drug in powder form.

TVAKPATRA

Tvakpatra consists of dried mature leaves of *Cinnamomum tamala* (Buch. Ham.) Nees & Eberm. (Fam. Lauraceae); a small evergreen tree upto 7.5 m high and occurs in tropical, sub-tropical Himalayas between 900-2300 m, often raised from seeds; sown in nursery; leaves collected in dry weather from about ten years old plant during October-March.

SYNONYMS—

Sansk.	:	Patra, Varāṅga, Coca
Assam.	:	Tejpat, Mahpat
Beng.	:	Tejpatra, Tejpata
Eng.	:	Indian Cinnamon
Guj.	:	Tamala patra, Develee
Hindi	:	Tejpatra
Kan.	:	Tamalapatra, Dalchini Ele
Kash.	:	Dalchini pan, Tajpatra
Mal.	:	Karuvapatta patram
Mar.	:	Tamalpatra
Ori.	:	Tejapatra
Punj.	:	Tajpater
Tam.	:	Lavangapatri
Tel.	:	Akupatri
Urdu	:	Tezpat

DESCRIPTION—

(a) Macroscopic—

Leaves—12.5—20 cm long, 5-7.5 cm wide at the centre, 3 converging nerves from base to apexe young leaves pink; petiole 7.5—13 mm long; margin entire, apex acute or accuminate, both surfaces smooth; stomata paracytic; odour, aromatic; taste, slightly sweet, mucilaginous and aromatic.

(b) Microscopic—

Petiole and midrib—transverse section of petiole and midrib shows epidermis externally covered with cuticle, uniseriate, multicellular (1 to 3 cells), trichomes present, oil cells single or in group, isolated large stone cells, much lignified showing striations found scattered, most of the parenchymatous cells of cortex with reddish-brown contents; pericycle represented by a few layers of sclerenchymatous cells, stele more or less planoconvex as in the midrib of leaf; xylem on upper and phloem on lower side consisting of usual elements, present.

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 6 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 9 per cent, Appendix 2.2.7.
Volatile oil	— Not less than 1 per cent v/w Appendix 2.2.10.

CONSTITUENTS—Essential oils (d-α phellandrene and eugenol).

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Madhura
Guṇa	:	Laghu, Picchila, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Rucya, Kaphavātahara, Arśoghna

IMPORTANT FORMULATIONS— citrakādi taila; Kāsīsādi taila; Vajraka taila.

THERAPEUTIC USES— Aruci; Hṛllāsa; Arśa; Pīnasa.

DOSE— 1—3g of the drug in powder form.

UDUMBARA

Udumbara consists of dried bark of *Ficus racemosa* Linn. Syn. *Ficus glomerata* Roxb. (Fam. Moraceae); a large deciduous tree distributed all over India, found throughout the year, grows in evergreen forests, moist localities and bank of streams to the elevation of 1800 m, often cultivated in villages for shade and its edible fruits.

SYNONYMS—

Sansk.	:	Sadāphala
Assam.	:	Jangedumuru, Yagyadimru
Beng.	:	Jagnadumur, Yagnadumur
Eng.	:	Cluster Fig. Country fig.
Guj.	:	Umbro, Umerdo, Umardo, Umarado
Hindi	:	Gulara, Gular
Kan.	:	Attihanninamara, Oudumbara, Athimara, Attigida
Kash.	:	Rumbal
Mal.	:	Athi
Mar.	:	Atti, Gular, Umber
Ori.	:	Jajnadimbri, Dimbiri,
Punj.	:	Kath Gular, Gular
Tam.	:	Atti
Tel.	:	Atti, Medi
Urdu	:	Gular

DESCRIPTION—

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

(b) Microscopic—Transverse section of bark shows cork, 3—6 layers of thin-walled cells filled with brownish content; cork cambium single layered; secondary cortex 6—12 layered, composed of thin-walled, rectangular cells arranged regularly, a number of secondary cortex cells contain starch grains and some contain rhomboidal crystals of calcium oxalate, most of the cells filled with chloroplast giving green appearance; cortex a fairly wide zone composed of circular to oblong, thin-walled cells, containing orange-brown content, most of the cells filled with simple and compound satrch grains, a number of cells also contain cubical and rhomboidal crystals of calcium oxalate, some cortical cells get lignified with pitted walls found scattered singly or in large groups throughout cortical region; secondary phloem a very wide zone composed of parenchyma with patches of sieve tubes, companion cells by medullary rays; phloem parenchyma circular to oval and thin-walled; phloem fibres much elongated, lignified, very heavily thickened and possess a very narrow lumen: medullary rays uni to pentaseriate, widen towards peripheral region; a number of ray cells also get lignified and show pitted wall as described above; laticiferous cells also found in phloem region similar to parenchyma but filled with small granular masses; starch grains and rhomboidal crystals of calcium oxalate also found in most of phloem parenchyma and ray cells; cambium, when present, 2—3 layered, of tangentially elongated thin-walled cells.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	14 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	7 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	9 per cent, Appendix 2.2.7.

CONSTITUENTS—Tannins.

PROPERTIES AND ACTION—

Rasa	:	Kaṣāya
Guṇa	:	Rūkṣa, Guru
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Mūtrasaṁgrahaṇīya, Vraṇaśodhaka, Vraṇaropaka, Medohara, Kaphapittaśāmaka, Raktastambhana

IMPORTANT FORMULATIONS— Nyagrodhādi kvātha cūrṇa; Mūtrasaṁgrahaṇīya kaṣāya cūrṇa.

THERAPEUTIC USES— Raktapitta; Dāha; Medoroga; Yonidoṣa.

DOSE— 3—6 g of the drug in powder form.
20—30 g of the drug for decoction.

UPAKUÑCIKĀ

Upakuñcikā consists of seeds of *Nigella sativa* Linn. (Fam. Ranunculaceae); a small herb, 45–60 cm high, mostly cultivated in Punjab, Himachal Pradesh, Bihar and Assam.

SYNONYMS—

Sansk.	:	Sthūlajīraka, Upakuñcī, Suṣavī
Beng.	:	Mota Kalajira, Kalajira
Eng.	:	Small Fennel, Nigella Seed
Guj.	:	Kalonji jeeru, Kalounji
Hindi.	:	Kalaunji, Mangaraila
Kan.	:	Karijirige
Mar.	:	Kalaunji Jire, Kalejire
Mal.	:	Karinjirakam
Punj.	:	Kalvanji
Tam.	:	Karunjeerakam, Karunjiragam
Tel.	:	Peddajila karra
Urdu	:	Kalongi

DESCRIPTION—

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

(b) **Microscopic**—Transverse section of seed shows single layer of epidermis consisting of elliptical, thick-walled cells covered externally by a papillose cuticle, filled with reddish-brown content; epidermis followed by 2—4 layers of thick-walled, tangentially elongated, parenchymatous cells, followed by a pigmented layer composed of tangentially elongated, cylindrical thick-walled cells filled with reddish-brown pigment; below pigmented layer, parenchyma composed of thick-walled rectangular, radially elongated cells, present in a layer; endosperm consists of moderately thick-walled, rectangular to polygonal cells, a few filled with oil globules; embryo embedded in endosperm.

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

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	6 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	0.2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than	20 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	15 per cent, Appendix 2.2.7.

CONSTITUENTS—Essential oil, fixed oil, resin, saponin and tannin.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Rucya, Saṁgrāhī, Cakṣuṣya, Garbhāśayaviśodhana, Pittala, Dīpana, Pācana, Medhya, Hṛdya, Vātakaphāpaha, Kṛmighna

IMPORTANT FORMULATIONS— Nārāyaṇa cūrṇa; Kāṇkāyana guṭikā.

THERAPEUTIC USES— Gulma; Ādhmāna; Atisāra; Kṛmiroga.

DOSE— 1—3 g of the drug in powder form.

VARUṆA

Varuṇa consists of dried stem bark of *Crataeva nurvala* Buch-Ham (Fam. Capparidaceae); a small wild or cultivated tree found throughout the year in India, often found along streams, also in dry, deep boulder formation in Sub-Himalayan tracts.

SYNONYMS—

Sansk.	:	Varaṇa
Beng.	:	Varuna
Eng.	:	Three leaved caper
Guj.	:	Vayvarno, Varano
Hindi	:	Baruna, Barna
Kan.	:	Bipatri, Mattamavu, Neervalamara
Mal.	:	Neermatalam
Mar.	:	Haravarna, Varun, Vayavarna
Ori.	:	Baryno
Punj.	:	Barna, Barnahi
Tam.	:	Maralingam
Tel.	:	Bilvarani

DESCRIPTION—

(a) **Macroscopic**—Thickness of bark varies, usually 1—1.5 cm according to the age and portion of the plant from where the bark is removed, outer surface, greyish to greyish-brown with ash- grey patches; at places, surface rough due to a number of lenticels, shallow fissures and a few vertical or longitudinal ridges; inner most surface smooth and cream white in colour; fracture tough and short; odour, indistinct; taste, slightly bitter.

(b) **Microscopic**—Transverse section of mature stem bark shows, an outer cork composed of thin-walled, rectangular and tangentially elongated cells, phellogen single layered, thin-walled, tangentially elongated cells followed by a wide secondary cortex, consisting of thin-walled, polygonal to tangentially elongated cells with a number of starch grains; starch grains mostly simple, occasionally compound with 2—3 components also present; large number of stone cells in groups of two or more, found scattered in secondary cortex, single stone cells not very common, stone cells vary in size and shape, being circular to rectangular or elongated with pits and striations on their walls; stone cells distributed somewhat in concentric bands in phloem region except in inner region of phloem which is devoid of stone cells; secondary phloem comparatively a wide zone, consisting of sieve tubes, companion cells, parenchyma and groups of stone cells, alternating with medullary rays; sieve elements found compressed forming ceratenchyma in outer phloem region, whereas in inner region of phloem, intact; medullary rays mostly multiseriate composed of thin-walled, radially elongated cells, tangentially elongated towards outer periphery, a number of starch grains similar to secondary cortex also present in phloem and ray cells; few rhomboidal crystals of calcium oxalate also found in this region; inner most layer is cambium.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than	2 per cent, Appendix 2.2.2.
Total ash	— Not more than	13 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than	1 per cent, Appendix 2.3.4.
Alcohol-soluble extractive	— Not less than	1 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than	8 per cent, Appendix 2.2.7.

CONSTITUENTS—Saponin and tannin.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Dīpana, Bhedī, Vātaśleṣmahara

IMPORTANT FORMULATIONS— Varuṇādi kvātha cūrṇa.

THERAPEUTIC USES— Aśmarī; Mūtrakṛcchra; Gulma; Vidradhi.

DOSE— 20—30 g of the drug for decoction.

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VĀSĀ

Vāsā 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 1200m; flowers during February-March and also at the end of rainy season; leaves stripped off from older stems and dried in drying sheds.

SYNONYMS—

Sansk.	:	Vṛṣa, Āṭarūṣa, Vāsaka
Assam.	:	Titabahak, Bahak, Vachaka
Beng.	:	Baksa, Vasaka
Eng.	:	Vasaka
Guj.	:	Aduso, Ardusi, Adulso
Hindi	:	Aduss, Arusa
Kan.	:	Adsale, Adusoge, Atarusha, Adsole, Adasale
Kash.	:	Vasa
Mal.	:	Attalataka m, Atalotakam
Mar.	:	Adulsa. Vasa
Ori.	:	Basanga
Punj.	:	Bhekar, Vansa, Arusa
Tam.	:	Vasambu, Adathodai
Tel.	:	Addasaramu
Urdu	:	Adusa, Basa

DESCRIPTION—

(a) 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, exstipulite, glabrescent, 8—10 pairs of lateral vein bearing few hairs; dried leaves dull brown above, light greyish brown below; odour, characteristic; taste, bitter.

(b) Microscopic—Transverse section of leaf shows, dorsiventral surface wih 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 μ and glandular trichomes with unicellular stalk and 4 celled head measuring, 25—36 μ in diameter in surface view; cystoliths in mesophyll l yers, elongated and cigar shaped; acicular and prismatic forms of calcium oxalate crystals present in mesophyll; palisade ratio, 5—6, 5—8.5; stomatal index, 10.8—14.2—18.1 for lower surface.

IDENTITY, PURITY AND STRENGTH—

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 21 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 22 per cent, Appendix 2.2.7.

CONSTITUENTS—Alkaloids and essential oil.

PROPERTIES AND ACTION—

Rasa	:	Tikta, Kaṣāya
Guṇa	:	Laghu
Vīrya	:	Śīta
Vipāka	:	Kaṭu
Karma	:	Kaphapittahara, Raktasaṁgrāhika, Kāsaghna, Hṛdya

IMPORTANT FORMULATIONS— Vāsakāsava; Vāsāvaleha.

THERAPEUTIC USES—Kāsa; Śvāsa; Kṣaya; Raktapitta; Prameha; Kāmalā; Kuṣṭha.

DOSE— 10—20 ml of juice of fresh leaves.

10—20 g of the dried drug for decoction.

VIḌAÑGA

Viḍaṅga consists of dried mature fruits of *Embelia ribes* Burm. f. (Fam. Myrsinaceae); large scandent shrub with long slender, flexible branches; distributed throughout hilly parts of India upto 1600 m.

SYNONYMS —

Sansk.	:	Jantughna, Kṛmighna, Vella, Kṛmihara, Kṛmiripu
Assam.	:	Vidang
Bang.	:	Vidang
Guj.	:	Vavding, Vavading, Vayavadang
Hindi	:	Vayavidanga, Bhabhiranga, Baberang
Kan.	:	Vayuvidanga, Vayuvilanga
Kash.	:	Babading
Mal.	:	Vizhalari, Vizalari
Mar.	:	Vavading, Vavding
Ori.	:	Bidanga, Vidanga
Punj.	:	Babrung, Vavaring
Tam.	:	Vayuvilangam, Vayuvidangam
Tel.	:	Vayuvidangalu
Urdu	:	Baobarang, Babrang

DESCRIPTION—

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

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

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

IDENTITY, PURITY AND STRENGTH—

Identification :—

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

(II) Boil 5 g of the powdered seeds with 25 ml *alcohol* and filter. Divide the deep red coloured filtrate into two portions. To one portion, add *solution of lead Acetate;* a dirty green precipitate is produced. To the other portion add *solution of ferric* Chloride a reddish-brown precipitate is produced.

Foreign matter	— Not more than 2 per cent, Appendix 2.2.2.
Total ash	— Not more than 6 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 9 per cent, Appendix 2.2.7.

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

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

CONSTITUENTS—Benzoquinones, alkaloid (christembine), tannin and essential oil.

PROPERTIES AND ACTION—

Rasa	:	Kaṭu, Tikta
Guṇa	:	Rūkṣa, Laghu, Tīkṣṇa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kṛmināśana, Dīpana, Anulomana, Vātakaphāpaha

IMPORTANT FORMULATIONS— Viḍaṅgāriṣṭa; Viḍaṅga lauha; Viḍaṅgādi lauha.

THERAPEUTIC USES— Kṛmiroga; Ādhmāna; Śūla; Udararoga.

DOSE—5—10 g of the drug in powder form.

VIJAYĀ

Vijayā consists of dried leaves of cultivated or wild plants of *Cannabis sativa* Linn. (Fam. Cannabinaceae); an annual, erect, dioecious herb, one to two m high, found almost throughout the year; practically naturalised in the Sub-Himalayan tracts in India and abundantly found in waste lands from Punjab eastwards to Bengal and extending Southwards.

SYNONYMS —

Sansk.	:	Bhaṅgā, Mādanī
Assam.	:	Bhan, Bhang
Beng.	:	Bhang, Sidhi
Eng.	:	Indian Hemp,
Guj.	:	Bhang
Hindi	:	Bhaang, Bhanga
Kan.	:	Bhangigida, Ganjagida
Kash.	:	Pang, Bangi
Mal.	:	Kanchavu
Mar.	:	Bhang, Ganja
Ori.	:	Bhanga, Ganjei
Punj.	:	Bhang
Tam.	:	Ganja
Tel.	:	Ganjayi
Urdu.	:	Qinaab, Bhang

DESCRIPTION—

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

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

IDENTITY, PURITY AND STRENGTH :—

Foreign matter	—Not more than 2 per cent, Appendix 2.2.2.
Total ash	—Not more than 15 per cent , Appendix 2.2.3.
Acid-insoluble ash	—Not more than 5 per cent, Appendix 2.2.4.
Alcohol (90 per cent) soluble extractive	—Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	—Not less than 13 per cent, Appendix 2.2.7.

CONSTITUENTS — Resin (Cannabinols, particularly tetrahydrocannabinol).

Note—Soonna of this drug is to be done before use as described in the appendix.

PROPERTIES AND ACTION —

Rasa : Tikta

Guṇa : Laghu, Tīkṣṇa

Vīrya : Uṣṇa

Vipāka : Kaṭu

Prabhāva : Madakārī

Karma : Dīpana, Pācana, Grāhī, Kaphahara, Vājīkara, Vākvardhana, Nidrājanana, Vyavāyī

IMPORTANT FORMULATIONS — Jātīphalādi cūrṇa ; Madanānanda modaka.

THERAPEUTIC USES — Agnimāndya; Atisāra; Grahaṇīroga; Klaibya; Anidrā.

DOSE — 125 — 250 mg of the drug in powder form.

YAṢṬĪ

Yaṣṭī consists of dried, unpeeled, stolon and root of *Glycyrrhiza glabra* Linn, (Fam. Leguminosae); a tall perennial herb, upto 2 m high found cultivated in Europe. Persia, Afghanistan and to little extent in some parts of India.

SYNONYMS—

Sansk.	:	Yaṣṭīmadhūka, Yaṣṭikā, Madhūka, Madhuyaṣṭī, Yaṣṭyāhvā
Assam.	:	Jesthimadhu, Yeshtmadhu
Beng.	:	Yashtimadhu
Eng.	:	Liquorice root
Guj.	:	Jethimadha, Jethimard, Jethimadh
Hindi	:	Mulethi, Mulathi, Muleti, Jethimadhu, Jethimadh
Kan.	:	Jestamadu, Madhuka, Jyeshtamadhu, Atimadhura
Kash.	:	Multhi
Mal.	:	Irattimadhuram
Mar.	:	Jesthamadh
Ori.	:	Jatimadhu, Jastimadhu
Punj.	:	Jethimadh, Mulathi
Tam.	:	Athimadhuram
Tel.	:	Atimadhuramu
Urdu.	:	Mulethi, Asl-us-sus

DESCRIPTION —

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

(b) Microscopic—

Stolon— transverse section of stolon shows cork of 10-20 or more layers of tabular cells, outer layers with reddish-brown amorphous contents, inner 3 or 4 rows having thicker, colourless walls; secondary cortex usually of 1-3 layers of radially arranged parenchymatous cells containing isolated prisms of calcium oxalate; secondary phloem a broad band, cells of inner part cellulosic and outer lignified, radially arranged groups of about 10-50 fibres, surrounded by a sheath of parenchyma cells, each usually containing a prism of calcium oxalate about 10-35 μ long; cambium form tissue of 3 or more layers of cells; secondary xylem distinctly radiate with medullary rays, 3-5 cells wide, vessels about 80-200μ in diameter with thick, yellow, pitted, reticulately thickend walls; groups of lignified fibres with crystal sheaths similar to those of phloem; xylem parenchyma of two kinds, those between the vessels having thick pitted walls without inter-cellular spaces, the remaining with thin walls; pith of parenchymatous cells in longitudinal rows, with inter-cellular spaces.

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

IDENTITY, PURITY AND STRENGTH —

Total ash	— Not more than 10 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 2.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 20 per cent, Appendix 2.2.7.

CONSTITUENTS—Glycyrrhizin, glycyrrhizic acid, glycyrrhetinic acid, asparagine, sugars, resin and starch.

PROPERTIES AND ACTION—

Rasa	:	Madhura
Guṇa	:	Guru, Snigdha
Vīrya	:	Śīta
Vipāka	:	Madhura
Karma	:	Vātapittajit, Raktaprasādana, Balya, Varṇya, Vṛṣya, Cakṣuṣya

IMPORTANT FORMULATIONS— Elādi guṭikā; Yaṣṭīmadhuka taila; Madhuyaṣṭyādi taila.

THERAPEUTIC USES— Kāsa; Svarabheda; Kṣaya; Vraṇa; Vātarakta.

DOSE— 2— 4 g of the drug in powder form.

YAVĀNĪ

Yavānī consists of dried fruit of *Trachyspermum ammi* (Linn.) Sprague ex Turril Syn. *Carum copticum* Benth & Hook. f. *Ptychotis ajwan* DC. (Fam. Umbellifel rae); an annual, erect herb, upto 90 cm tall, cultivated almost throughout India, uprooted and thrashed for collecting the fruits.

Synonyms

Sansk.	:	Dīpyaka, Yamānī, Yamānikā, Yavānikā
Assam.	:	Jain
Beng.	:	Yamani, Yauvan, Yavan, Javan, Yavani, Yoyana
Eng.	:	Bishop's weed
Guj.	:	Ajma, Ajmo, Yavan, Javain
Hindi	:	Ajwain, Jevain
Kan.	:	Yom, Omu, Oma
Mal.	:	Omam, Ayanodakan
Mar.	:	Onva
Ori.	:	Juani
Tam.	:	Omam
Tel.	:	Vamu

DESCRIPTION:—

(a) **Macroscopic**—Fruit, consists of two mericaprs, greyish brown, ovoid, compressed, about 2 mm long and 1 mm wide with pale coloured protuberances; 5 ridges and 6 vittae in each mericarp; usually separate, 5 primary ridges pale in colour; odour, characteristic, thymolic; taste, pungent.

(*b*) **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 tabular 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; 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 5 per cent, Appendix 2.2.2.
Total ash	— Not more than 9 per cent, Appendix 2.2.3.
Acid-insoluble ash	— Not more than 0.2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	— Not less than 2 per cent, Appendix 2.2.6.
Water-soluble extractive	— Not less than 13 per cent, Appendix 2.2.7.
Volatile Oil	— Not less than 2.5 per cent, Appendix 2.2.10.

CONSTITUENTS——Essential oil and fixed oil.

PROPERTIES AND ACTION —

Rasa	:	Kaṭu, Tikta
Guṇa	:	Rūkṣa, Laghu, Tīkṣṇa
Vīrya	:	Uṣṇa
Virpāka	:	Kaṭu
Karma	:	Dīpana, Pācana, Rucya, Anulomana, Śūlahara, Kṛmighna

IMPORTANT FORMULATIONS— Yavānī Ṣāḍava.

THERAPEUTIC USES— Ādhmāna; Ānāha; Udararoga; Gulma; Kṛmiroga; Śūla.

DOSE— 3—6 g of the drug in powder form.

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APPENDICES

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APPENDIX I

1. APPARATUS FOR TESTS AND ASSAYS

1.1 Nessler Cylinders

Nessler cylinders which are used for comparative tests are matched tubes of clear colourless glass with a uniform internal diameter and flat, transparent base. They comply with Indian Standard 4161—1967. They are of transparent glass 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 3.0 mm. The external height to the 50-ml mark of the cylinder used for a test must not vary by more than 1 mm.

1.2 Sieves

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

Sieves conform to the following specifications :

Approximate sieve number*	Nominal mesh aperture size mm	Tolerance average aperture size ±mm
4	4·0	0·13
6	2·8	0·09
8	2·0	0·07
10	1·7	0·06
12	1·4	0·05
16	1·0	0·03
—	μm	± μm
22	710	25
25	600	21
30	500	18
36	425	15
44	355	13
60	250	13(9·9)**
85	180	11(7·6)
100	150	9·4(6·6)
120	125	8·1(5·8)
150	106	7·4(5·2)
170	90	6·6(4·6)
200	75	6·1(4·1)
240	63	5·3(3·7)
300	53	4·8(3·4)
350	45	4·8(3·1)

1.3 Thermometers

Unless otherwise specified, thermometers suitable for pharmacopoeial tests conform to Indian Standard 4825—1968 and are standardised 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 standardised for total immersion or for partial immersion. Each thermometer should be employed according to the condition of immersion under which it was standardised. In the selection of the thermometer it is essential to consider the conditions under which it is to be used.

*Sieve number 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.

1.4 Volumetric Glassware

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

Pharmacopoeial assays involving volumetric measurements require the use of accurately calibrated glassware. Volumetric apparatus must be suitably designed to assure accuracy. The design, construction and capacity of volumetric 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	

1.5 Weights and Balances

Pharmacopoeial tests and assays require the use of analytical balances that vary in capacity, sensitivity and reproducibility. The accuracy needed for a weighing should dictate 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

2.1 TESTING OF DRUGS

2.1.1.—Systematic study of Crude Drugs

In the Indian Systems of Medicine comprising of Ayurveda, Unani 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 or gums etc. constitute single drugs in the Indian Systems of Medicine. These vegetable drugs are either used in dried forms or some times as whole fresh or their juice. The study of these crude drugs made with a view to recognise them is called Pharmacognosy (Pharmaka=Drug; gignosco=to acquire knowledge of), meaning the knowledge or 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, Miscroscopical and sensory (organoleptic) characters, (v) Chemical composition wherever possible, (vi) Identity, Purity, Strength and assay, (vii) 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 difinite 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 tissues like palisade cells, vascular 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, fibres, vessels etc. as also from the study of the cell deposits like crystals, starch etc. the drugs are identified. The studies of diagnostic elements are helpful especially when the drugs are in powdered condition and give clue in the identification of drugs. Linear measurements and other methods of quantitative microscopy give further aid in the identification of the drugs. The sections or the powdered drug samples are cleared by clearing agents, mostly by chloral-hydrate solution, before mounting on the slide.

The basic chemical nature of cell-wall of almost all the plants is cellulosic, However, lignin, suberin, cutin or mucilage are deposited on the cellulose. Cellulose gives blue colour with chlorzinc-iodine solution or with cuoxam. (Copper-oxide-ammonia) reagent. Lignin present in the middle lamella and secondary cell-wall of many vessels, fibres 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 give with 5% potassium hydroxide red colour because of anthraquinone derivatives, strychnine present in Nux-vomica gives purplish-red colour with ammonium vanadate and concentrated sulphuric acid.

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

2.1.2.—Microscopical Methods of Examining Crude Vegetable Drugs

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

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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 or chloral hydrate*. Crush the material with scalpel and cover with cover slip before examining.

(ii) **Cut materials**—For examining cut leaves, herbs 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 chloralhydrate 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 Chloral-hydrate 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

Generally 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 cannot 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 ($0.6 \times 0.5 \times 1.5$ 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 teasing 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. Shape 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 0.5-1 g. 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 through 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 a needle.

III. BARKS

A. Entire material :

Prepare transverse or 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 longitudinal 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 darivatives are detected by treating with alkali solution (blood-red colour shows the presence of anthraquinone derivatives).

B. Cut materials :

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

C. Powder :

(i) Prepare specimen for examination by placing a little amount of powder on a slide, add 1-2 drops of *phloroglucinol* 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 *safranine*, examine the specimen under a dissecting microscope. For micro-chemical test the small and thin 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 strach 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 or 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 scrappings 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, anthraquinone derivatives, tannins, mucilage, etc.

2.1.3—Types of Stomata

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

1. **Anomocytic** (irregular-celled)—Previously known as ranunculaceous. The stoma is surrounded by a varying number of cells in no way differing form those of the epidermis generally.
2. **Anisocytic** (unequal-celled)—Previously known as cruciferous or solanaceous. The stoma is usually surrounded by three subsidiary cells, of which one is markedly smaller than the others.
3. **Diacytic** (Cross-celled)—Previously known as caryophyllaceous. The stoma is accompanied by two subsidiary cells whose common wall is at right angles to the guard cells.
4. **Paracytic** (parallel-celled)—Previously known as rubiaceous. The stoma has one each side one or more subsidiary cells parallel to the long axis of the pore and guard cells.

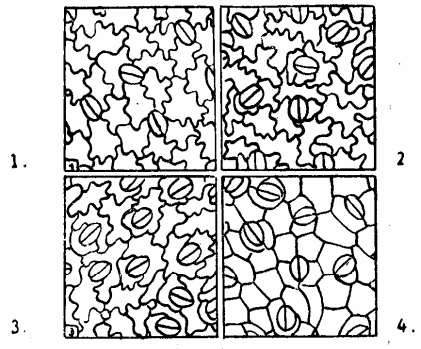

Fig. 1 Various types of stomata

2.1.4—Determination of Stomatal Index

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

Place leaf fragments of about 5×5 mm in size in a test tube containing about 5 ml of *Choral hydrate solution* and heat in a boiling water water-bath for about 15 minutes or until the fragments become transparent. Transfer a fragment to a microscopic slide and prepare the mount, the lower epidermis uppermost, in chloral hydrate solution and put a small drop of glycerol-ethanol solution on one side of the

cover-glass to prevent the preparation from drying. Examine with a 40x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Mark on the drawing paper a cross(x) for each epidermal cell and a circle (o) for each stoma. Calculate the result as follows:

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

Where S = the number of stomata in a given area of leaf; and

E = the number of epidermal cells (including trichomes) in the same area of leaf.

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

2.1.5—Determination of Palisade Ratio

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

Place leaf fragments of about 5x5 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 minutes or until the fragments become transparent Transfer a fragment to a microscopical Slide and prepare the mount, 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 count only when more than half of it is within the area of the epidermal cells. Calculate the average number of palisade cells beneath one epidermal cells, dividing the count by 4; this is the "Palisade ratio " (See figure 2).

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

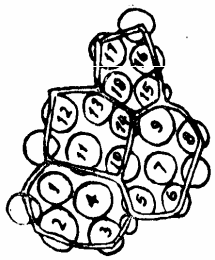

Fig. 2 Palisade ratio $\frac{18.4}{4} = 4.5$

2.1.6—Determination of vein-Islet Number

The mesophyll of a leaf is divided into small portions of photosynthetic tissue by anastomosis of the veins and veinlets; such small portions or areas are termed " 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 millimetres from the central portion of the Lamina and excluding the midrib and the margin of the leaf. Clear the pieces of lamina by heating in a test tube containing *Chloral hydrate solution* on a boiling water-bath for 30 to 60 m or until clear and prepare a mount in *glycerol-solution* or, if desired, stain with *safranin solution* and prepare the mount in *Canada Balsam*. Place the stage micrometer on the microscope stage and examine with 4x objective and a 6x eyepiece. Draw a line representing 2mm 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 veinlets 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 millimetres. 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 millimetre, 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 millimetre. Carry out the rest of the procedure as stated above. The result obtained is the number of vein-is lets in 1 square millimetre. For each sample of leaf make not less than 12 determinations and calculate the average number.

2.2. DETERMINATIONS 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 dimesion; and of powderd 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 100 Kg, 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 a quartering process in the same manner until each of the quarters weigh at least 125 g; two such quarters then constitute an original sample.

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

When the total weight of the drug to be sampled is less than 100 Kg, 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 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 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 10 Kg, the preceding 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 unground 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 contaminations such as earth, stones and extraneous material. Any matter not covered by the description of the drug in the monograph shall be regarded as a non-extraneous foreign matter.

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

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

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

2.2.4.—Determination of Acid-Insoluble Ash

Boil the ash obtained in (2.2.3) for 5 minutes with 25 ml 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 consatnt 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 or 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°. Substract the weight of the insoluble matter from the weight of the ash; the difference in weight represents the water-soluble ash. Calculate the percentage of water-soluble ash with reference to the air-dried drug.

2.2.6.—Determination of Alcohol-Soluble Extractive

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

2.2.7.—Determination of Water-Soluble Extractive

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

2.2.8.—Determination of Ether-Soluble Extractive (fixed Oil Content)

Transfer a suitably weighed quantity (depending on the fixed oil content) of the air dried, crushed drug to an extraction thimble, extract with *solvent ether* (or *petroleum ether*, b.p. 40° to 60°) in a continuous extraction apparatus (soxhlet extractor) for 6 hours. Filter the extract quantitatively into a tared evaporating dish and evaporate off the solvent on a water bath. Dry the residue at 105° to constant weight. Claculate 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 10 g, of drug (without preliminary drying) after accuratcly weighing (accurately weighed to within 0.01 g) it in a tared evaporating dish. For example, for underground or unpowdered drug, prepare about 10 g, 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 weighing after drying for 30 minutes and cooling for 30 minutes in an desiccator, show not more than 0.01g difference.

2.2.10.—Determination of Volatile Oil in Drugs

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 returned 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 (see fig. 3). 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.

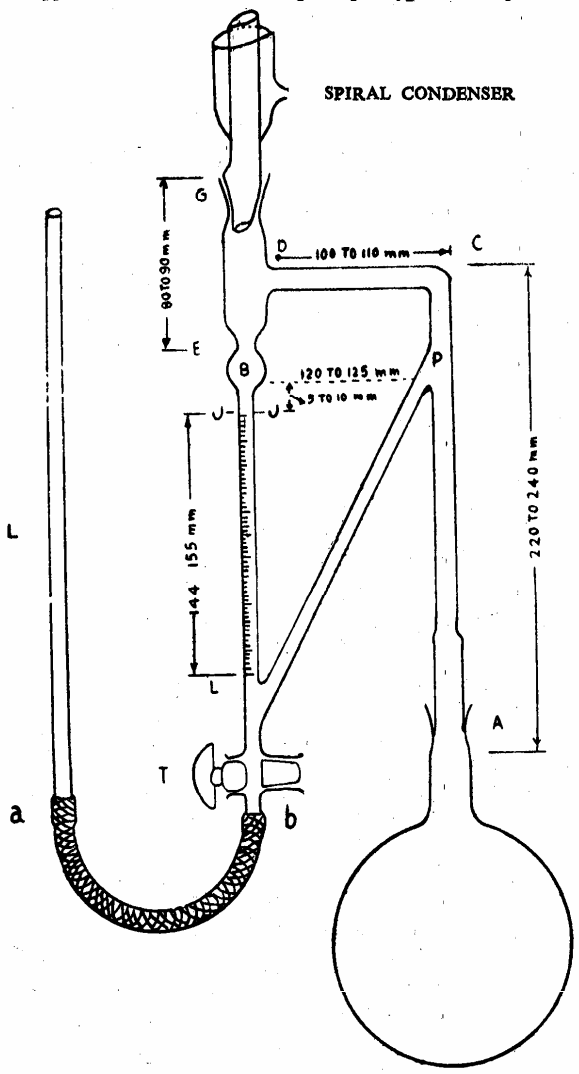

Fig. 3 Apparatus for volatile oil determination

(a) **Distilling flask**—A spherical flask, 1,000 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.

Tube 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 1

Tube EG, length — 80 to 90 mm.

Internal Diameter — 30 to 40 mm.

Bulb B— length 20 to 22 mm.

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 fiftieths of a millilitre.

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

Levelling tube 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).

Rubber tubing a—b length 450 to 500 mm. Internal diameter 5 to 8 mm.

(c) **Burner** —A luminous Argand burner with chimney and sensitive regulating 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

The drug in the form directed in the Table or the powdered drug in the condition in which it is received is placed, 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 stripes, 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 heated 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 rotated occasionally to wash down any material that adheres to its sides.

At the end of the specified time heating is discontinued, the apparatus is allowed to cool for 10 minutes and the tap T is opened and the tube L1 lowered slowly; as soon as the layer of the oils 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 antoher 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.

TABLE

Drug	Weight to be taken	Condition when distilled	Approximate time of distillation in hours
1	2	3	4
Ajmodā	20	Whole	4
Dhānyaka	40	No. 10 powder	3
Guggulu	40	Whole	3
Haridrā	20	No. 20 powder	5
Jatāmānsi	20	Whole	4
Jātiphala	15	No. 20 powder	3
Knṛṣṇjiraka	20	Whole	4
Lavaṅga	4	Coarsely crushed	4
Misreya	25	Whole	4
Sukāmailā	20	Seed only, Whole	5
Tvakpatra	40	No. 10 powder	5
Tvak	40	No. 10 powder	5
Yavānī	20	Whole	4

2.2.11 Special Processes used in Alkaloidal Assays

2.2.11a Continuous Extraction of Drugs

Where continuous extraction of a drug or any other substance is recommended in the monograph, the process consists of percolating it with a suitable solvents at a temperature approximately that of the boiling point of the solvent. Any apparatus that permits the uniform percolation of the drug and the continuous flow of the vapour of the solvent around the percolator may be used. The type commonly known as the soxhlet apparatus is suitable for this purpose.

A simple apparatus is shown in the accompanying illustration. A is an outer tube of stout glass; the wider part is about 18 cm in length and has an internal diameter of 4.8 to 5 cm; the lower end C is about 5 cm. in length and has an external diameter of about 1.6 cm. B is a straight glass tube open at both ends, about 9 cm in length and having an external diameter of about 3.8 cm; over its lower flanged end is tied firmly a piece of calico or other suitable material. D is a glass C oil, which supports the margin of the tube B and prevents it from resting in contact with the outer tube A. The lower end C of the outer tube A is fitted by a cork to the distilling flask E, in which a suitable quantity of the solvent has been placed. The substance to be extracted, previously moistened with the solvent or subjected to any preliminary treatment required, is introduced into the inner tube B , which is supported so that the percolate drops into the outer tube. A pad of cotton wool G is placed on the top of the drug, the inner tube is lowered into position and the outer tube connected by means of a suitable cork with the tube of a reflux condenser F. The flask is heated and the extraction continued as directed (*See* Fig. 4).

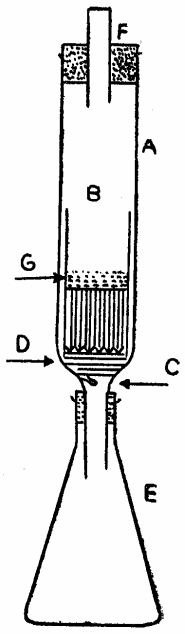

Fig. 4 APPARATUS FOR THE CONTINUOUS EXTRACTION OF DRUGS

2.2.11b Tests for complete Extraction of Alkaloids—Complete extraction is indicated by the following tests:

When extracting with an aqueous or alcoholic Liquid—After extracting at least three times with the liquid, add to a few drops of the next portion, after acidifying with 2 *N hydrochloric acid* if necessary, 0.05 ml of potassium mercuri-iodide solution or for solanaceous alkaloids 0.05 ml of *potassium iodobismuthate solution;* no precipitate or turbidity, is produced.

When extracting with an immiscible solvent—After extracting at least three times with the solvent, add to 1 to 2 ml of the next portion 1 to 2 ml of 0.1 *N hydrochloric acid,* remove the organic solvent by evaporation, transfer the aqueous residue to a test tube, and add 0.05 ml of *potassium mercuri-iodide solution* or solanaceous alkaloids 0.05 ml of *potassium iodobismuthate solution* or for emetine, 0.05 ml of *iodine solution*; not more than a very faint opalescenece is produced.

2.3. LIMIT TESTS

2.3.1 Limit Test for Arsenic

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

Apparatus—

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

Two rubber bungs (about 25 mm X 25 mm), each with a hole bored centrally and true, exactly 6.5 mm in diameter, are fitted with a rubber band or spring 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		0.132 g
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 to 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.

Citire 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 per cent w/w of HCl and complying with the following additional tests :

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

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

Hydrochloric acid (constant-boiling composition) AsT.—Boil *hydrochloric acid AsT* to constant boiling Composition in the presence of *hydrazine hydrate*, using 1 ml of a 10 per cent w/v solution in *water* per litre 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 of 400 papers is approximately equal numerically, to the weight in g per sq. mm.

Nitric acid AsT : *Nitric acid* which complies with 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 2ml 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 5g in the cold with 20ml 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 10g in 25ml of *hydrochloric acid AsT* and 35ml 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 5g in 50ml of *water*, add 20ml 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 ane qual volume of *hydrochloric acid*, boiling down to the original volume, and filtering through a fine-grain filter paper.

It complies with the following test :

To 10ml add 6ml of water and 10ml of *hydrochloric acid AsT*, distil and collect 16ml. 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 10g with 50ml of water, add 0.2ml 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 10ml 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, but 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 10mm when the tube has a rounded-off end, or so that the ground end of the

NOTE—Murcuric 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.

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 10g of *zinc Ast* are added, and the prepared glass tube is 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 operating 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.

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 substana indicates that the proportion of arsenic is 1 part per million.

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

(2) The most suitable temperature for carrying out the test is generally about 40° but because the rate of the evolu ion of the gas varies somewhat with diffrent batches zinc AsT, the temperature may be adjusted to obtain a regular, but 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 50ml of water, 10ml 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 than the 1-ml *standard stain*, the proportion of arsenic present does not exceed the permitted limit.

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

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

Ferrous sulphate : Dissolve 5g in 10 ml of *water* and 15ml of *stannated hydrochloric acid AsT* and distil 20ml; to the distillate add a few drops of *bromine solution AsT.* Add 2ml of *stannated hydrochloric acid AsT*, heat under a reflux condenser for one hour, cool, and add 10ml of *water* and 10ml of *hydrochloric acid AsT.*

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

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

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

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

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

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

Sodium hydroxide : Dissolve 2.5g in 50ml 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 50ml with *water*, and add 1ml 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 10ml of *dilute nitric acid* in a *Nessler cylinder*. Dilute to 50ml with water and add 1ml of silver nitrate solution. Stir immediately with a glass rod and allow to stand for five minutes.

2.3.3—Limit Test For Heavy Metals

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

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

Special Reagents—

Acetic acid Sp. : *Acetic acid* which complies with the following additional test : Make 25 ml alkaline with *dilute ammonia solution Sp.*, add 1ml 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 2ml of the acid and dilute with *water* to 25ml, add 10ml of *hydrogen sulphide solution.* Any dark colour produced is not more than that of a control solution consisting of 2ml of the acid and 4.0ml of *standard lead solution* diluted to 25m with *water.*

Ammonia solution Sp. : *Strong ammonia solution* which complies with the following additional test : Evaporate 10 ml to dryness on a water-bath; to the residue add 1ml 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 10ml of *hydrogen sulphide solution.* Any darkening produced is not greater than in a blank solution containing 2ml of dilute acetic acid Sp. 1.0 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 20ml add 1ml of *Potassium cyanide solution Sp.*, dilute to 50ml 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 2ml of *dilute acid sp.*, dilute to 17ml with water and add 10 ml of *hydrogen sulphide solution;* any darkening produced is not greater than in a blank solution containing 2.0ml of *standard lead solution,* 2ml 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 10ml of the acid in the manner described under *Hydrochloric acid Sp.*

Lead nitrate stock solution : Dissolve 0.1598 g of *lead nitrate* in 100ml of *water* to which has been added 1ml of *nitric acid,* then dilute with *water* to 1000.0ml.

This solution must be prepared and stored in polyethylene or glass containers free from soluble lead salts.

Standard lead solution : On the day of use, dilute 10.0ml of *lead nitrate stock solution* with *water* to 100.0ml. Each ml of *standard lead solution* contains the equivalent of 10 μg of lead. A control comparison solution prepared with 2.0 ml of standard lead solution contains, when compared to a solution representing 1.0g 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 10ml with 10ml of *water,* make alkalkine with *ammonium solution Sp.* add 1ml of *potassium cyanide solution Sp.* dilute to 50ml with water, and add two drops of *sodium sulphide solution;* no darkening is produced.

Potassium Cyanide Solution Sp. : See Appendix 2,3, 5 Sulphuric acid Sp. : Sulphuric acid which complies with following additional test : Add 5g to 20ml of *water* make alkaline with *ammonia solution Sp.*, add 1ml of *potassium cyanide solution Sp.*, dilute to 50ml with *water* and add two drops of *sodium sulphide Solution;* no darkening is produced.

Method A

Standard Solution : Into a 50-ml *Nessler cylinder*, pipette 2ml 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 3.0 and 4.0, dilute with *water* to about 35ml., and mix.

Test Solution : Into a 50-ml *Nessler cylinder*, Place 25ml 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 25ml the specified quantity of the substance being tested. Adjust with *dilute acetic acid Sp.* or *dilute ammonia solution Sp.* to a pH between 3.0 and 4.0 dilute with *water* to about 35 ml and mix.

Procedure : To each of the cylinders containing the *standard solution* and *test solution* respectively add 10ml of freshly prepared *hydrogen sulphide solution*, mix, dilute with *water* to 50 ml, allow to stand for five minutes, and view downwards over a white surface; the colour produced in the *test solution*. not darker than that produced in the *standard solution*.

Method B

Standard solution : Proceed as directed under Method A.

Test solution : Weigh in a suitable crucible the quantity of the substance specified in the individual monograph, add sufficient *sulphuric acid Sp.* to wet the sample, and ignite carefully at a low temperature until thoroughly charred. Add to the charred mass 2ml of *nitric acid Sp.* and five drops of *sulphric acid Sp.* and heat cautiously until white fumes are no longer evolved. Ignite, preferably in a muffle furnace, at 500° to 600° until the carbon is completely burnt off. Cool, add 4ml 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 10ml 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 3.0 and 4.0. Filter if necessary, rinse the crucible and the filter with 10ml of *water.*, combine the filtrate and washings in a 50 ml *Nessler Cylinder.*, dilute with *water*, to about 35ml, and mix. Procedure : Proceed as directed under Method A.

Method C

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

Test Solution : Into a 50ml *Nessler Cylinder*, Place 25ml 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 20 ml of *water* and 5ml of *dilute sodium hydroxide solution.* Dilute 50ml 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 0.1726g of *ferric ammonium sulphate* and dissolve in 10ml of 0.1*N sulphuric acid* and sufficient *water* to produce 1000.0ml. Each ml of this solution contains 0.02mg of Fe.

Method

Dissolve the specified quantity of the substance being examined in 40ml of *water*, or use 10ml of the solution prescribed in the monograph, and transfer to a *Nessler cylinder*. Add 2ml 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 2.0ml of *standard iron solution* with 40ml of *water* in a *Nessler cylinder*. Add 2ml of a 20 per cent w/v solution of *iron-free citric acid* and 0.1ml of *thioglycollic acid*, mix, make alkaline with *iron-free ammonia solution*, dilute to 50ml 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 reagent 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. :** Dissolve 2g of *potassium cyanide* in 15 ml of *strong ammonia solution* and dilute with *water* to 100 ml.

(2) **Ammonium 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 soluion 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 10.0 ml of *standard lead solution* with sufficient 1 per cent v/v solution of nitric acid to produce 100.0 ml. Each ml of this solution contains 1 μg of lead per ml.

(4) **Dithizone extraction solution :** Dissolve 30 mg of *diphenylthiocarbazone* in 1000 ml of *chloroform* and add 5 ml of *alcohol.* 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 65ml. Transfer to separator, add five drops of *thymol blue solution,* add *strong ammonia solution* until the solution becomes yellow. Add 10ml of a 4 per cent w/v solution of *sodium diethyldithiocarbamate* and allow to stand for five minutes. Extract with successive quantities, each of 10ml, 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* until the solution is pink and then dilute with sufficient water to produce 100 ml.

(6) **Potassium cyanide solution Sp. :** Dissolve 50g of *potassium cyanide* in sufficient *water* to produce 100 ml. Remove the lead from this solution by extraction with successive quantities, each of 20ml of *dithizone 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 10g of *potassium cyanide* in each 100 ml.

(7) **Standard 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 50ml of *water* add 50 ml of *ammoniam citrate solutoin 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 25.0 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 10ml of *buffer solution* pH 2.5 and mix.

(12) **Ammonia-cyanide wash solution :** To 35ml of pH 2.5 *wash solution* add 4ml 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 6ml of *ammonium citrate solution Sp.*, and 2 ml of *hydroxylamine hydrochloride solution Sp.*, (For the determination of lead in iron salts use 10 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 ammonnia solution.* Cool the solution if necessary, and add 2ml of *potassium cyanide solution Sp.* Immediately extract the solution with several quantities each of 5ml, of *dithizone extraction solution,* draining off each extract into another separating funnel, until the dithizone extraction solution retains its green colour. Shake the combine dithizone solutions for 30 seconds with 30ml of a 1 per cent w/v solution of *nitric acid* and discard the chloroform layer. Add to the acid solution exactly 5 ml of *standard dithizone solution* and 4ml of *ammonia-cyanide solution Sp.* and shake for 30 seconds; the colour of the chloroform layer is of no deeper shade 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 Sulphated Ash

Heat a silica or platinum crucible to redness for 10 minutes, allow to cool in a desiccator and weigh. Put 1 to 2g of the substance, accurately weighed, into the crucible, ignite gently at first, until the substance is thoroughly charred. Cool, moisten the residue with 1 ml of *sulphuric acid,* heat gently until

white fumes are no longer evolved and ignite at 800°±25° until all black particles have disappeared. Conduct the ignition in a place protected from air currents. Allow the crucible to cool, add a few drops of *sulphuric acid* and heat. Ignite as before, allow to cool and weigh. Repeat the operation until two successive weighings do not differ by more than 0.5 mg.

2.3.7—Limit Test for Sulphates

Reagents—

Barium sulphate reagent : Mix 15ml 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.

0.5M Barium chloride : *Barium chloride* dissolved in *water* to contain in 1000 ml 122.1 g of $BaCl_2$, $2H_2O$.

Method

Dissolve the specified quantity of the substance in *water*, or prepare a solution as directed in the text, transfer to a *Nessler cylinder*, and add 2 ml of *dilute hydrochloric acid*, except where *hydrochloric acid* is used in the preparation of the solution. Dilute to 45ml with *water*, add 5ml 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 1.0 ml of 0.1089 per cent w/v solution of potassium sulphate and 2ml of *dilute hydrochloric acid* in a *Nessler cylinder*, dilute to 45 ml with *water*, add 5ml of barium *sulphate reagent*, stir immediately with a glass rod and allow to stand for five minutes.

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APPENDIX 3

3. PHYSICAL TESTS AND DETERMINATIONS

3.1 Determination of Boiling or Distilling Range

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

Apparatus—

Use an apparatus consisting of the following :

1. **Distilling flask** : A round-bottom distilling flask of 200 ml capcity and having a total length of 17 to 19 cm and an inside neck diameter of 20 to 22 mm. Attached about midway on the neck approximately 12 cm from the bottom of the flask, is a side-arm 10 to 12 cm long and 5 mm in internal diameter which is at an angle of 70° to 75° with the lower portion of the neck.
2. **Condenser** : A straight glass condenser 55 to 60 cm long with a water-jacket about 40 cm long or any other type of condensor having equivalent condensing capacity. The lower end of the condenser may be bent to provide a delivery tube, or it may be connected to a bent adaptor that serves as a delivery tube.
3. **Receiver** : A 100 ml cylinder, graduated in 1 ml sub-divisions.
4. **Thermometer** : An accurately standardised, partial immersion thermometer having the smallest practical sub-divisions (not greater than 0.2°). When placed in position, the steam is located in the centre of the neck and the top of the bulb is just below the bottom of the outlet to the side arm.

Method

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

Assemble the apparatus, and place in the flask 100 ml of the liquid under examination, taking care not to allow any of the liquid to enter the side-arm. Insert the thermometer and seal the entire heating and flask assembly from external air currents. Add a few pieces of porous material and heat rapidly to boiling using a Bunsen burner and an asbestos plate pierced by a hole 33 mm in diameter. Record the temperature at which the first drop of distillate falls into the cylinder, and adjust the rate of heating to obtain a regular distillation rate of 4 to 5 ml per minute. Record the temperature when the last drop of liquid evaporates from the bottom of the flask or when the specified percentage has distilled over. Correct the observed temperature readings for any variation in the 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°	0.040
100° to 140°	0.045
140° to 190°	0.050
190° to 240°	0.055
More than 240°	0.060

3.2 Determination of congealing range or temperature

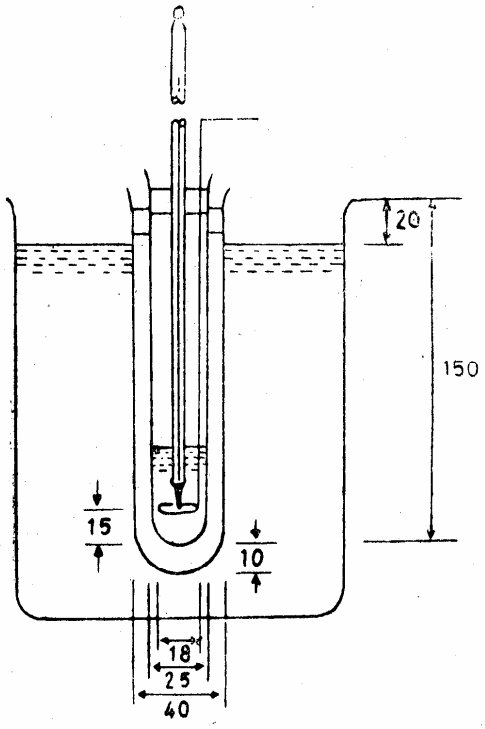
The congealing temperature is that point at which there exists a mixture of the liquid (fused) phase of a substance and a small but increasing proportion of the solid phase. It is distinct from the freezing point, which is the temperature at which the liquid and solid phase of a substance are in equilibrium.

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

The following method is applicable to substances that melt between —20° and 150°.

Apparatus—

A test-tube about 25 mm in diameter and 150 mm long placed inside a test-tube about 40 mm in diameter and 160 mm long; the inner tube is closed by a stopper that carries a stirrer and a thermometer



(Dimensions in mm)

(about 175 mm long and with 0.2 graduations) fixed, so that the bulb is about 15 mm above the bottom of the tube. The stirrer is made from a glass rod or other suitable material formed at one end into a loop of about 18 mm overall diameter at right angle to the rod. The inner tube with its jacket is supported centrally in a 1-litre beaker containing a suitable cooling liquid to within 20 mm of the top. A thermometer is supported in the cooling bath (see Fig. 5).

Method

Melt the substance, if solid, at a tempeature not more than 20° above its expected congealing point and pour it into the inner test-tube to a 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 test-tube. Fill the bath to almost 20 mm from the tube with a suitable fluid at a temperature 4° to 5° below the expected congealing point. If the substance is a liquid at room temperature, carry out the determination using a bath temperature about 15° below the expected congealing point. When the sample has cooled to about 5° above its expected congealing point stir it continuously by moving the loop up and down between the top and bottom of the sample, at a regular rate of 20 complete cycles per minute. Record the reading of the

thermometer every 30 seconds and continue stirring only so long as the tempeature is falling. Stop the stirring when the temperature is constant or starts to rise slightly. Continue recording the temperature for atleast three minutes after the temperature again begins to fall after remaining constant.

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

3.3 Determination of pH Values

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

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

Apparatus—

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

Operate the pH meter and electrode system according to the manufacturer's instructions. Calibrate the apparatus using buffer *solution D* as the primary standard, adjusting the meter to read the appropriate pH value given in the Table 1, corresponding to the temperature of the solution. Where provision is made for setting the scale, use a second reference buffer solution, either *buffer soution A, buffer solution E* or *buffer solution G*. In this case a check is carried out with a third refereene 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°	A	B	C	D	E	F	G	H
15	1.67	—	3.80	4.00	6.90	7.45	9.28	10.12
20	1.68	—	3.79	4.00	6.88	7.43	9.22	10.03
25	1.68	3.56	3.78	4.01	6.86	7.41	9.18	10.01
30	1.68	3.55	3.77	4.02	6.85	7.40	9.14	9.97
35	1.69	3.55	3.76	4.02	6.84	7.39	9.10	9.98
$\Delta pH/\Delta t$	+0.001	—0.001	—0.002	+0.001	—0.003	+0.003	—0.008	—0.009

Reference buffer solutions

The following reference buffer solutions must be prepared using *carbon dioxode free water*; phthalate and phosphate salts should be dried at 110° for two hours before use. Buffer solutions should be stored in bottles made of alkali-free glass, and must not be used later than three months after preparation.

1. **Buffer solution A** : Dissolve 12.71 g of *potassium tetraoxalate* in sufficient *carbon dioxide-free water* to produce 1000.0 ml.
2. **Buffer solution B** : A freshly prepared saturated solution, at 25°, of *potassium hydrogen tartrate*.
3. **Buffer solution C** : Dissolve 11.51 g of *potassium dihydrogen citrate* in sufficient carbon dioxide-free water to produce 1000.0 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 1000.0 ml.
5. **Buffer solution E** : Dissolve 3.40 g of *potassium dihydrogen phosphate* and 3.55 g of *anhydrous disodium hydrogen phosphate*, both previously dried at 110° to 130° for two hours, in sufficient *carbon dioxide-free water* to produce 1000.0 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 110° to 130° for two hours, in sufficient *carbon dioxide-free water* to produce 1000.0 ml.

7. **Buffer solution G :** Dissolve 3.814 g of *borax* in sufficient *carbon dioxide-free water* to produce 1000.0 ml.

NOTE—*This solution should be stored protected from 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 1000.0 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 prepered using *carbon dioxide-free water.*

3.4 Determination of melting range or 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 Pharmacopoiea. 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
Vanillin	81°—83°
Acetanilide	114°—116°
Phenacetin	134°—136°
Sulphanilamide	164.5°—166.5°
Sulphapyridine	191°—193°
Caffeine (dried at 100°)	234—237°

Unless otherwise specified in the individual monograph, Method I should be used.

Method I

Apparatus :

(a) A glass heating vessel of suitable construction and capacity containing one of the following or any other suitable bath liquid, to a height of not less than 14 cm.

(i) Water for temperatures upto 60°

(ii) Glycerin for temperatures upto 150°.

(iii) Liquid paraffin for sufficiently high boiling range for temperatures upto 250°.

(iv) Sesame oil or a suitable grade of liquid silicone for temperatures upto 300°.

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

(c) An accurately standardised thermometer suitable for the substance under examination (see Appendix 1.3). 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 0.3mm 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 reduced pressure over a suitable desiocant for not less than 16 hours. Introduce into a capillary glass tube, one end of which is sealed, a sufficient quantity of the dry powder to form a compact column about 3 mm high.

Heat the bath until the temperature is about 10° below the expected melting point. Remove the thermometer and quickly attach the capillary tube to the thermometer by wetting both with a drop of the liquid of the bath or otherwise and adjust its height so that the closed end of the capillary is near the middle of the thermometer bulb. Replace the thermometer and continue the heating, with constant stirring, sufficiently to cause the temperature to rise at a rate of about 3° per minute. When the temperature is about 3° below the lower limit of the expected melting range, reduce the heating so that the temperature rises at a rate of about 1° to 2° per minute. Continue the heating and note the temperature at which the column of the sample collapses definitely against the side of the tube at any point, when melting may be considered to have begun and note also the temperature at which the sample becomes liquid throughout as seen by the formation of a definite meniscus. The two temperatures fall within the limits of the melting range.

Method II

Apparatus : Use the apparatus described under Method I except that the glass capillary tube is open at both ends and has an internal diameter of 1.1 to 1.3 mm, an external diameter of 1.4 to 1.3 mm and length of 50 to 60 mm.

Procedure : Rapidly melt the material to be tested, at a temperature not more than 10° above the point of complete fusion. Draw it into a capillary tube to a depth of about 10 mm. Cool the charged tube at 10°, or lower, for 24 hours, or in contact with ice for at least 2 hours. Attach the tube to the thermometer and adjust it so that the column of substance is in level with the thermometer bulb; suspend the thermometer in the heating vessel containing water at 15° so that the lower end of the column of the substance is 30 mm below the surface of the water and heat the water with constant stirring so that the temperature rises at the rate of 1° per minute the temperature at which the partly melted substance is observed to rise in the capillery tube is the melting temperature.

Method III

Apparatus : (a) A glass boiling-tube, overall length, 110mm, internal diameter, 25 mm.

(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 other device which will ensure uniformity of the temperature throughout the water in the beaker.

(e) An accurately standardised thermometer suitable for the substance under examination (see Appendix 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°. Cool and allow the temperature of the molten substance to drop to a temperature of 8° to 10° above the expected melting point. Chill the bulb of the thermometer to 5°, wipe it dry and while it is still cold, dip it in the molten substance so that the lower half of the bulb is submerged. Withdraw it immediately, and hold it vertically away from the heat until the wax surface dulls, then dip it for five minutes into a water-bath at a temperature not higher than 15°.

Fit the thermometer through the boared cork into the boiling tube so that the lower part is 15 mm above the bottom of the tube. Suspend the tube in the beaker filled with water adjusted to about 15° and raise the temperature of the bath at the rate of 2° per minute to 30°, then adjust the rate to 1° per minute and note the temperatures at which the first drop of melted substance leaves the thermometer. Repeat the determination twice on a freshly melted portion of the substance. If the three readings differ by less than 1°, take the average of the three as the melting point. If they differ by more than 1°, make two additional determinations and take the average of the five readings.

3.5 Optical rotation and specific optical rotation

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

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

The *optical rotation*, unless otherwise specified, is measured at the wavelength of the D line of sodium (λ=589.3μm) at 25°, on a layer 1dm thick. It is expressed in degrees.

The *specific optical rotation* $(\alpha)_D^{25}$ of a liquid substance is the angle of rotation α of the plane of polarisation at the wavelength of the D line of sodium (λ—589.3 mm) measured at 25°, calculated with reference to a 1.0 dm thick layer of the liquid, and divided by the specific gravity.

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

Apparatus

A commercial instrument constructed for use with a sodium lamp and capable of giving readings to the nearest 0.02° 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 and 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° and using the concentrations indicated below :

Concentration (g/100 ml)	Angle of Rotation(+), at 25°
10.0	13.33
20.0	26.61
30.0	39.86
40.0	53.06
50.0	66.23

Method

For solids : Weigh accurately a suitable quantity of the substance being examined, to give a solution of the strength specified in the monograph, and transfer to a volumetric flask by means of *water* or other solvent if specified. If a solvent is used, reserve a portion of it for the blank determination. Unless otherwise specified, adjust the contents of the flask to 25° by suspending the flask in a constant-temperature bath. Make up to volume with the solvent at 25° and mix well. Transfer the solution to the polarimeter tube within 30 minutes from the time of the substance was dissolved and during this time interval maintain the solution at 25°.

Determine the zero point of the polarimeter and then make five readings of the observed rotation of the test solution at 25°. Take an equal number of readings in the same tube with the solvent in place of the test solution. The zero correction is the average of the blank readings, and is subtracted from the average observed rotation if the two figures are of the same sign or added if they are opposite in sign, to give the corrected observed rotation.

For liquids : Unless otherwise specified, adjust the temperature of the substance being examined to 25° transfer to a polarimeter tube and proceed as described. For solids, beginning at the words "Determine the zero point.....".

Calculation—Calculate the specific optical rotation using the following formula, dextro-rotation and laevo-rotation being designated by (+) and (—) respectively :

$$\text{For liquids } (\alpha)_D^{25} = \frac{\alpha}{l d_{25}^{25}}$$

$$\text{For solids } (\alpha)_D^{25} = \frac{100\alpha}{lc}$$

Where

a = corrected observed rotation, in degrees, at 25°.

D = D line of sodium light (λ=589.3 mm)

l = length of the polarimeter tube in dm.

d_{25}^{25} specific gravity of the liquid or solution at 25°.

c = concentration of the substance in per cent w/v

NOTE—THE REQUIREMENTS FOR OPTICAL ROTATION AND SPECIFIC OPTICAL ROTATION IN THE PHARMACOPOEIA APPLY TO THE DRIED, ANHYDROUS OR SOLVENT FREE MATERIAL.

3.6 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 1.2, 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 40.0 per cent through a sieve with a nominal mesh aperture of 355 μm.

Moderately coarse powder : A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 710 μm and not more than 40.0 per cent through a sieve with a nominal mesh aperture of 250 μm.

Moderately fine powder : A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 355 μm and not more than 40.0 per cent through a sieve with a nominal mesh aperture of 180 μm.

Fine powder : A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 180 μm.

Very fine powder : A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 125 μm.

When the fineness of a powder is described by means of a number, it is intended that all the particles of the powder shall pass through a *sieve* of which the nominal mesh aperture, in μm, is equal to that number.

When a batch of a vegetable drug is being ground and sifted, no portion of the drug shall be rejected but it is permissible except in the case of assays, to withhold the final tailings, if an approximately equal amount of tailings from a preceding batch of the same drug has been added before grinding.

Sieves : Sieves for testing powder fineness comply with the requirements stated under sieves, Appendix 1.2.

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 sifting 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 sifting 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 circula and tapping motion given to sieves in hand sifting but has a uniform mechanical action may be employed

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

3.7 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 the wavelength of the light used in its measurement.

Unless otherwise prescribed, the refractive index is measured at 25°($\pm$0.5) with reference to the wavelength of the D line of sodium (λ=589.3 nm). The temperature should be carefully adjusted and maintained since the refractive index varies significantly with temperature.

The Abbe refractometer is convenient for most measurements of refractive index but other refractometer of equal or greater accuracy may be used. Commercial refractometers are normally constructed for use with white light but are calibrated to give the refractive index in terms of the D line of sodium light.

To achieve accuracy, the apparatus should be calibrated against *distilled water:* which has a refractive index of 1.3325 at 25° or against the reference liquids given in the following Table:—

TABLE

Reference Liquid	$n_D^{2\sigma\zeta}$	Temperature Co-efficient $\triangle n/\triangle t$
Carbon tetrachloride	1.4603	—0.00057
Toluene	1.4969	—0.00056
a-Methylnaphthalene	1.6176	—0.00048

* Reference index value for the D line of sodium, measured at 20°.

The cleanliness of the instrument should be checked frequently by determining the refractive index of distilled water which at 25° is 1.3325.

3.8 Weight Per Millilitre and Specific Gravity

Weight per Millilitre—The weight per millilitre of a liquid is the weight in g of 1 ml of a liquid when weighed in air at 25°, unless otherwise specified.

Method—Select a thoroughly clean and dry pycnometer. Calibrated the pycnometer by filling it with recently boiled and cooled *Water* at 25° and weighing the contents. Assuming that the weight of 1 ml of *water* at 25° when weighed in air of density 0.0012 g per ml, is 0.99602 g. calculate the capacity of the pycnometer. (Ordinary deviations in the density of air from the value given do not affect the result of a determination significantly). Adjust the temperature of the substance to be examined, to about 20° and fill the pycnometer with it. Adjust the temperature of the filled pycnometer to 25°, remove any excess of the substance and weigh. Substract the tare weight of the pycnometer from the filled weight of the pycnometer. Determine the weight per milliliter dividing the weight in air, expressed in g, of the quantity of liquid which fills the pycnometer at the specified temperature, by the capacity expressed in ml, of the pycnometer at the same temperature.

Specific Gravity—The specific gravity of a liquid is the weight of a given volume of the liquid at 25° (unless otherwise specified) compared with the weight of an equal volume of *Water* at the same temperature, all weighings being taken in air.

Method—Proceed as described under Wt. per ml. Obtain the specific gravity of the liquid by dividing the weight of the liquid contained in the pycnometer by the weight of *Water* contained, both determined at 25° unless otherwise directed in the individual monograph.

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4. 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 with *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_3COOH=60.05.

Contains not less than 99.0 per cent w/w of $C_2H_4O_2$. About 17.5 N in strength.

DESCRIPTION—At a temperature above its freezing point a clear colourless liquid, odour, pungent and characteristic; crystallises when cooled to about 10° and does not completely re melt until warmed to about 15°.

SOLUBILITY—Miscible with *water*, with *alcohol*, with *glycerin* and with most fixed and volatile oils.

BOILING RANGE—Between 117° and 119°, Appendix 3.1.

CONGEALING TEMPERATURE—Not lower than 14.8°, Appendix 3.2.

WT. PER ML.—At 25° about 1.047 g, Appendix 3.8.

HEAVY METALS—Evaporate 5 ml to dryness in a porcelain dish on water-bath, warm the residue with 2 ml of 0.1 N *hydrochloric acid* and add water to make 25 ml; the limit of heavy metals is 10 parts per million, Appendix 2.3.3.

CHLORIDE—5 ml complies with the limit test for chlorides, Appendix 2.3.2

SULPHATE—5 ml complies with the limit test for sulphates, Appendix 2.3.7.

CERTAIN ALDEHYDIC SUBSTANCES—To 5 ml add 10ml 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 10ml of *water*, to 5ml of this solution add 2·0ml of 0.1*N potassium dichromate* and 6 ml of *sulphuric acid*, and allow to stand for one minute, add 25ml of *water*, cool to 15° and add 1 ml of freshly prepared *potassium iodide solution* and titrate the liberated iodine with 0.1*N sodium thiosulphate*, using *starch solution* as indicator. Not less than 1 ml of o.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 OXIDISABLE IMPURITIES—To 5ml 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 MATTER—Leaves not more than 0.01 per cent w/w of residue when evaporated to dryness and dried to constant weight at 105°.

ASSAY—Weigh accurately about 1 g into a stoppered flask containing 50ml of *water* and titrate with *N sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *sodium hydroxide* is equivalant to 0.06005 g of $C_2H_4O_2$.

Acetic acid, lead free—Acetic acid which complies with following additional test, boil 15ml until the volume is reduced to about 15ml, cool, make alkaline with lead-free ammonia solution, add 1ml of lead-free *potassium cyanide solution*, dilute to 50ml with water, add 2 drops of *sodium sulphide solution*; no darkening is produced.

Acetone—Propan-2-one; $(CH_3)_2CO$=58.08

DESCRIPTION—Clear, colourless, mobile and volatile liquid; taste, pungent and sweetish; odour characteristic; flammable.

SOLUBILITY—Miscible with *water*, with *alcohol*, with *solvent ether*, and with *chloroform*, forming clear solutions.

DISTILLATION RANGE—Not less than 96.0 per cent distils between 55.5° and 57°, Appendix 3.1.1.

ACIDITY—10ml diluted with 10ml of freshly boiled and cooled water; does not require for neutralisation more than 0.2ml of 0.1*N sodium hydroxide*, using *phenolphthalein solution* as indicator.

ALKALINITY—10ml diluted with 10ml of freshly boiled and cooled *water*, is not alkaline to *litmus solution*.

METHYL ALCOHOL—Dilute 10ml. with *water* to 100ml. To 1ml of the solution add 1ml of *water* and 2ml of *potassium permanganate* 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 5ml of *decolorised magenta solution* and set aside for thirty minutes between 15°, and 30°; no colour is produced.

OXIDISABLE SUBSTANCES—To 20ml add 0.1ml of 0.1*N potassium permanganate*, and allow to stand for fifteen minutes; the solution is not completely decolorised.

WATER—Shake 10ml with 40ml of *carbon disulphide*; a clear solution is produced.

NON-VOLATILE MATTER—When evaporated on a water-bath add dried to constant weight at 105°, leaves not more than 0.01 per cent w/v of residue.

Acetone Solution, Standard—A 0.05 per cent v/v solution of acetone in water.

Alcohol—

DESCRIPTION : Clear, colourless, mobile, volatile liquid, odour, characteristic and spirituous; taste, burning readily volatilised even at low temperature, and boils at about 78°, flammable. Alcohol containing not less than 94·85 percent 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 *phenolphthalein solution*; the solution remains colourless and requires not more than 2.0ml of 0.1 *N sodium hydroxide* to produce a pink colour.

SPECIFIC GRAVITY : Between 0.8084 and 0.8104 at 25°; Appendix 3.8.

CLARITY OF SOLUTION : Dilute 5 ml to 100 ml with *water* in glass cyliner; the solution remains clear when examined against a black background. Cool to 10° for thirty minutes; the solution remains clear.

METHANOL : To one drop add one drop of *water*, one drop of *dilute phosphoric acid*, and one drop of *potassium permanganate solution* Mix, allow to stand for one minute and add sodium bisulphite solution dropwise, until the permanganate colour is discharged. If a brown colour remains, add one drop of *dilute phosphoric acid* to the colourless solution add 5ml of freshly prepared *chromotropic acid solution* and heat on a water-bath at 60° for ten minutes; no violet colour is produced.

FOREIGN ORGANIC SUBSTANCES : Clean a glass-stoppered cylinder thoroughly with *hydrochloric acid*, rinse with *water* and finally rinse with the alcohol under examination. Put 20 ml in the cylinder, cool to about 15° and then add from a carefully cleaned pipette 0.1ml of 0.1 *N potassium permanganate*. Mix at once by inverting the stoppered cylinder and allow to stand at 15° for five minutes; the pink colour does not entirely disappear.

ISOPROPYL ALCOHOL AND T-BUTYL ALCOHOL : To 1 ml add 2ml of water and 10ml of *mercuric sulphate solution* and heat in a boiling water-bath; no precipitate is formed within three minutes.

ALDEHYDES AND KETONES : Heat 100ml of *hydroxyl amine hydrochloride solution* in a loosly 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 50ml 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* until 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 0.9ml of 0.05*N sodium hydroxide* is required.

FUSE OIL CONSTITUENTS : Mix 10ml with 5ml of *water* and 1ml 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 40ml in a tared dish on a water-bath and dry the residue at 105° for one hour; the weight of the residue does not exceed 1 mg.

STORAGE : Store in tightly-closed containers, away from fire.

LABELLING : The label on the container states "Flammable".

Dilute alcohols—Alcohol diluted with water to produce Dilute Alcohols. They are prepared as described below :

Alcohol (90 per cent)

Dilute 947 ml of alcohol to 1000ml with water.

Specific Gravity—At 15.56°/15.56°, 0.832 to 0 .835, Appendix-3.8

Alcohol (80 per cent)

Dilute 842ml of alcohol, to 1000ml with water.

Specific Gravity—At 15.56°/15.56°, 0.863 to 0.865, Appendix—3.8 *Alcohol* (60 per cent)

Dilute 623 ml of alcohol to 1000ml with water.

Specific Gravity——At 15.56°/15.56°, 0.913 to 0.914, Appendix-3.8 *Alcohol* (50 per cent)

Dilute 526ml of alcohol to 1000 ml with water.

Specific Gravity—At 15.56°/15.56°, 0.934 to 0.935, Appendix-3.8 *Alcohol* (25 per cent)

Dilute 263ml of alcohol to 1000ml with water.

Specific Gravity—At 15.56°/15.56°, 0.9705 to 0.9713 Appendix-3.8 *Alcohol* (20 per cent)

Dilute 210ml of alcohol to 1000ml with water.

Specific Gravity—At 15.56°/15,56°, 0.975 to 0.976, Appendix 3.8

Alcohol, Aldehyde-free.—Alchohol which complies with the following additional test :

ALDEHYDE—To 25ml, contained in a 300ml flask, add 75ml of *dinitrophenyl hydrazine solution* heat on a water bath under a reflux condenser for twenty four hours, remove the alcohol by distillation, dilute to 200ml with a 2 percent 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 anion exchange resin for thirty minutes and filter.

Ammonia, xN.—Solutions of any normality xN may be prepared by diluting 75 xml of strong *ammonia solution* to 1000ml 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 1000ml.

Ammonia Solution, Dilute.—Contains approximately 10 per cent w/w of NH_3.

Dilute 425ml of *strong ammonia solution* to 1000ml with *water.*

WT. PER ML—At 25°, about 0.960 g, Appendix—3.8.

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 25.0 per cent w/w of NH_3 (limit, 24.5 to 25,5). About 13.5N in strength.

DESCRIPTION—Clear, colourless liquid; odour, strongly pungent and characteristic.

SOLUBILITY—Miscible with *water* in all proportions.

WT. PER. ML—At 25°, about 0.91g, Appendix 3.8

HEAVY METALS—Evaporate 5ml to dryness on a water-bath. To the residue, add 1 ml of *dilute hydrochloric acid* and evaporate to dryness. Dissolve the residue in 2ml of *dilute acetic acid* and add *water* to make 25ml; 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 40ml on a 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 5ml. The solution complies with the *limit est for sulphates*; Appendix 2.3.7.

TARRY MATTER—Dilute 5ml with 10ml 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 5mg of residue remains.

ASSAY—Weigh 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 5ml nearly to dryness on a water-bath add 40ml of water, 2ml 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 50ml 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 100ml.

Ammonium Chloride : $NH_4Cl = 53.49$

DESCRIPTION : Colourless crystals or white crystalline powder; odourless; taste, saline.

SOLUBILITY : Freely soluble in *water*, sparingly soluble in *alcohol.*

ARSENIC : Not more than 4 parts per million, Appendix 3.

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 0.5g in 10ml of *water* and add 1ml 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 : Acidify 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 2.3.6.

ASSAY : Weigh accurately about 0.1g, dissolve in 20ml of *water* and add a mixture of 5ml of *formaldehyde solution*, previously neutralised to *dilute phenolphthalein solution* and 20ml of water. After two minutes, titrate slowly with 0.1*N sodium hydroxide*, using a further 0.2ml of *dilute phenolphthalein solution.* Each ml. of 0.1*N sodium hydroxide* is equivalent to 0.005349g of NH_4Cl. Storage : Store in tightly-closed container.

Ammonium Chloride Solution—A 10.0 per cent w/v solution of *ammonium chloride* in water.

Amonium Citrate Solution—Dissolve with cooling, 500g *citric acid* in a mixture of 200ml of *water* and 200ml of 13.5M 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 2.3.7

SULPHATED ASH—Not more than 0.05 per cent, Appendix 2.3.5

Ammonium Oxalate : $(CO_2NH_4)_2\ H_2O = 142.11$

DESCRIPTION—Colourless crystals

SOLUBILITY—Soluble in water

CHLORIDE—2g, with an additional 20ml of *dilute nitric acid*, complies with the limit test for chlorides, Appendix 2.3.2.

SULPHATE—Dissolve 1g in 50ml of water, add 2.5ml of hydrochloric acid and 1ml of *barium chloride solution* and allow to stand for one hour; no turbidity or precipitate is produced.

SULPHATED ASH—Not more than 0.005 percent, Appendix—2.3.6.

Ammonium oxalate solution—A2.5 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 pH 8.0, 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 page 2.3.2.

SULPHATE—2.5g with an additional 4ml of *hydrochloric acid*, complies with the limit test for sulphate, page—2.3.7.

Ammonium Phosphate, Solution—A 10.0 per cent w/v solution of ammonium phosphate in water.

Ammonium Thiocyanate—NH_4SCN=76.12.

DESCRIPTION—Colourless crystals.

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 30ml of *hydrogen peroxide solution boil* for two minutes, cool, and add 10ml of *dilute nitric acid* and 1ml of *silver nitrate solution*; any opalescence produced is not greater than that obtained by treating 0.2ml of 0.01N *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_4 SCN=76.12; 7.612g in 1000ml. Dissolve about 8g of *ammonium thiocyanate* in 1000ml of water and standardise the solution as follows :

Pipette 30ml of standardised 0.1N *Silver nitrate* into a glass stoppered flask, dilute with 50ml of *water* then 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 redbrown colour. Each ml of 0.1N *Silver nitrate* is equivalent to 0.007612g of NH_4 SCN.

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 accurately 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 more than 0.1 per cent of residue when volatilised.

ASSAY—Weigh accurately about 0.2g and dissolve in 20ml of boiling water and 5ml of N *sodium hydroxide*, cool, add 5ml of *N hydrochloric acid* and 3g of *sodium bicarbonate*, and titrate with 0.1*N iodine*. Each ml of 0.1*N iodine* is equivalent to 0.004946g of As_2O_3.

Barium Chloride : $BaCl_2$, $2H_2$ O=244.27.

DESCRIPTION—Colourless crystals.

SOLUBILITY—Freely soluble in water.

LEAD—Dissolve 1g in 40ml of recently boiled and cooled water, add 5ml 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 10ml of *nitrogen-free sulphuric acid* and heat to boiling; the blue colour does not entirely disappear.

Barium Chloride Solution—A 10.0 per cent w/v solution of *barium chloride* in *water.*

Bismuth Oxynitrate : Bismuth Oxide Nitrate contains 70.0 to 74.0 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 20 ml of *glycerin* and 20ml of *water.* Add 0.1 g 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 103.0 per cent of $Na_2B_4 O_7 10H_2O$.

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 is alkaline to *litmus solution.*

HEAVY METALS—Dissolve 1 g in 16 ml of water and 6 ml of *N hydrochloric acid* and add *water.* to make 25 ml; the limit of heavy metals is 20 parts per million, Appendix 2.3.3.

IRON—0.5 g complies with the *limit test for iron*, Appendix. 2.3.4.

CHLORIDES—1 g complies with the *limit test for chlorides.* Appendix 2.3.2.

SULPHATES—1 g complies with the *limit test for sulphates.* Appendix 2.3.7.

ASSAY—Weigh accurately about 3 g and dissolve in 75 ml 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 $Na_2B_4O_7 . 10.H_2O$.

STORAGE—Preserve Borax in well-closed container.

Boric Acid : H_3BO_3=61.83.

DESCRIPTION—Colourless plates or white crystals or white crystalline powder, greasy to the touch; odourless; taste, slightly acid and bitter with a sweetish after taste.

SOLUBILITY—Soluble in *water* and in *alcohol*; freely soluble in boiling *water*, in boiling *alcohol* and in *glycerin.*

SULPHATE—Boil 3 g with 30 ml of *water* and 1 ml of *hydrochloric acid,* cool, and filter; 25 ml of the filtrate complies with the *limit test for sulphates*, Appendix 2.3.7.

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 1.0 g in 2 ml of *dilute acetic acid* and sufficient *water* to produce 25 ml, Appendix 2.3.3.

ASSAY—Weigh accurately about 2 g, and dissolve in a mixture of 50 ml of *water* and 100 ml of *glycerine*, previously neutralised 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 containers.

LABELLING—The label on the container states "Not for internal use".

Boric acid Solution : Dissolve 5g of *boric acid* in a mixture of 20ml of *water* and 20 ml 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. Cool, 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 2.3.7.

Bromine Solution : Dissolve 9.6 ml of *bromine* and 30 g of *potassium bromide* in sufficient *water* to produce 100 ml.

Bromocresol Purple—4,4'—(3H-2, Benzoxathiol-3-ylidene) bis (2,6—dibromo-o-cresol) SS—dioxide; $C_{21}H_{14}Br_2O_4S$=540 .2.

Gives a yellow colour in weakly acid solutions and a bluish-violet colour in alkaline, neutral and extremely weakly acid solutions (pH range, 5.2 to 6.8).

Bromocresol purple solution—Warm 0.1g of *bromocresol purple* with 5 ml of *ethanol* (90 per cent) until dissolved, add 100 ml of *Ethanol* (20 per cent), 3.7 ml of 0.05*M Sodium hydroxide*, and sufficient *ethanol* (20 *per cent*) to produce 250 ml.

Complies with the 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 0.02 *M Sodium hydroxide VS* has been added is bluish-violet. Not more than 0.20 ml of 0.02 *M hydrochloric acid VS* is required to change the colour to yellow.

Bromophenol blue—4,4,—(3H-2, 1-Benzoxathiol-3-ylidene) bis-(2-6-dibromophenol) SS-dioxide $C_{19}H_{19}Br_4O_5S$—670.

Gives a yellow colour in moderately acid solutions, and a bluish-violet colour in weekly acid and alkaline solutions (pH range, 2.8 to 4.6).

Bromophenol blue solution : Warm 0.1g of *bromophenol 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 *alchcol* (20 per cent) to produce 250 ml.

Complies with the following test :

SENSITIVITY—A mixture of 0.05 ml of the solution and 20 ml of *carbon dioxide-free water* to which 0.05 ml of 0.1*N hydrochloric acid* has been added is yellow. Not more than 0.10 ml of 0.1*N Sodium hydroxide* is required to change the colour to bluish-violet.

Bromothymol Blue : 6,6'—(3H-2, 1—Benzoxathiol -3-ylidene) bis (2-bromothymol) SS—dioxide $C_{27}H_{28}Br_2O_5S$=624 .

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

Bromothymol Blue Solution—Warm 0.1 g of *bromothymol blue* with 3.2 ml of 0.05N *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 test :

SENSITIVITY—A mixture of 0.3 ml of the solution and 100 ml of *Carbon dioxide—free water* is yellow. Not more than 0.10 ml of 0.02*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 0.5 g of *citric acid* and 1 ml of *starch solution*, no blue colour is produced.

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

Calcium Carbonate : $CaCO_3$=100 .1

Analytical reagent grade of commerce.

Calcium Chloride : $CaCl_2$ H_2O=147.0.

Analytical reagent grade of commerce.

Calcium Chloride Solution—A 10 per cent w/v solution of calcium chloride in water.

Calcium Hydroxide : $Ca(OH)_2$=74.09.

Analytical reagent grade of commerce.

Calcium Hydroxide Solution—Shake 10 g of Calcium hydroxide repeatedly with 1000 ml of water and allow to stand until clear.

Calcium Sulphate : $CaSO_4$, $2H_2O$=172 .17.

DESCRIPTION—White powder.

SOLUBILITY—Slightly soluble in *water*.

CHLORIDE—Boil 5 g with 50 ml 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—Boil 1 g with 50 ml of *water*, cool, and titrate with 0.1 *N hydrochloric acid*, using bromo *thymol 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 of residue.

Camphor : $C_{10}H_{16}O$=152.23.

Camphor is a ketone, obtained from *Cinnamomum camphora* (*Linn.*) Nees and Eberm. (Fam. Lauraceae) and *Ocimum kilimandscharicum Guerke* (Fam. Labiatae) (Natural Camphor) or produced synthetically (Synthetic Camphor). It contains not less than 96.0 per cent of $C_{10}H_{16}O$.

DESCRIPTION—Colourless or white crystals, granules or crystalline masses or colourless to white, translucent tough masses; odour, penetrating and characteristic; taste, pungent, aromatic, and followed by a sensation of cold. Readily pulverisable in the presence of a little *alcohol chloroform*, or solvent ether.

SOLUBILITY—Slightly soluble in water; very soluble in *alcohol*, in *chloroform and* in *solvent ether*, freely soluble in fixed oils and in volatile oils.

MELTING RANGE—174° to 179°, Appendix 3.4.

SPECIFIC OPTICAL ROTATION—+41° to +43°, determined in a 10 per cent w/v solution of Natural Camphor in alcohol, Appendix 3.5 Synthetic Camphor is the optically inactive, racemic form.

WATER—A 10 per cent w/v solution in *light petroleum* (boiling *range* 40° *to* 60°) is clear.

NON-VOLATILE MATTER—Leaves not more than 0.05 per cent of residue when volatilised at 105°.

ASSAY—Weigh accurately about 0.2 g and dissolve in 25 ml of *aldehyde-free alcohol*, in a 300-ml 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 200 ml 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 ml of cold *water* until the washings are neutral of *litmus paper*. Dry to constant weight at 80° and weigh. Each g of precipitate is equivalent to 0.458 g 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° and 47° Appendix 3.1.

WT. PER ML—At 25°, about 1.263 g, Appendix 3.8.

NON-VOLATILE MATTER—When evaporated to dryness on a water bath, and dried to constant weight at 105°. leaves not more than 0.005 per cent w/v of residue.

Carbon Tetrachloride : CCl_4=153.82

DESCRIPTION—Clear, colourless, volatile, liquid; odour, characteristic.

SOLUBILITY—Practically insoluble in water; miscible with ethyl alcohol, and with solvent ether.

DISTILLATION RANGE—Not less than 95 per cent distils between 76° and 77°, Appendix 3.1.

WT. PER Ml.—At 20°, 1.592 to 1.595 g., Appendix 3.8.

Chloride : Free Acid—Shake 20ml with 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 Chlorine—Shake 10 ml with 5 ml of *cadmium iodide solution* and 1½ml 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 with100 ml of water and add 3 g of *potassium iodide* : the liberated iodine requires for decolourisation not less than 9 ml of 0.1 *N sodium thiosulphate*.

Non-volatile Matter : Leaves on evaporation on a water-bath and drying to constant weight at 105° not more than 0·002 per cent w/v of residue.

Caustic Alkali Solution, 5 per cent

5 g of *potassium* or *sodium hydroxide* in water and dilute to 100 ml.

Charcoal, decolourising—General purpose grade complying with the following test.

DECOLOURISING POWER—Add 0.10 g to 550 ml of a 0.006 per cent w/v solution of *bromophenol blue* in ethanol (20 per cent) contained in a 200 ml flask, and mix. Allow to stand for five minutes,and filter; the colour of the filtrate is not deeper than that of a solution prepared by diluting 1 ml of the *bromophenol blue solution* with *ethanol* (20 per cent) to 50 ml.

Chloral Hydrate CCl_3 $CH(OH)_2$ Mol Wt. 165.40.

DESCRIPTION : Colourless, transparent crystals, odour, pungent but not 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 1 g 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 crystalline precipitate is produced and no smell of iodoform is perceptible.

CHLORIDE : 3 g 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 mixure to stand for two minutes, and then titrate with *N sulphuric acid* using *phenolphthalein 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 0.1654 g of $C_2H_2Cl_3O_2$

STORAGE : Store in tightly closed, light resistant containers in a cool place.

Chloral Hydrate Solution :—Dissolve 20 g 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 use 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 exposure to air it becomes moist and gradually decomposes.

SOLUBILITY—Slightly soluble in water and in alcohol.

STABILITY—Loses not more than 3.0 per cent of its availale 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 1000 ml 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 100 ml of *water*, acidify with 5 ml of *acetic acid* and titrate the liberated idodine with 0.1 *N sodium thiosulphate*. Each ml of 0.1 *N sodium thiosulphate* is equavalent to 0.003545 g of available chlorine.

Storage—Preserve in a well-closed container.

Chlorinated Lime Solution.—Mix 100 g of *chlorinated lime* with 1000 ml of *water* transfer the mixture to a stoppered bottle; set aside for three hours, shaking occasionally; filter through calico.

Chlorinated Lime Solution must be recently prepared.

Chloroform : $CHCl_3$=119.38

DESCRIPTION—Colourless, volatile liquid; odour, characteristic. taste, sweet and burning.

SOLUBILITY : Slightly soluble in *water* ; freely miscible with *ethyl alcohol* and with *solvent ether.*

Wt. per ml. : Between 1.474 and 1.478 g, Appendix 3.8.

BOILING RANGE : A variable fraction, not exceeding 5 per cent v/v, distils below 60° and the remainder distils berween 50° to 62°, Appendix 3.1.

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 5ml 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 glsss-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 unpleasent 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 chlorofrom 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 0.2 ml of *silver nitrate solution* and set aside in the dark for five minutes; no opalescence is produced.

FOREIGN ODOUR—Allow 10 ml to 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 25 ml by evaporation and drying at 105°.

Storage: Store in tightly-closed, glass-stoppered, light-resistant bottles.

NOTE:—Care should be taken not to vaporise chloroform in the presence of a flame because of the production of harmful gases.

CHLOROFORM WATER

Chloroform	:	2.5 ml
Purified Water	:	sufficient to produce 1000 ml

Dissolve the *chloroform* in the *purified water* by shaking.

Chromic-sulphuric Acid Mixture—A saturated solution of Chromium trioxide in *sulphuric acid.*

Chromium Trioxide : $Cr\ 0_3$=99.99

Analytical reagent grade.

Chromotropic Acid—$C_{10}\ H_8O_8S_2.2\ H_2\ O$ =356.32

DESCRIPTION—White to brownish powder. It is usually available as its sodium salt, $C_{10}\ H_8\ O_8\ S_2\ Na_2$, which is yellow to light brown in colour.

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

Sensitivity—Dilute exactly 0.5 ml of *formaldehyde solution* with water to make 1000 ml. Dissolve 5 mg of *chromotropic acid* or its sodium salt, in a 10 ml of a mixture of 9 ml of *sulphuric acid* and 4 ml of *water*. Add 5 ml 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—$C_6F_8O_7$, $7H_2O$=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 $(C_2\ H_3\ O_2)_2$, H_2O=199.65

Contains not less than 98.0 per cent of $C_4H_6O_4Cu$, H^2O

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 2.3.7.

Assay—Weigh accurately about 0.8 g and dissolve in 50 ml of *water*, add 2 ml of *aceticacid* and 3g. of *potassium iodide*, and titrate the liberated iodine witn 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 $C_4H_6O_4$, Cu, H_2O.

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

Copper Sulphate—Cu SO_4, $5H_2O$=249.68

Contains not less than 98.5 per cent and not more than the equivalent to 101.0 per cent of $CuSO_4$ $5H_2O$.

Description—Blue triclinic prisms or a blue, crystalline powder.

SOLUBILITY—Soluble in *water*, very soluble in boiling water, almost insoluble in *alcohol;* very slowly soluble in *glycerin*.

ACIDITY AND CLARITY OF SOLUTION—1 g. 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 5 g, add 25 ml 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 7 mg.

Copper Sulphate, Anhydrous—$CuSO_4$=159.6

Prepared by heating copper sulphate to constant weight at about 230°.

Copper Sulphate Solution—A10.0 per cent w/v solution of *copper sulphate* in *water*.

Catechol Violet—4, 4'—(3H-2, I-Benzoxathiol-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 ethylene diamine tetra acetate*, the solution is 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 mixitue 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 hydroxide* 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; $(NO_2)_2\ C_6H_3$, NH, NH_2= 198.14

DESCRIPTION—Orange-red crystals or a crystalline powder.

SOLUBILITY—Practically insoluble in *water* slightly soluble in alcohol.

CLARITY AND COLOUR OF SOLUTION—0.5 g yields a clear yellow solution on heating with a mixture of 25 ml of water and 25 ml of *hydrochloric acid.*

MELTING RANGE—197° to 200°, with decomposition Appendix, 3.4.

SULPHATED ASH—Not more than 0.5 per cent, Appendix 2.3.7.

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—$(C_6H_5.\ NH.\ C_6H_4)_2$=336.42

DESCRIPTION—White or faintly grey coloured, crystalline powder.

MELTING RANGE—246° to 250°. Appendix 3.4

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 2.3.7.

Diphenly Carbazide—1,5—Diphenyl Carbazide: $(C_6H_5NH.\ NH)_2\ CO$=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_6H_5 N: NCS. NH. NH. C_6H_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 2.3.7.

Disodium Ethylene Diamine Tetra Acetate—(Disodium Acetate) $C_{10}H_{14}N_2Na_2O_8$, $2H_2O$=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 fluorescein Disodium Salt; $C_{20}H_6O_5Br_4Na_2$=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—Dissolve 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 24.0 per cent, calculate with reference to the substance dried at 110° for two hours. Appendix 2.3.7.

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; $C_{20}H_{12}N_3NaO_7S$=461.38.

Brownish black powder having a faint, metallic sheen. soluble in *alcohol,* in *methyl alcohol and* in hot water.

Ether, Diethyl Ether—$(C_2H_5)_2O$=74.12

Analytical reagent grade.

A volatile, highly flammable, colourless liquid, boiling point, about 34° ; weight per ml about 0.71g

WARNING—It is dangerous to distil or evaporate ether to dryness unless precautions have been taken to remove peroxides.

Ethyl Acetate—$CH_3.CO_2C_2H_5$=88.11.

Analytical reagent grade.

A colourless liquid with a fruity odour; boiling point, about 77°; weight per ml, about 0.90 g.

Ethyl Alcohol—C_2H_5OH=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_2H_5OH.

IDENTIFICATION—Acidity or Alkalinity: Clarity of solution; Methanol; Foreign organic substances; Isopropyl alcohol and butyl alcohol; Aldehydes and ketones; Fusel oil constituents; Non-volatile matter; complies with the requirements described under Alcohol.

SPECIFIC GRAVITY—Between 0.7871 and 0.7902, at 25°, Appendix 3.8.

STORAGE—Store in tightly closed containers in a cool place away from fire and protected from moisture.

LABELLING—The label on the container states "Flammable".

Ferric Ammonium Sulphate—Ferric Alum, $Fe(NH_4)(SO_4)_2 12H_2O$=482.18

Contains not less than 99.0 per cent and not more than the equivalent of 101.0 per cent of $Fe(NH_4)(SO_4)_7.12H_2O$.

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 hydochloric acid* and 1 ml of *potassium ferricyanide solution;* no green or blue colour is produced.

ASSAY—Weigh accurately about 2 g, 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 titrations Each ml of 0.1 N sodium thiosulphate is equivalent to 0.04822 g of $Fe(NH_4)(SO_4)_2 . 12 H_2O$.

Ferric Ammonium Sulphate—0.1N $Fe NH_4(SO_4)_2 . 12 H_2O$=482.18; 48,22g in 1000 ml.

Dissolve 50 g of *ferric-ammonium* sulphate in a mixture of 300 ml of water and 6 ml of *sulphuric acid.* dilute with *water* to 1000 ml, and mix. Standardise the solution as follows :—

Measure accurately about 30 ml of the solution into a glass-stoppered flask, add 5 ml of *hydrochloric acid*, mix, and add a solution of 3g of *potassium iodide* in 10ml of *water*. Insert the stopper, allow to stand for ten minutes in the dark, then titrate the liberated *iodine* with standardised 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 $Fe NH_4 (SO_4)_2 . 12H_2O$.

NOTE—Store 0.1 N Ferric Ammonium Sulphate in tightly-closed, light resistant containers.

Ferric Chloride—Anhydrous Ferric Chloride; Ferric Chloride; $FeCl_3$=162.22

DESCRIPTION—Greenish-black crystals or a crystalline powder, free from the orange colour of the hydrated salt, which is readily acquired by exposure to atmospheric moisture.

SOLUBILITY—Soluble in *water*, yielding an orange coloured opalescent solution.

FERROUS SALTS—Dissolve 2.0 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, not 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 Chloride Solution—Contains not less than 14.25 per cent and not more than 15.75 per cent w/v of $FeCl_3$.

DESCRIPTION—Clear, Yellowish-brown liquid.

ASSAY—Dilute 2 ml with 20 ml of water, add 1 ml of *sulphuric acid* and 0.1 N potassium permanganate drop by drop until 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 0.1*N sodium thiosulphate* is equivalent to 0.01622 g of $FeCl_3$.

Ferrous Sulphate—$FeSO_4 . 7H_2O$=278.0

DESCRIPTION—Transparent, green crystals, or a pale bluish-green, crystalline powder; odourless; taste, metallic and astringent, Efflorescent 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 3.0 and 4.0, determined in a 5.0 per cent w/v solution, Appendix 3.3

ARSENIC—Not more than 2 parts per million, Appendix 2.3.1.

COPPER, ZINC AND LEAD—Dissolve 8.0 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 100.0 ml (solution A).

COPPER—To 10.0 ml of solution A obtained in the test for Copper, Zinc and Lead, add 1 g of *citric acid*, make alkaline with *dilute ammonia solution* and add 25 ml of *water* and 5 ml of *sodium diethyldithiocarbamate.*

Ferrous Solphate Solution—A 2.0 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

Formaldehyde Solution is a solution of formaldehyde in *water* with *methyl alcohol* added to prevent polymerisation. It contains not less than 34.0 per cent w/w and not more than 38.0 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 0.1*N sodium hydroxide* is required.

WT. PER ML—At 20°, 1.079 to 1.094 g. Appendix 3.8.

ASSAY—Weigh accurately about 3g 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 excess of alkali with *N sulphuric acid* using *phenolphthalein solution* as indicator. Repeat 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 requivalent to 0.03003 g of CH_2O.

STORAGE—Preserve Formaldehyde Solution in a well-closed container preferably at a temperature not below 15°.

Formaldehyde Solution, Dilute

Dilute 34 ml of *formaldehyde solution* with sufficient water to produce 100 ml.

Glycerin—$C_3H_8O_3$=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 *chlororom.* 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 0.2 ml of 0.1 *N sodium hydroxide* is recquired to produce a pink colour.

WT PER ML—Between 1.252 g and 1.257 g, Appendix—3.8, corresponding to between 98.0 per cent and 100.0 per cent w/w of $C_3H_8O_3$

REFRACTIVE INDEX—Between 1.470 and 1.475 determined at 20°. Appendix 3.7.

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—10 g 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 25 ml. Appendix 2.3.3.

SULPHATE—1 ml complies with the *limit test for sulphates*, Appendix 2.3.7.

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 1.6 ml of 0.1*N potassium permanganate* 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 *copper 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 mixture for five minutes. Cool, add a few drops of *phenolphthalein solution* and titrate 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 2.3.6.

STORAGE—Store in tightly-closed containers.

GLYCERIN SOLUTION—Dilute 33 ml of *glycerin* to 100 ml with water and add a small piece of camphor or liquid phenol.

Hexamine $(CH_2)_6N_4$=140.2

Analytical reagent grade.

Hydrazine Hydrate—NH_2. NH_2H_2O=50.06

Analytical reagent grade.

A colourless liquid with an ammonical odour; weight per ml. about 1.03 g.

Hydrochloric Acid—HCl=36.46

Concentrated Hydrochloric Acid

DESCRIPTION—Clear, colourless, fuming liquid, odour, pungent.

ARSENIC—Not more than 1 part per million, Appendix 2.3.1.

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

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

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

SULPHATE—To 5 ml add 10 mg of *sodium bicarbonate* and evaporate to dryness on a water bath; the residue, dissolved in *water;* complies with the *limit test for sulphates*, Appendix 2.3.7.

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 per cent, Appendix 2.3.6.

ASSAY—Weigh accurately about 4 g into a stoppered flask containing 40 ml of *water*, and titrate with *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.0364 g of HCl.

STORAGE—Store in glass-stoppered containers at a temperature not exceeding 30°.

Hydrochloric Acid, x N—Solution of any normality x N may be prepared by diluting 84×ml of *hydrochloric acid* to 1000 ml with *water*.

Hydrochloric Acid—(1 per cent 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°

Hydrochloric Acid—N: HCl=36.46

36.46 g in 1000 ml

Dilute 85 ml of *hydrochloric acid* with *water* to 1000 ml and standardise the solution as follows :

Weigh accurately about 1.5 g of *anhydrous sodium carbonate* P.S., previous heated at about 270° 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 0.5299g of *anhydrous and sodium carbonate* is equivalent to 1 ml of N. hydrochloric acid.

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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 per cent w/v solu: tion 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 per cent w/v of H_2O_2; weight per ml, about 1.02g.

Hydroaen Sulphide—H_2S=34.08

Use laboratory cylindergrade, or prepare 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, with a characteristic unpleasant odour.

Hydrogen Sulphide Solution—A recently prepared, saturated solution of hydrogen sulphide in water at 20°.

Hydrogen Sulphide solution contains about 0.45 per cent w/v of H_2S.

Hydroxylamine Hydrochloride; Hydroxylamonium Chloride:—$NH_2.OH,HCl$=69·49

Contains not less than 97·0 per cent w/w of NH_2OH,HCl.

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

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

Free Acid—Dissolve 1·0 g in 50 ml of *alcohol*, add 3 drops of *dimethyl yellow solution* and titrate to a full yellow colour with *N sodium hydroxide;* not more than 0.5 ml of *N sodium hydroxide* is required.

Sulphated Ash—Not more than 0·2 per cent, Appendix 2.3.6.

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

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

***Indigo Carmine** CI 730 15; $C_{16}H_8N_2Na_2O_8S_2$=466·4

Analytical regent grade.

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

Indigo Carmine solution—To a mixture of 10 ml of *hydrochloric acid* and 990 ml of a 20 per cent 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 of 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 AND 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 2.3.1.

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 per cent as residue when volatilised 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 0.1*N 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, 0.1N : I=126.90; 12.69 g in 1000 ml

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

Weigh accurately about 0.15 g of *arsenic trioxide P.S.*, previously dried at 105° 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 *0.1N 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 : $CH_3CHOH.COOH = 90 \cdot 08$

Analytical reagent grade of commerce

Lactophenol—Dissolve 20 g of *phenol* in a mixture of 20 g of *lactic acid*, 40 g of *glycerol*, and 20 ml of *water*.

Lead Acetate : Sugar of lead; $(CH_3CO_2)_2Pb, 3H_2O = 379 \cdot 33$

Contains not less than 99 ·5 per cent and not more than the equivalent of 104 ·5 per cent of $C_4H_6O_4Pb, 3H_2O$.

DESCRIPTION—Small, white, transparent, monoclinic prisms, or heavy, crystalline masses; 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 2.3.1.

COPPER, IRON, SILVER, AND ZINC—Dissolve 0 ·5 g in 10 ml of *water*, add 2 ml of *dilut 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 ethylenediaminetetraacetate* is equivelent to 0 ·01897 g of $C_4H_6O_4Pb, 3H_2O$.

STORAGE—Preserve Lead Acetate in a well-closed container.

Lead Acetate Solution—A 10 ·0 per cent w/v solution of *lead acetate in carbon dioxide-free water.*

Lead Nitrate : $Pb(NO_3)_2 = 331 \cdot 21$

Contains not less than 99 ·0 per cent 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°. 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 ether and in volatile oils.

WT. PER ML.—At 25°, 0·860 to 0·904 g Appendix 3·8.

Litmus—Fragments of blue pigment prepared from various species of *Rocella lecanora* or other lichens. It has a characteristic odour.

Partly soluble in water and in alcohol. Gives a red colour with acids and a blue coluor with alkalies (pH range, 5·0 to 8.0).

Litmus Solution—Boil 25 g of coarsely powdered litmus with 100 ml of *alcohol* (90 *per cent*) 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 *per cent*). 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 mixuture 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 mm×60 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 etehe and in volatile oils.

WT. PER ML—At 25°, 0·860 to 0·904 g, Appendix 3·8.

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 mm × 60 mm 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; $[H_2N.\ C_6H_4)_2C:\ C_6H^3(CH_3):NH_2{}^+]Cl^-$=337·85

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

DESCRIPTION—Dark red powder, or green crystals with a metallic lustre.

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

SULPHATED ASH—Not more than 5·0 per cent, Appendix 2.3.7.

Megenta Solution, Decolorised—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 is 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 allowed 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 per cent 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 2M *hydrochloric acid*, and 2 ml of 5*M sodium hydroxide.*

Magnesium Sulphate : $MgSO_4$. $7H_2O$—246·47

DESBRIPTION—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 2·0 g in 10 ml of *water*, 2·0 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 acidify 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 48·0 per cent and 52·0 per cent, determined on 1·0 g by drying in an oven at 105° for two hours and igniting to constant weight at 400°.

ASSAY : Weigh accurately about 0·3 g and dissolve in 50 ml of *water.* Add 10ml of *strong ammonia-ammonium chloride solution,* and titrate with 0·05*M disodium ethylenediaminetetraacetate* using 0.1g of *mordant black* II *mixture* as indicator, until the pink colour is discharged from the blue. Each ml of 0·05*M disodium ethylenediaminetetraacetate* is equivalent to 0·00602 g of $MgSO_4$.

STORAGE : Store in well-closed containers.

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

Mercuric Chloride : $HgCl_2$=271·50

Contains not less than 99·5 per cent of $HgCl_2$;

DESCRIPTION—Heavy, colourless or white, crystalline masses, or a white crystalline powder.

SOLUBILITY—Soluble in *water*; freely soluble in *alcohol.*

NON-VOLATILE MATTER—When volatilised, leaves not more than 0·1 per cent 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 completelfy redissolved, and titrate the excess of iodine with 0·1*N sodium thiosulphate.* Each ml of 0·1*N iodine* is equivalent to 0·01357 g of $HgCl_2$.

Mercuric Chloride, 0·02M

Dissolve 54·30 g of *mercuric chloride* in sufficient *water* to produce 1000 ml.

Mercuric Chloride Solution—A 5·0 per cent w/v solution of *mercuric chloride* in *water.*

Mercuric Oxide, Yellow : HgO = 216·59

Contains not less than 99 ·0 per cent of HgO, calculated with reference to the substance dried at 105° 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 OR 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 1 g 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 per cent 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°. Each ml of 0 ·1*N ammonium thiocyanate* is equivalent to 0 ·01083 g of HgO.

STORAGE—Preserve Yellow Mercuric Oxide in a 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 ·0 per cent of $HgSO_4$.

DESCRIPTION—A white; crystalline powder, Hydrolyses in *water.*

SOLUBILITY—Soluble in *dilute sulphuric acid.*

CHLORIDE—Dissolve 2 ·0 g in a mixture of 2 ml 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,* Apendix 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 indicator. 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 colour-less liquid.

SPECIFIC GRAVITY—At 25°, not more than 0 ·791, Appendix 3.8.

DISTILLATION RANGE—Not less than 95 per cent distils between 64 ·5° and 65 ·5°, Appendix 3 ·1.

REFRACTIVE INDEX—At 20°, 1 ·328 to 1 ·329, Appendix 3.7.

ACETONE—Place 1 ml in a *Nessler Cylinder,* add 19 ml of water, 2 ml of a 1 per cent w/v solution of 2-*nitrobenzaldehyde* in *alcohol* (50 *per cent*), 1 ml of 30 per cent 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 add 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 required.

NON-VOLATILE MATTER—When evaporated on a water-bath and dried to constant weight at 105°, leaves not more than 0·005 per cent w/v of residue.

Methyl Alcohol, Dehydrated—Methyl alcohol which complies with the following additional requirements. WATER—Not more than 0·1 per cent 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 per cent and not more than 22 per cent, determined by drying in an oven at 100° to 105°.

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, $C_{14}H_{14}O_3N_3SNa$.

An orange-yellow powder or crystalline scales, slightly soluble in cold water; insoluble in alcohol; readily soluble in hot water.

Methyl Orange Solution—Dissolve 0·1g 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 ml 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—Prepare two solutions in separate bottles, with ground glass stoppers :

(a) Dissolve 2 g of *α-naphthol* in 95 per cent *alcohol* and made upto 10 ml with *alcohol* (α-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 Black II Mixture : *Mordant black mixture.*

A mixture of 0·2 part of modarnt black 11 with 100 parts of *sodium chloride*. *Mordant Black* II Mixture should be recently prepared.

α-Naphthol : 1-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—93° to 96°, Appendix 3·4.

SULPHATED ASH—Not more than 0·05 per cent, Appendix 2.3.6.

α-Naphthol Solution : 1-Naphthol solution.

Dissolve 1 g of *α-naphthol* in a solution of 6 g of *sodium hydroxide* and 16 g of *anhydrous sodium carbonate* in 100 ml of *water*.

α-naphthnol solution must be prepared immediately before use.

1-Naphthyl amine—$C_{10}H_9N$ = 143·2—Analytical reagent grade.

Almost colourless crystals, or a white crystalline powder; melting point, about 50°.

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 1-*naphthylamine* in 30 ml of 6*M acetic acid* and dilute to 150 ml with *water*.

Nitric Acid—Contains 70·0 per cent w/w of HNO_3 (limits, 69·0 to 71·0). About 16 N in strength.

DESCRIPTION—Clear, colourless, fuming liquid.

WT. PER ML.—At 20°, 1·41 to 1·42 g, Appendix 3.8.

COPPER AND ZINC—Dilute 1 ml with 20 ml of *water*, and add a slight excess of *dilute ammonia solution*; the mixture does not become blue. Pass *hydrogen sulphide*; a precipitate is not produced.

IRON—0·5 ml complies with the *limit test for iron*, Appendix 2.3.4.

LEAD—Not more than 2 parts per million, Appendix 2.3.6.

CHLORIDE—5 ml neutralised 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 2.3.7.

SULPHATED ASH—Not more than 0·01 per cent w/w, Appendix 2.3.6.

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 g 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 per cent 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° to 45°, Appendix 3.4.

SULPHATED ASH—Not more than 0·1 per cent, Appendix 2.3.6.

Oxalic Acid : $(CO_2H)_2$, $2H_2O = 126.07$.;

Contains not less than 99.5 per cent 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 1 drop of *silver nitrate solution*; no turbidity is produced.

SULPHATED ASH—Not more than 0.05 per cent, Appendix 2.3.5.

ASSAY—(A) Weigh accurately about 3g 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 to 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° 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, 0.1*N* : $H_2C_2O_4$, $2H_2O = 1,6,07$, 6.303 g in 100 ml.

Dissolve 6.45 g of oxalic acid in sufficient water to produce 1000 ml and standardise 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°. Add slowly from a burette freshly standardised 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°. 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° to 40°).

WT. PER ML.—At 20°, 0.620 to 0.630 g, Appendix 3.8

Light Petroleum—(Boiling range, 40° to 60°).

WT. PER ML—At 20°, 0.630 to 0.650 g, Appendix 3.8.

Light Petroleum—(Boiling range, 60° to 80°).

WT. PER ML.—At 20°, 0.670 to 0.690 g, Appendix 3.8.

Light Petroleum—(Boiling range, 80° to 100°).

WT. PER ML—At 20°, 0.700 to 0.720 g, Appendix 3.8.

Light Petroleum—(Boiling range, 100° to 120°).

WT. PER ML.—At 20°, 0.720 to 0.740 g, Appendix 3.8.

Light Petroleum—(Boiling range, 120° to 160°).

WT. PER ML.—At 20°, about 0.75 g, Appendix 3.8.

NON-VOLATILE MATTER—When evaporated on a water-bath and dried at 105°, leaves not more than 0.002 per cent 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° to 136°.

Phenol : C_6H_5OH=94.11.

Analytical reagent grade.

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

Phenol Liquified—General reagent grade.

A solution in water containing about 80 per cent 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 0.10 g of *phenol red* in 2.82 ml of 0.*IN 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 *alcohol*.

Phenolphthalein Solution—Dissolve, 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° for one hour, 215° to 219°, Appendix 3.4.

SULPHATED ASH—Not more than 0.1 per cent, Appendix 2.3.6.

Phloroglucinol should be kept protected from light.

Phloroglucinol Solution of—A 1.0 percent w/v solution of *phloroglucinol in alcohol* (90 per cent).

Phosphoric Acid : $H_8 PO_4$ =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 0.5ml add 10 ml of *water* and 2 ml of *silver nitrate solution* and heat on a waterbath 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 2ml 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 2.3.7.

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*, neutralising 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_3PO_4.

STORAGE : Store in a well-closed glass containers.

Phosphoric Acid, xN

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

Phosphoric Acid, Dilute

Contains approximately 10 per cent 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°.

Potassium Antimonate : $KSbo_3, 3H_2O$=262.90

Contains not less than 40.0 per cent 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 accuratly 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, wash 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*, neutralise 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 of 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 per cent and not more than the equivalent of 102.0 per cent 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 per cent of $KBrO_3$, calculated with reference to the substance dried to constant weight at 105°.

DESCRIPTION—White, crystalline powder.

SOLUBILITY—Soluble in *water*, freely soluble in boiling *water*, almost insoluble in *alcohol*.

ACIDITY OR ALKALINITY—A 5 per cent w/v solution in *water* is clear and colourless and neutral to *litmus solution*.

SODIUM—A warm 10 per cent 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 per cent 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 2.3.7.

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 98.0 per cent 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 2.3.7.

CHROMIUM—To 25 ml of a 2 per cent 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° for two hours spread in a thin layer and then cooled in a desiccator.

Potassium Chlorate : $KClO_3$ = 122.55.

Contains not less than 99.0 per cent of $KClO_3$.

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 2.3.7.

ASSAY—Weigh accurately about 0.3 g and dissolve in 10 ml of *water* in a stoppered-flask, add 1 g of *sodium nitrate*, dissovled in 10 ml of *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 a 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 washings 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 : KCl = 74.55

Analytical reagent grade.

Potassium Chromate : K_2CrO_4=194.2

Analytical reagent grade.

Potassium Chromate solution—A 5.0 per cent 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.

(1) **Copper Solution.**—Dissolve 34.66 g of carefully selected small crystals of *copper sulphate*, showing no trace of efflorescence or of adhering moisture, in sufficient water to make 500 ml. Keep this solution in small, well-stoppered bottles.

(2) **Alkaline Tartrate Solution.**—Dissolve 176 g of sodium *potassium tartrate* and 77 g of *sodium hydroxide* in sufficient *water* to produce 500 ml.

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

Potassium Cyanide.— KCN = 65.12.

Contains not less than 95.0 per cent 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 per cent 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 10.0 per cent 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 per cent of $K_2Cr_2O_7$.

DESCRIPTION—Orange-red crystals or a crystalline powder.

SOLUBILITY.—Soluble in *water*.

Chloride.—To 20 ml of a 5 per cent w/v solution in *water* and 10 ml *nitric acid*, warm to about 50° 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 7.0 per cent w/v solution of *potassium dichromate* in *water*.

Potassium Dichromate Solution, 0.1N : $K_2Cr_2O_7$=294.18, 4.903g in 1000 ml.

Weigh accurately 4.903 g of *potassium dichromate* P.S. previously powdered and dried at 20° 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 99.0 per cent 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 99.0 per cent of $K_4Fe(CN)_6$, $3H_2O$

DESCRIPTION.—Yellow, crystalline powder.

SOLUBILITY.—Soluble in water.

ACIDITY OR ALKALINITY.—A 10 per cent 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 5.0 per cent 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 per cent and not more than the equivalent of 100.1 per cent of $C_8H_5O_4K$ calculated with reference to the substance dried at 110° for one hour.

DESCRIPTION.—White, crystalline powder.

SOLUBILITY.—Slowly soluble in *water*, forming clear, colourless solution.

ACIDITY.—A 2.0 per cent 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, 0.02M

Dissolve 4.084 g of *potassium hydrogen phthalate* in sufficient *water* to produce 1000 ml.

Potassium Hydrogen Phthalate, 0.2M.

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 85.0 per cent of total alkali, calculated as KOH and not more than 4.0 per cent of K_2CO_3.

DESCRIPTION—Dry, white sticks, pellets 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 *ethyl 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 per cent 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 2.3.7.

SODIUM—To 3 ml of a 10 per cent 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 5.0 per cent w/v of total alkali, calculated 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 1.0 per cent 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° 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 2.0 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 dissovle 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 any 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 of *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 per cent w/v solution of *potassium iodide* in *water*.

Potassium Iodobismuthate 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 per cent 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 Mercuric-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 : $KMnO_4$ = 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 2.3.7.

ASSAY : Weigh accurately about 0.8 g, dissolve in *water* and dilute to 250 ml. Titrate with this solution 25.0 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° throughout the entire titration. Each ml of 0.1 *N oxalic acid* is equivalent to 0.00316 g of $KMnO_4$.

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 1.0 per cent 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 a water-bath for one hour and allow to stand for two days. Filter through glass wool and standardise the solution as follows :—

To an accurately measured 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 standardised 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 KMnO .

Potassium Tetraoxalate : $KH_3(C_2O_4)_2, 2H_2O = 254.2$

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.

*p*H : 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 3.3.

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 per cent w/v determined on 100 ml by evaporating on a water bath and drying in an oven at 105° for one hour.

STORAGE—Store in tightly-closed containers.

Resorcinol—Benzene—1, 3diol; $C_6H_4(OH)_2 = 110.1$

Analytical reagent grade.

Colourless crystals or crystalline powder, melting point about 111°.

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 per cent).

Seasame oil

DESCRIPTION—A pale yellow oil, odour, slight; taste, bleed.

SOLUBILITY—Slightly soluble in *alcohol;* miscible with *chloroform*, with solvent *ether* with *light petroleum* (b. p. 40° to 60°). and with *carbon disulphide*.

REFRACTIVE INDEX—At 40°, 1.4650 to 1.4665, Appendix 3.7

WT. PER ML—At 25°, 0.916 to 0.921 g; Appendix 3.8.

STORAGE—Preserve sesame oil in a well-closed container protected from light, and avoid exposure to excessive heat.

Silver Carbonate—Ag_2CO_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, polymerised, 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 per cent of its weight of water at 20°. Its absorptive capacity may be regenerated by heating at 150° 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 4.0 per cent w/v solution add 7.5 ml of 2*N 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 0.5g 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 5.0 per cent 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 standardise the solution as follows :

Weigh accurately about 0.1 g of *sodium chloride P.S.* previously dried at 110° 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

DISCRIPTION—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 5.0 per cent w/v solution in *carbon dioxide-free water*, not more than 8.6, Appendix 3.3.

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 4.0 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* dropwise to give the solution a faint pink colour. Cool and dilute to 25 ml with *water*, Appendix 2.3.3.

CHLORIDES—Dissolve 1.0 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 2.3.7.

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 per cent w/v solution of *sodium bicarbonate* in *water*.

Sodium Bisulphite—Consists of sodium bisulphite ($NaHSO_3$) and sodium metabisulphite ($Na_2S_2O_5$) in varying proportions. It yields not less than 58.5 per cent and not more than 67.4 per cent 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 0.2g and transfer to a glass-stoppered flask, and 50 ml of 0.1*N iodine* and insert the stopper of the flask. Allow to stand for five minutes, add 1 ml of *hydrochloric acid*, and titrate the excess of *iodine* with 0.1*N sodium thiosulphate*, using *starch solution* as indicator added towards the end of the titration. Each ml of 0.1*N iodine* is equivalent to 0.003203 g of SO_2.

STORAGE—Preserve Sodium Bisulphite in tightly-closed containers in a cool place.

Sodium Bisulphite Solution—Dissolve 10 g of *sodium bisulphite* in sufficient *water* to make 30 ml.

Sodium Bisulphite Solution must be freshly prepared.

Sodium Carbonate—Na_2CO_3. $10H_2O$=286.2

Analytical reagent grade.

Sodium Chloride—NaCl=58.44

Analytical reagent grade.

Sodium Cobaltinitrite—$Na_3CO(NO_2)_6$=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 per cent 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 per cent 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 per cent 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 per cent 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 3.2.1.

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 3N *hydrochloric acid*. Heat to boiling, cool and dilute to 25 ml with water.

POTASSIUM—Acidify 5 ml of a 5 per cent 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.

SULPHATES—1 g dissolved in *water* with the addition of 3.5 ml of *hydrochloric acid* complies with the *limit test for sulphates,* Appendix 2.3.7.

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 persistant 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 1000ml.

Sodium Hydroxide Solution—A 20.0 per cent w/v solution of *sodium hydroxide* in *water.*

Sodium Hydroxide Solution, Dilute

A 5.0 per cent 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 99.0 per cent and not more than the equivalent of 104.0 per cent 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 neutralisation 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 text 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 2.3.7

ASSAY—Weigh accurately about 2 g and heat until carbonised, cool, and boil the residue with 50 ml of *water* and 50 ml of 0.5*N sulphuric acid;* filter, and wash the filter with *water;* titrate the excess of acid in the filtrate and washings with 0.5*N sodium hydroxide,* using *methyl orange solution* as indicator. Each ml of 0.5*N sulphuric acid* is equivalent to 0.07056 g of $C_4H_4O_6KNa$, $4H_2O$.

Sodium Sulphide—Na_2S+aq.

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

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

Sodium Sulphite, Anhydrous—Na_2SO_3=126.06

DESCRIPTION—Small crystals or powder.

SOLUBILITY—Freely soluble in *water,* soluble in *glycerin;* almost isoluble in *alcohol.*

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

DESCRIPTION—Large colourless crystals or coarse, crystalline powder; odourless; taste, saline, deliquecent in moist air and effloresces in dry air at temperature above 33°.

SOLUBILITY—Very soluble in *water;* insoluble in *alcohol.*

pH—Between 6.0 and 8.4, determined in a 10 per cent w/v solution, Appendix.

ARSENIC—Not more than 2 parts per million, Appendix 2.3.1.

HEAVY METALS—Not more than 20 parts per million, determined by Method A. Appendix 2.3.3 on a solution prepared in the following manner : Dissolve 1 g in 10 ml of *water,* slowly add 5 ml of *dilute hydrochloric acid* and evaporate the mixture to dryness on a water-bath. Gently boil the residue with 15 ml of *water* for two minutes, and filter. Heat the filtrate to boiling, and add sufficient *bromine solution* to the hot filtrate to produce a clear solution and add a slight excess of *bromine solution.* Boil the solution to expel the *bromine* completely, cool to room temperature, then add a drop of *phenolphthalein solution* and *sodium hydroxide solution* until a slight pink colour is produced. Add 2 ml of *dilute acetic acid* and dilute with *water* to 25 ml.

CALCIUM—Dissolve 1 g in 20 ml of *water,* and add a few ml of *ammonium oxalate solution;* no turbidity is produced.

CHLORIDE—Dissolve 0.25 g in 15 ml of 2*N nitric acid* and boil gently for three to four minutes cool and filter; the filtrate complies with the *limit test for chlorides,* Appendix 2.3.2.

SULPHATE AND SULPHITE—Dissolve 0.25 g in 10 ml of *water,* to 3 ml of this solution add 2ml of *iodine solution,* and gradually add more *iodine solution,* dropwise until a very faint-persistant yellow colour is produced; the resulting solution complies with the *limit test for sulphates,* Appendix 2.3.7.

SULPHIDE—Dissolve 1 g in 10 ml of *water* and 10.00 ml of a freshly prepared 5 per cent 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-piont is approached. Each ml of 0.1N iodine is equivalent to 0.02482 g of $Na_2S_2O_3.\ 5H_2O$.

STORAGE—Store in tightly-closed containers.

Sodium Thiosulphate—0.1N ; $Na_2S_2O_3.\ 5H_2O$=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. Standardise the solution as follows :

Dissolve 0.300 g of *potassium bromate P. S.* in sufficient *water* to produce 250 ml. To 50 ml of this solution, add 2g 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 tiration, 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-Restandardise 0.1*N sodium thiosulphate* frequently.

Stannous chloride—$SnCl_2,\ 2H_2O$=225.63.

Contains not less than 97.0 per cent of $SnCl_2,\ 2H_2O$.

DESCRIPTION—Colourless crystals.

SOLUBILITY—Soluble in *dilute hydrochloric acid.*

ARSENIC—Dissolve 5.0 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 5.0 g in 10 ml of *hydrochloric acid.*

SULPHATE—5.0 g, with the addition of 2ml of *dilute hydrochloric acid,* complies with the *limit test for sulphates,* Appendix 2.3.7.

ASSAY—Weigh accurately about 1.0 g and dissolve in 30 ml of *hydrochloric acid* in a stoppered flask. Add 20ml of *water* and 5 ml of *chloroform* and titrate rapidly with 0.05*M potassium iodate* until the *chloroform* layer is colourless. Each ml of 0.05*M potassium iodate* is equivalent to 0.02256 g of $SnCl_2.2H_2O$.

Stannous chloride Solution—May be prepared by either of the two methods given below:

1. Dissolve 330 g of *stannous chloride* in 100 ml of *hydrochloric acid* and add sufficient *water* to produce 1000 ml.

2. Dilute 60 ml of *hydrochloric acid* with 20 ml of *water,* add 20 g of tin and heat genetly 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 thi 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 per cent, Appendix 2.2.3.

Starch, Solution—Triturate 0.5 g of *soluble starch*, with 5 ml of *water*, and add this, with constant stirring, to sufficient water to produce about 100 ml. Boil for a few minutes, cool, and filter.

Solution of *starch* must be recently prepared.

Sudan Red G— CI 26100; Sudan III; Solvent Red 23; 1-(4-Phenyl-azophenylazo)-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 98.0 per cent of H_3NO_3S.

DESCRIPTION—White crystals or a white crystalline powder.

SOLUBILITY—Readily soluble in water.

MELTING RANGE—203° to 205°, with decomposition, Appendix 3.4.

Sulphuric Acid—H_2SO_4=98.08.

When no molarity is indicated use analytical reagent grade of commerce containing about 98 per cent 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 × ml of sulphuric acid to an equal volume of water and diluting with water to 1000 ml.

Solutions of sulphuric acid contain about 10 per cent w/v of H_2SO_4 per g mol.

Sulphuric Acid, Dilute—Contains approximately 10 per cent 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 98.0 per cent w/w of H_2SO_4, and complies 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 89.0 per cent 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 0.4g 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 neutralised 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°.

Thymol Blue—6, 6'—(3H—2, 1 Benzoxathil—3—ylidene) dithymol SS—dioxide; $C_{27}H_{30}O_6S=466.6$

Gives a red colour in strongly acid solutions a yellow colour in weakly acid and weakly alkaline solutions, and a blue colour in 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 of 0.05M 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 and 100 ml of Carbon dioxide-free water to which 0.2 ml of 0.02N 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 per cent w/v of $TiCl_3$.

Weight per ml, about 1.2 g.

Dull purplish liquid with a strongly acid reaction.

Titanous Chloride—0.1N : $TiCl_3=154.26$; 15.43g in 1000 ml.

Add 103 ml of *titanous chloride solution* to 100 ml of *hydrochloric acid*, dilute to 1000 ml with recently boiled and cooled water, and mix, Standardise, immediately before use, as follows:

Place an accurately measured volume of about 30 ml of standardised 0.1*N* *ferric ammonium sulphate* in a flask and pass in a rapid stream of *carbon dioxide* until all the air has been removed. Add the *titanous chloride solution* from a burette and in an atmosphere of *carbon dioxide* until near the calculated endpoint then add 5 ml of *ammonium thiocyanate solution*, and continue the titration until the solution is colourless. Each ml of 0.1*N* *ferric ammonium sulphate* is equivalent to 0.01543 g of $TiCl_3$.

Water—See purified water.

Water Ammonia-free—Water which complies with the following additional test :

To 50 ml add 2 ml of *alkaline potassium mercuri-iodide solution* (Nessler's reagent); no colour is produced.

Water, Carbon Dioxide-free—Water which has been boiled vigorously for a few minutes and protected from the atmosphere during cooling and storage.

Xylenol Orange—[3H—2, 1-Benzoxathiol-3-ylidene bis (6-hydroxy-5-methyl-m-phenylene) methylenenitril] 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 absent, for example in the presence of an excess of disodium ethylene diamine tetraacetate, this solution is yellow.

Xylenol Orange Solution—Shake 0.1g 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

GENERAL INFORMATION

(A) Definition and Method of Preparing Kvātha or Decoction

(Caraka Samhita, Sutrasthana Adhyaya 4; 8½)

(Dravyaguna Vijnana, Paribhasakhanda)

Kvātha is the decoction obtained by boiling coarse powder of drug(s) in proporion of 4, 8 or 16 times (for mṛdu dravya—4 times; for madhyama dravya —8 times and for khara dravya—16 times respectively) of water reduced to one-fourth and strained in cloth.

(B) Śodhana of Drugs

Śodhana is the process of grinding etc. with specified drugs for removal of impurities and potentiation of drugs.

The PARIBHASA of various ayurvedic technical terms used under Śodhana are as follows :

DOLĀYANTRA

(Rasaratna Samucchaya, Adhyaya 9; 3-4)

Dolāyantra is a contrivance consisting of a pot half filled with liquid with a horizontal rod put on the rim from which is suspended a quantity of the drug tied up in a thin cloth to be heated.

BHĀVANĀ

(Rasatarngini, Taranga 2; 49 & Bhaishaja Ratnavali Paribhasa Prakaran 50)

Bhāvanā is the process by which powders of drugs are ground to a soft mass with liquid substances and are then allowed to dry under the sun rays during the day and are again put in the liquids during the night time. This process is repeated for 7 days unless otherwise mentioned.

NIMAJJANA

(Rasendracudamani, Adhyaya 4; 77)

NIMAJJANA is the process of immersing the drug material in a specified liquid.

KĀÑJIKA

(Paribhasa paradipa)

Powder of Āśudhānya such as Kulmāṣa, Ṣaṣṭhika Rice, etc. alongwith a small quantity of white readish (Mūlaka) cut into pieces 768 g. are placed in an earthen pot and 3.072 litres of water is added. The mouth of the pot is closed and kept for two, three weeks during which period the fluid becomes sour. This sour fluid is called Kāñjika, Dhānyāmla or Āranāla.

CŪRṆODAKA

(Rasatarangini, Taranga 11; 216-217)

The filtrate obtained by mixing 60 ml. of water with 250 mg. of lime powder keeping for 9 hours and then filtering after decantation, is called Cūrṇodaka or Sudhodaka.

PUṬAPĀKA

(Sarangadhara Samhita, Madhyama Khanda, Adhyaya 1; 22-24½)

Puṭapāka Svarasa is the juice of fresh drug obtained by the process of puṭapāka. The kalka (paste) of plant material is bundled in leaves of gambhari, vata, eranda, etc.

The bundle is covered with clay in layers of about 2 cm. thickness. When the clay is dried, the bundle is placed amidst fire till it becomes reddish. The bundle is then opened, juice from kalka is pressed out.

METHOD OF ŚODHANA :—

1. Citraka Śodhana

(Rasatarangini, Taranga 24; 575)

(1) Citraka mula (Rt.)	1 Part
(2) Cūrṇodaka	Q. S. for nimajjana.

Method—Small pieces of citrakamūla are soaked in lime water and thereafter washed, dried in the sun.

2. Guñjā Śodhana

(Rasamṛta, Pariśista 8; Page 147)

1. Guñjā (ssd)	1 Part
2. Kāñjika	Q. S. for svedana

Method—Svedana is done for three hours in dolāyantra. The testa is remoned. Thereafter, it is washed, dried and kept.

3. Hiṅgu Śodhana

(Rasatarangini, Taranga 24; 578)

1. Rāmaṭha (hiṅgu)	(Exd.)	1 Part
2. Ājya (goghṛta)		Q. S.

Method—Hiṅgu is roasted with ghee in a pan till it becomes crisp.

4. Kampilla Śodhana

(Ayurveda Prakasa, Adhyaya 2; 346)

1. Kampilla (Phala raja)	1 Part
2. Mātuluṅga rasa (Fr.)	Q. S. for bhavana
3. Ārdraka rasa (Rz.)	Q. S. for bhavana

Method—Kampillaka available in the market is heavily adulterated (mixed with brick powder or more commonly with tile powder. The material therefore is to be briskly shaken with water so that the tile powder settles down & Kampillaka Raja float on the top of water. It is to be removed out allowing the settled matter undisturbed. This may be repeated 3 times and the top layer (very light) is allowed to dry and subjected to the śodhana.

Bhāvanā is given three times with ingredient No. 2 & 3 separately.

5. Karavīra Śodhana

(Sarangadhara samhita, Madhyama Khanda, Adhyaya 12; 300)

1. Karavīra (lf.)	1 Part
2. Godugdha	Q. S. for svedana

Method—Svedana is done in dolāyantra for three hours.

6. Snuhī Śodhana

(Rastarangini, Taranga 24; 517-518)

1. Sudha (Snuhī) (St.)	48g
2. Ciñcā dala drava	24

Method—Ciñcāpatra svarasa (obtained from puṭapāka) is mixed with powder of snuhī and dried in the sun.

7. Vijayā Śodhana

(Rasamṛta. pariśista 8; page 147)

1. Vijayā (lf.)	Part 1
2. Jala	Q. S. of Prakṣālana

Method—The leaves of Vijayā are put in muslin bag and washed in water till free from turbidity and then dried.

APPENDIX 6

6.1 WEIGHT AND MEASURES

METRIC SYSTEM

Measure of Mass (Weights)

1 Kilogram (Kg) — is the mass of the International Prototype Kilogram.

1 Gramme (g) — the 1000th part of 1 Kilogram.

1 Milligram (mg) — the 1000th part of 1 gramme.

1 Microgram (μg) — the 1000th part of 1 milligram.

Measures of capacity (volumes)

1 Litre (l) is the volume occupied at its temperature of maximum density by a quantity of water having a mass of 1 Kilogram.

1 Millilitre (ml)—the 1000th part of 1 litre.

The accepted relation between the litre and the cubic centimetre is 1 litre —1000.027 cubic centimeters.

Relation of capacity to Weight (Metric)

One litre of water at 20° weighs 997.18 grammes when weighed in air of density 0.0012 gramme per millilitre against brass weights of density 84 grammes per millilitre.

Measures of Length

1 Metre (m) is the length of the International Prototype Metre at 0.

1 Centimetre (cm) — the 100th part of 1 metre.

1 Millimetre (mm) — the 1000th part of 1 metre.

1 Micron (μ) — the 1000th part of 1 millimetre.

1 Millimicron (mμ) — the 1000th part of 1 micron.

6.2 APPROXIMATE EQUIVALENTS OF DOSES IN INDIAN SYSTEM AND METRIC SYSTEMS:

1	Ratti or Guñjā		=125 mg
8	Rattis or Guñjās	=1 Māṣā	=1g
12	Māṣās	=1 Karṣa (Tola)	=12 g
2	Karṣās (Tolas)	=1 Sukti	=24 g
2	Suktis (4 Karṣas or Tolas)	=1 Pal	=48 g
2	Palās	=1 Prasṛti	=96 g
2	Prasṛtis	=1 Kuḍava	=192 g
2	Kuḍavās	=1 Mānikā	=384 g
2	Mānikās	=1 Prastha	=768 g
4	Prasthās	=1 Āḍhaka	=3 Kg 73 g
4	Āḍhakās	=1 Droṇa	=12 Kg 288 g
2	Droṇas	=1 Sūrpa	=24 Kg 576 g
2	Sūrpās	=1 Droṇi (Vahi)	=49 Kg 152 g
4	Droṇis	=1 Khārī	=196 Kg 608 g
100	Palās	=1 Tulā	=4 Kg 800 g
20	Tulās	=1 Bhāra	=96 Kg

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APPENDIX 7

CLASSICAL AYURVEDIC REFERENCE

अजगन्धा

अजगन्धा · · · · · दशेमानि शूलप्रशमनानि भवन्ति ।
(च० सू०; 4/45)

अजगन्धा खरपुष्पा वस्तगन्धा विगन्धिका ।
कारवी बर्बरा गन्धा तुङ्गी पूतिमयूरिका ।।
अजगन्धा वातहरा वीर्योष्णा तु ज्वरापहा ।
गुल्माष्ठीलाकफानाहशूलजिद्वह्निकृत्परा ।
(ध० नि०, शतपुष्पादि वर्ग; 97–98)

अजगन्धा कटूष्णा स्याद्वातगुल्मोदरापहा ।
कर्णव्रणार्त्तिशूलघ्नी पीताचेदञ्जने हिता ।।
(रा० नि०; शता० ह्वाटि वर्ग; 178)

अजमोदा

अजमोदा च शूलघ्नी तिक्तोष्णा कफवातजित् ।
हिक्काध्मानारुचीर्हन्ति कृमिजिद्वह्निन दीपनी ।।
(ध० नि०, शतपुष्पादि वर्ग; 98)

अजमोदा खराश्वा च माथूरो दीप्यकस्तथा ।
तथा ब्रह्मकुशा प्रोक्ता कारवी लोचमस्तका ।
अजमोदा कटुस्तीक्ष्णा दीपनी कफवातनुत् ।
उष्णा विदाहिनी हृद्या वृष्या बलकरी लघुः ।
नेत्रामयकृमिच्छर्दिहिक्कावस्तिरुजो हरेत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 79)

अजमोदा कटुरुष्णा रुक्षा कफवातहारिणी रुचिकृत् ।
शूलाध्मानारोचकजठरामयनाशनी चैव ।।
(रा० नि०, पिप्पल्यादि वर्ग; 110)

आमलकी (आर्द्रा)

विद्यादामलके सर्वान् रसान् लवणवर्जितान् ।
(च० सू०; 27/147)

अम्लं समधुरं तिक्तं कषायं कटुकं सरम् ।
चक्षुष्यं सर्वदोषघ्नं वृष्यमामलकीफलम् ।
हन्ति वातं तदम्लत्वात्पित्तं माधूर्यशैत्यतः ।
कफं रूक्षकषायत्वात्फलेभ्योऽभ्यधिकं च तत् ।।
(सु० सू०; 46/143–144)

वयस्यामलकी वृष्या जातीफलरसं शिवम् ।
धात्रीफलं श्रीफलं च तथामृतफलं स्मृतम् ।
त्रिष्वामलकमाख्यातं धात्री तिष्यफलाऽमृता ।।
हरीतकी समं धात्रीफलम् किन्तु विशेषतः ।
रक्तपित्तप्रमेहघ्नं परं वृष्यं रसायनम् ।।
हन्ति वातं तदम्लत्वात्पित्तं माधुर्यं शैत्यतः ।
कफं रूक्षकषायत्वात्फलं धात्र्यास्त्रिदोषजित ।।
यस्य यस्य फलस्येह वीर्यं भवति यादृशम् ।
तस्य तस्यैव धीर्य्येण मज्जानमपि निर्दिशेत् ।।
(भा० प्र०; हरीतक्यादि वर्ग; 38–41)

आमलकं कषायाम्लं मधुरं शिशिरं लघु ।
दाहपित्तवमीमेहशोफघ्नं च रसायनम् ।।
(रा० नि०; 327)

आमलकी (शुष्क)

विद्यादामलके सर्वान् रसान् लवणवर्जितान् ।
(च० सू०; 27/147)

अम्लं समधुरं तिक्तं कषायं कटुकं सरम् ।
चक्षुष्यं सर्वदोषघ्नं वृष्यमामलकी फलम् ।
हन्ति वातं तदम्लत्वात्पित्तं माधूर्यशैत्यतः ।
कफं रूक्षकषायत्वात्फलेभ्योऽभ्यधिकं च तत् ।।
(सु० सू०; 46/143–144)

हरीतकीसमं धात्रीफलं किन्तु विशेषतः ।
रक्तपित्तप्रमेहघ्नं पर वृष्यं रसायनम् ।।
हन्ति वातं तदम्लत्वात्पित्तं माधुर्यशैत्यतः ।
कफं रूक्षकषायत्वात्फलं धात्र्यास्त्रिदोषजित् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 39–40)

आरग्वध

चतुरंगुलो मृदुविरेचनानाम् श्रेष्ठः ।
(च० सू०; 25/40)

आरग्वधो राजवृक्षः शंपाकश्चतुरंगुलः ।
आरेवतो व्याधिघातः कृतमालः सुवर्णकः ।।

कर्णिकारो दीर्घफलः स्वर्णाङ्गः स्वर्णभूषणः ।
आरग्वधो गुरुः स्वादुः शीतलः स्रंसनोत्तमः ।।
ज्वरहृद्रोगपित्तास्रवातोदावर्त्तशूलनुत् ।
तत्फलं स्त्रंसनं रुच्यं कुष्ठपित्तकफापहम् ।।
ज्वरे तु सततं पथ्यं कोष्ठशुद्धिकरं परम् ।
(भा० प्र०, हरीतक्यादिवर्ग; 148–160)

अर्क (मूल एवं पत्र)

अर्कः सर्याह्वयः पुष्पी विक्षीरोऽथ विकीरणः ।
जम्भलः क्षीरपर्णी स्यादास्फोटोभास्करोरविः ।।
अर्कस्तु कटुरुष्णश्च वातहृद्दीपनः सरः ।
शोफव्रणहरः कण्डूकुष्ठप्लीहकृमीञ्जयेत् ।।
(ध० नि०, करवीरादिवर्ग; 13–14)

अर्कःक्षीरदलः पुष्पी प्रतापः क्षीरकाण्डकः ।
विक्षीरो भास्करः क्षीरी खर्जूघ्नः शिवपुष्पकः ।।
भञ्जन क्षीरपर्णी स्यात् सविता च विकीरणः ।
सूर्य्याह्वश्च सदापुष्पो रविरास्फोटकस्तथा ।
तूलफलः शुकफलो विंशतिश्च समाह्वयः ।।
अर्कस्तु कटुरुष्णश्च वातजिद्दीपनीयक : ।
शोफव्रणहरः कण्डू-कुष्ठक्रिमिविनाशनः ।
(रा० नि०, करवीरादिवर्ग; 26–28)

असन

यथा सर्वाणि कुष्ठानि हितः खदिर बीजकौ ।
(सु० चि० अ०; 6)

बीजकः सकषायश्च कफपित्तास्रनाशनः ।
(ध० नि०, आम्रादिवर्ग; 115)

बीजकः कुष्ठवीसर्पश्वित्रमेहगुदक्रिमीन् ।
हन्ति श्लेष्मास्रपित्तञ्च त्वच्यः केश्यो रसायनः ।।
(भा० प्र०, वटादिवर्ग; 21)

अशोक

अशोकः शीतलस्तिक्तो ग्राही वर्ण्यः कषायकः ।
दोषापचीतृषादाहकृमिशोषविषास्रजित् ।।
(भा० प्र०, पुष्पवर्ग; 48)

अश्वगंधा

गन्धान्ता वाजिनामादिरश्वगन्धा हयाह्वया ।
वराहकर्णी वरदा बलदा कुष्ठगन्धिनी ।।
अश्वगन्धाऽनिलश्लेष्मश्वित्रशोथ क्षयापहा ।
बल्या रसायनी तिक्ता कषायोष्णाऽतिशुक्रला ।।
(भा० प्र०, गुडूच्यादिवर्ग; 189–190)

अश्वत्थ

बोधिवृक्षकषायं तु प्रपिबेन्मधुना सह ।
वातरक्तं जयत्याशु त्रिदोषमपि दारुणम् ।
(च० चि०; 29/158)

बोधिद्रुः पिप्पलोऽश्वत्थश्चलपत्रो गजाशनः ।
पिप्पलोदुर्जरः शीतः पित्तश्लेष्मव्रणास्रजित् ।
गुरुस्तुवरको रुक्षो वर्ण्यो योनिविशोधनः ।।
(भा० प्र०, वटादिवर्ग; 3)

पिप्पलः सुमधुरस्तु कषायः शीतलश्च कफपित्त-विनाशी ।
रक्तदाहशमनः स हि सद्यो योनिदोषहरणः किल पक्व ।।
(रा० नि०, आम्रादिवर्ग; 114)

अतसी

अतसी नीलपुष्पी च पार्वती स्यादुमा क्षुमा ।।
अतसी मधुरा तिक्ता स्निग्धा पाके कटुर्गुरु : ।
उष्णा दृक्छुक्रवातघ्नी कफपित्तविनाशिनी ।।
(भा० प्र०, धान्यवर्ग; 66–67)

अतिबला

बलाचतुष्टयं शीतं मधुरं बलकान्तिकृत् ।
स्निग्धं ग्राहि समीरास्रपित्तास्रक्षतनाशनम् ।।
(भा० प्र० गुडूच्यादिवर्ग; 144)

अतिविषा

अतिविषा दीपनीयपाचनीय सांग्राहिक सर्वदोष-हराणाम् ।
(च० सू०; 25/40)

अतिविषा शुक्लकंदा ज्ञेया विश्वा च भङ्गुरा ।
श्यामकंदा प्रतिविषाशृङ्गी चोपविषा विषा ।।
आर्द्रा श्वेता विरुपा च विषदा पित्तवल्लभा ।
घुणप्रियाऽतिसारघ्नी बालानां रोगनाशिनी ।।
कटूष्णाऽतिविषा तिक्ता कफपित्तज्वरापहा ।
आमातीसारकासघ्नी विषच्छर्दिविनाशिनी ।।
(ध० नि०; गुडूच्यादिवर्ग; 9–11)

विषात्वतिविषा विश्वा शृङ्गी प्रतिविषाऽरुणा ।
शुक्लकन्दा चोपविषाभङ्गुरा घुणवल्लभा ।।
विषा सोष्णा कटुस्तिक्ता पाचनी दीपनी हरेत् ।
कफपित्तातिसारामविषकासवमिक्रिमीन् ।।
(भा० प्र०, हरीतक्यादिवर्ग; 213–214)

बब्बूल

बब्बूलः कफनुद् ग्राही कुष्ठक्रिमिविषापहः ।
(भा० प्र०, वटादिवर्ग; 37)

ग्रामरक्तातिसारघ्नः पित्तदाहार्त्तिनाशनः ।।
बब्बूलस्य फलं रुक्षं विशदं स्तम्भनं गुरु ।
(कै० दे० नि०, ओषधिवर्ग; 1087½)

बाकुची

ग्रवल्गुजो बाकुची स्यात्सोमराजी सुपर्णिका ।
शशिलेखा कृष्णफला सोमा पूतिफलीति च ।।
सोमवल्ली कालमेषी कुष्ठघ्नी च प्रकीर्तिता ।
बाकुची मधुरा तिक्ता कटुपाका रसायनी ।।
विष्टम्भहृद्धिमा रुच्या सरा श्लेष्मास्रपित्तनुत् ।
रूक्षा हृद्या श्वासकुष्ठमेहज्वर कृमिप्रणुत् ।।
तत्फलं पित्तलं कुष्ठकफानिलहरं कटु ।
केश्यं त्वच्यं कृमिश्वासकासशोथामपाण्डुनुत् ।।
(भा० प्र०, हरीतक्यादिवर्ग; 206–209)

बाकुची सोमराजी च सोमवल्ली सुवल्लिका ।
सिता सितावरी चन्द्र-लेखा चान्द्री च सुप्रभा ।।
कुष्ठहन्त्री च काम्बोजी प्रतिगन्धा च वल्गुजा ।
स्मृता चन्द्रामिधा राजी काल्माषी च तथैन्दवी ।।
कुष्ठदोषापहा चैव कान्तिदाऽवल्गुजा तथा ।
चन्द्रामिधा प्रभायुक्ता विंशतिः स्यात्तु नामतः ।।
बाकुची कटुतिक्तोष्णा क्रिमिकुष्ठकफापहा ।
त्वग्दोषविषकण्डूति-खर्जुप्रशमनी च सा ।।
(रा० नि०, शताह्वादिवर्ग; 62–65)

बिभीतक

भेदनं लघु रूक्षोष्णं वैस्वर्यकृमिनाशनम् ।
चक्षुष्यं स्वादु पाक्याक्षं कषायं कफपित्तजित् ।।
(सु० सू०; 46/200)

बिभीतकस्त्रिलिङ्गः स्यादक्षः कर्षफलस्तु सः ।
कलिद्रुमो भूतवासस्तथा कलियुगालयः ।।
बिभीतकं स्वादुपाकं कषायं कफपित्तनुत् ।
उष्णवीर्यं हिमस्पर्शं भेदनं कासनाशनम् ।।
रुक्षं नेत्रहितं केश्यं कृमिवैस्वर्यनाशनम् ।
(भा० प्र०, हरीतक्यादिवर्ग; 36)

बिल्व (फल)

बिल्वं सांग्राहिकदीपनीयवातकफप्रशमनानाम् ।।
(च० सू०; 25/40)

कफानिलहरं तीक्ष्णं स्निग्धं संग्राहिदीपनम् ।
कटुतिक्तकषायोष्णं बालं बिल्वमुदाहृतम् ।।
(सु० सू०; 46/174)

बिल्वः शाण्डिल्यशैलूषौ मालूरश्रीफलावपि ।
श्रीफलस्तुवरस्तिक्तो ग्राही रुक्षोऽग्निपित्तकृत् ।
वातश्लेष्महरो बल्यो लघुरुष्णश्च पाचनः ।।
(भा० प्र०, गुडूच्यादिवर्ग; 13)

चन्द्रशूर

चन्द्रिका चर्महन्त्री च पशुमेहनकारिका ।
नन्दिनी कारवी भद्रा वासपुष्पा सुवासरा ।।
चन्द्रशूरं हितं हिक्कावातश्लेष्मातिसारिणाम् ।
ग्रसृग्वातगदद्वेषि बलपुष्टिविवर्द्धनम् ।।
(भा० प्र०, हरीतक्यादिवर्ग; 96–97)

चित्रक

चित्रकमूलं दीपनीय पाचनीय गुदशोथार्शः शूलहराणाम् ।
(च० सू०; 25/40)

चित्रको दहनो व्यालः पाठीनो दारुणोऽग्निकः ।
ज्योतिष्को वल्लरी वह्नि पाली पाठी कटुः शिखी ।।
कृष्णारुणोऽनलो द्वीपी चित्रभानुश्च पावकः ।
चित्रकोऽग्निसमः पाके कटुकः कफशोफजित् ।
वातोदरार्शो ग्रहणीक्षयपाण्डुविनाशनः ।।
(ध० नि०, शतपुष्पादिवर्ग; 80–81)

चित्रकोऽनलनामा च पाठी व्यालस्तथोषणः ।
चित्रकः कटुकः पाके वह्निकृत्पाचनो लघुः ।।
रूक्षोष्णो ग्रहणीकुष्ठशोथार्शः कृमिकासनुत् ।
वातश्लेष्महरो ग्राही वातार्शः श्लेष्मपित्तहृत् ।।
(भा० प्र०, हरीतक्यादिवर्ग; 70-71)

धान्यक

धान्यकं धानकं धान्यं धाना धानेयकं तथा ।
कुनटी धेनुका छत्रा कुस्तुम्बुरु वितुन्नकम् ।।
धान्यकं तुवरं स्निग्धमवृष्यं मूत्रलं लघु ।
तिक्तं कटूष्णवीर्यञ्च दीपनं पाचनं स्मृतम् ।।
ज्वरघ्नं रोचकं ग्राहि स्वादुपाकि त्रिदोषनुत् ।
तृष्णादाहवमिश्वासकासकार्श्यक्रिमिप्रणुत् ।।
(भा० प्र०, हरीतक्यादिवर्ग; 86–88)

धातकी

धातकी धातुपुष्पी च ताम्रपुष्पी च कुञ्जरा ।
सुभिक्षा बहुपुष्पी च वह्निज्वाला च सा स्मृता ।।
धातकी कटुका शीता मदकृत्तुवरा लघुः ।
तृष्णाऽतीसारपित्तास्रविषक्रिमिविसर्पजित् ।।
(भा० प्र०, हरीतक्यादिवर्ग; 186–187)

एरण्ड

एरण्डमूलं वृष्यवातहराणाम् ।
(च० सू०; 25/40)

शुक्ल एरण्ड आमण्डश्चित्रो गन्धर्वहस्तकः ।
पञ्चाङ्गुलो वर्द्धमानो दीर्घदण्डो व्यडम्बकः ।।
वातारिस्तरुणश्चापि रुबूकश्च निगद्यते ।
रक्तोऽपरो रुबूकः स्यादुरुबूको रुबुस्तथा ।।
व्याघ्रपुच्छश्च वातारिश्चञ्चुरुत्तानपत्रकः ।
एरण्डयुग्मं मधुरमुष्णं गुरु विनाशयेत् ।
शूलशोथकटीबस्तिशिरः पीडोदरज्वरान् ।
ब्रध्नश्वासकफानाहकासकुष्ठाममारुतान् ।।
(भा० प्र०, गुडूच्यादिवर्ग; 60–63)

गम्भारी

काश्मरी कटुका तिक्ता गुरूष्णा कफशोफनुत् ।
त्रिदोषविषदाहार्त्ति-ज्वरतृष्णास्रदोषजित् ।।
(रा० नि०, प्रभद्रादिवर्ग; 38)

गोक्षुर (मूल, फल)

गोक्षुरको मूत्रकृच्छ्रानिलहराणाम् ।
(च० सू०; 25/40)

गोक्षुर :क्षुरकोऽपि स्यात्त्रिकण्टः स्वादुकण्टकः ।
गोकण्टको गोक्षुरको वनश्रृगांट इत्यपि ।।
पलङ्कषाश्ववंष्ट्रा च तथा स्यादिक्षुगन्धिका ।
गोक्षुरः शीतलः स्वादुर्बलकृद्वस्तिशोधनः ।।
मधुरो दीपनो वृष्यः पुष्टिदश्चाश्मरीहरः ।
प्रमेहश्वासकासार्शःकृच्छ्रहृद्रोगवातनुत् ।।
(भा० प्र०, गुडूच्यादिवर्ग; 44–46)

गुडूची

अमृता सांग्राहिक-वातहर-दीपनीय-श्लेष्मशोणित विबन्धप्रशमनानाम् ।
(च० सू०; 25–40)

गुडूची कटुका तिक्ता स्वादुपाका रसायनी ।।
संग्राहिणी कषायोष्णा लघ्वीबल्याऽग्निदीपिनी ।
दोषत्रयाभतृड्दाहमेहकासांश्च पाण्डुताम् ।।
कामलाकुष्ठवातास्रज्वर क्रिमिवमीन्हरेत् ।
प्रमेहश्वासकासार्शः कृच्छ्रहृद्रोगवातनुत् ।।
(भा० प्र०, गुडूच्यादिवर्ग; 8–10)

गुग्गुलु

मेदोऽनिले गुग्गुलुः ।
(अ० हृ०, उ० स्था०; 40/48)

गुग्गुलुर्देवधूपश्च जटायुः कौशिकः पुरः ।
कुम्भोलूखलकं क्लीबे महिषाक्षः पलङ्कषः ।।
गुग्गुलुर्विशदस्तिक्तो वीर्योष्णः पित्तलः सरः ।
कषायः कटुकः पाके कटू रूक्षो लघुः परः ।।
भग्नसंधानकृद् वृष्यः सूक्ष्मः स्वर्यो रसायनः ।
(भा० प्र०, कर्पूरादिवर्ग; 32, 38½)

गुञ्जा (मूल, बीज)

गुञ्जाद्वयन्तु केश्यं स्याद्वातपित्तज्वरापहम् ।
कृमीन्द्रलुप्तकुष्ठानि रक्ता च धवलाऽपि ।।
(भा० प्र०, गुडूच्यादिवर्ग; 126–128)

गुञ्जाऽनुष्णा रसे तिक्ता कषाया कफपित्तहा ।
चक्षुष्या शुक्रला केश्या त्वच्या रुच्या बलप्रदा ।।
इन्द्रलुप्तहरा तीव्रा सविषा मदमोहकृत् ।
हन्ति रक्षोग्रहविषं कण्डूकुष्ठव्रणक्रिमीन् ।।
(कै० दे० नि०, ओषधिवर्ग; 785–796)

हरिद्रा

हरिद्रा स्वरसे तिक्ता रूक्षोष्णा विषमेहनुत् ।
कण्डूकुष्ठव्रणान्हन्ति देहवर्णविधायनी ।।
विशोधनी कृमिहरा पीनसारुचिनाशिनी ।
(ध० नि०, गुडूच्यादिवर्ग; 55½)

हरिद्रा काञ्चनी पीता निशाऽख्या वरवर्णिनी ।
कृमिघ्नी हल्दी योषित्प्रिया हट्टविलासिनी ।।
हरिद्रा कटुका तिक्ता रुक्षोष्णा कफपित्तनुत् ।
वर्ण्या त्वग्दोषमेहास्रशोथपाण्डुव्रणापहा ।।
(भा० प्र०, हरीतक्यादिवर्ग; 96–197)

हरीतकी

हरीतकी पञ्चरसामुष्णामलवणां शिवाम् ।
दोषानुलोमनीं लघ्वीं विद्याद्दीपनपाचनीम् ।।

आयुष्यां पौष्टिकीं धन्यां वयसः स्थापनीं पराम् ।
वर रोगप्रशमनीं बुद्धीन्द्रियबलप्रदाम् ॥
कुष्ठं गुल्ममुदावर्तं शोषं पाण्ड्वामयं मदम् ।
अर्शांसि ग्रहणीदोष पुराणं विषमज्वरम् ॥
हृद्रोगं सशिरोरोगमतीसारमरोचकम् ।
कासं प्रमेहमानाहं प्लीहानमुदरं नवम् ॥
कफप्रसेकं वैस्वर्यं वैवर्ण्यं कामलां क्रिमीन् ।
श्वयथुं तमकं छर्दि क्लैब्यमङ्गावसादनम् ॥
स्रोतोविबन्धान् विविधान् प्रलेपं हृदयोरसोः ।
स्मृतिबुद्धि प्रमोहं च जयेच्छीघ्रं हरीतकी ॥
(च० चि०; 29–34)

हरीतक्यभया पथ्या कायस्था पूतनाऽमृता ।
हैमवत्यव्यथा चापि चेतकी श्रेयसी शिवा ॥
वयस्था विजया चापि जीवन्ती रोहिणीति च ॥
(भा. प्र०, हरीतक्यादिवर्ग; 6–7)

हिंगु

हिंगुनिर्यासश्छेदनीयदीपनीयानुलोमिकवातकफप्रशमनानाम् ।
(च० सू०; 25/40)

सहस्रवेधि जतुकं बाह्लीकं हिङ्गुरामठम् ।
हिङ्गूष्णं पाचनं रुच्यं तीक्ष्णं वातबलासनुत् ॥
शूलगुल्मोदरानाहकृमिघ्नं पित्तवर्द्धनम् ।
(भा० प्र०, हरीतक्यादिवर्ग; 100–101)

जटामांसी

मांसी कृष्णजटा हिंस्रा नलदा जटिला मिशी ।
जटा च पिशिता पेशी क्रव्यादी च तपस्विनी ॥
मांसी स्वादुकषाया स्यात्कफपित्तास्रनाशिनी ।
विषमारुतहृद्बल्या त्वच्या कान्तिप्रसादनी ॥
(ध० नि०, चन्दनादिवर्ग; 43–44)

जटामांसी भूतजटा जटिला च तपस्विनी ।
मांसी तिक्ता कषाया च मेध्या कान्तिबलप्रदा ।
स्वाद्वी हिमा त्रिदोषास्रदाहवीसर्पकुष्ठनुत् ॥
(भा प्र०, कर्पूरादिवर्ग; 89)

जातीफल

जातीफलं जातिसस्यं शालूकं मालतीफलम् ।
मदशौण्डं जातिभृङ्गं पुटं सौमनसं फलम् ॥
जातीफलं कषायोष्णं कटु कण्ठामयार्तिजित् ।
वातातिसारमेहघ्नं लघु वृष्यं च दीपनम् ॥
(ध० नि०, चन्दनादिवर्ग; 33–34)

जातीफलं रसे तिक्तं तीक्ष्णोष्णं रोचनं लघु ॥
कटुकं दीपनं ग्राहि स्वर्यं श्लेष्मानिलापहम् ॥
निहन्ति मुखवैरस्यं मलदौर्गन्ध्यकृष्णताः ।
कृमिकासवमिश्वासशोषपीनसहृद्रुजः ॥
(भा० प्र०, कर्पूरादिवर्ग; 54–55)

कम्पिल्ल

कम्पिल्लकोऽथ रक्ताङ्गो रेची रेचनकस्तथा ।
रञ्जनो लोहिताङ्गश्च कम्पिल्लो रक्तचूर्णकः ॥
कम्पिल्लको वरेची स्यात् कटूष्णो व्रणनाशनः ।
गुल्मोदरविबन्धाध्मश्लेष्मक्रिमिविनाशनः ॥
(ध० नि०, चन्दनादिवर्ग; 124–125)

काम्पिल्लः कर्कशश्चन्द्रो रक्ताङ्गो रोचनोऽपि च ॥
काम्पिल्लः कफपित्तास्रकृमिगुल्मोदरव्रणान् ।
हन्ति रेची कटूष्णश्च मेहानाहविषाश्मनुत् ॥
(भा० प्र०, हरीतक्यादिवर्ग; 146–147)

काञ्चनार

काञ्चनारः काञ्चनको गण्डारिः शोणपुष्पकः ।
काञ्चनारो हिमो ग्राही तुवरःश्लेष्मपित्तनुत् ॥
कृमिकुष्ठगुदभ्रंशगण्डमालाव्रणापहः ।
(भा० प्र०, गुडूच्यादिवर्ग; 101, 103)

कंकोल

कङ्कोलं कटुतिक्तोष्णं वक्त्रवैरस्यनाशनम् ।
मुखजाड्यहरं रुच्यंवा तश्लेष्महरं परम् ॥
(ध० नि०, चन्दनादिवर्ग; 36)

कङ्कोलं कोलकं प्रोक्तं तथा कोषफलं स्मृतम् ।
कङ्कोलं लघु तीक्ष्णोष्णं तिक्तं हृद्यं रुचिप्रदम् ॥
आस्यदौर्गन्ध्यहृद्रोगकफवातामयान्ध्यहृत् ।
(भा० प्र०, कर्पूरादिवर्ग; 116)

कण्टकारी

.....कण्टकारिका इति दशेमानि कण्ठ्यानि भवन्ति ।
(च० सू०; 4/9)

कण्टकारिका इति दशेमानि कासहराणि भवन्ति ।
(च० सू०; 4/36)

कण्टकारिका इति दशेमानि श्वयथुहराणि भवन्ति ।
(च० सू०; 4/ 38

कण्टकार्य इति दशेमानि शीतप्रशमनानि भवन्ति ।
(च० सू०; 4/42)

कण्टकारी तु दुःस्पर्शा क्षुद्रा व्याघ्री निदिग्धिका ।
कण्टालिका कण्टकिनी धावनी दुष्प्रधर्षिणी ।।
कण्टकारी कटुस्तिक्ता तथोष्णा श्वासकासजित् ।
अरुचिज्वरवातामदोषहृद्गदनाशिनी ।।
(ध० नि०, गुडूच्यादिवर्ग; 95–96)

कण्टकारी तु दुःस्पर्शा क्षुद्रा व्याघ्री निदिग्धिका ।
कण्टालिका कण्टकिनी धावनी बृहती तथा ।।38।।
कण्टकारी सरा तिक्ता कटुका दीपनी लघुः ।
रुक्षोष्णा पाचनी कासश्वासज्वर कफानिलान् ।।
निहन्ति पीनसं पार्श्वपीड़ाकृमिहृदामयान् ।।41।।
(भा० प्र०, गुडूच्यादिवर्ग; 38–41)

कण्टकारी कण्टकिनी दुःस्पर्शा दुष्प्रधर्षिणी ।
क्षुद्रा व्याघ्री निदिग्धा च धावनी क्षुद्रकण्टिका ।।
बहुकण्टा क्षुद्रकण्टा ज्ञेया क्षुद्रफला च सा ।
कण्टकारिका चित्रफला स्याच्चतुर्दशसंज्ञका ।।
कण्टकारी कटूष्णा च दीपनी श्वासकासजित् ।
प्रतिश्यायार्त्ति दोषघ्नी कफवातज्वरार्तिनुत् ।।
(रा० नि०, शताह्वादिवर्ग; 30–32)

कन्यासार

वीरास्रावः सहासारः कुमारीरससम्भवः ।
सहासारोऽग्निजननः पित्तनिर्हरणो मतः ।।
बलकृद्रेचनः पुष्पजननो गर्भपातनः ।
विट्सङ्गे कृमिरोगे च सन्यासेऽपस्मृतौतथा ।
लुप्ते रजसि नारीणां शीतपित्ते शिरोरुजि ।
ज्वरे श्लेष्मोद्भवे प्लीह्नि मन्देऽग्नौ च प्रयुज्यते ।।
(आयुर्वेदविज्ञान)

करञ्ज

करञ्ज...फलं जन्तुप्रमेहनुत् ।
रुक्षोष्णंकटुकं पाके लघु वातकफापहम् ।।
(सु०, सू०; 46/197–198)

करञ्जः कटुकस्तीक्ष्णो वीर्योष्णो योनिदोषहृत् ।
कुष्ठोदावर्त्तगुल्मार्शोव्रणकृमिकफापहा ।।
तत्पत्रं कफवातार्शःकृमिशोथहरं परम् ।
भेदनं कटुकं पाके वीर्योष्णं पित्तलं लघु ।।
तत्फलं कफवातघ्नं मेहार्श कृमिकुष्ठजित् ।
(भा० प्र०, गुडूच्यादिवर्ग; 120–121½)

करवीर

करवीरं कटुस्तिक्तो वीर्ये चोष्णो ज्वरापहः ।
चक्षुष्यः कुष्ठकण्डूघ्नः प्रलेपाद्विषमन्यथा ।।
(ध० नि०; करवीरादिवर्ग; 3)

करवीरद्वयं तिक्तं कषायं कटुकञ्च तत् ।
व्रणलाघवकृन्नेत्रकोपकुष्ठव्रणापहम् ।।
वीर्योष्णं कृमिकण्डूघ्नं भक्षितं विषवन्मतम् ।।
(भा० प्र०, गुडूच्यादिवर्ग; 83–84)

कर्कटशृङ्गी

.....शृङ्गी कासहराणि भवन्ति ।
(च० सू०; 4/36)

कुलीरशृङ्गय इति दशेमानि हिक्कानिग्रहणानि भवन्ति ।।
(च० सू०; 4/30)

शृङ्गी कर्कटशृङ्गी च स्यात्कुलीर विषाणिका
अजशृङ्गी च चक्रा च कर्कटाख्या च कीर्तिता ।।
शृङ्गी कषाया तिक्तोष्णा कफवातक्षयज्वरान् ।
श्वासोर्ध्ववाततृट्कासहिक्काऽरुचिर्वमीन्हरेत् ।।
(भा० प्र०, हरीतक्यादिवर्ग; 178–179)

कार्पास (बीज)

तद्बीजं श्लेष्मलं वृष्यं स्निग्धं स्तन्यविवर्धनम् ।।
(कै० दे० नि०, ओषधिवर्ग; 1098)

कार्पासी तुण्डकेशी च समुद्रान्ता च कथ्यते ।
कार्पासकी लघुः कोष्णा मधुरा वातनाशिनी ।।
तत्पलाशं समीरघ्नं रक्तकृन्मूत्रवर्द्धनम् ।
तत्कर्णपिडकानादपूयास्रावविनाशनम् ।।
तद्बीजं स्तन्यदं वृष्यं स्निग्धं कफकरं गुरु ।।
(भा० प्र०, गुडूच्यादिवर्ग; 151–152)

कार्पासी मधुरा शीता स्तन्या पित्तकफापहा ।
तृष्णादाहश्रमभ्रान्ति मूर्च्छाहृद्बलकारिणी ।।
(रा० नि०, शताह्वादिवर्ग; 189)

कशेरु

कशेरुकद्वयं शीतं मधुरं तुवरं गुरु ।
पित्तशोणित दाहघ्नं नयनामयनाशनम् ।।
ग्राहि शुक्रानिल श्लेष्मारुचिस्तन्यकरं स्मृतम् ।।
(भा० प्र०, शाकवर्ग; 113)

केतकी

केतकः कटुकः स्वादुर्लघुस्तिक्तकफापहः ।
उष्णा तिक्तरसा ज्ञेया चक्षुष्या हेमकेतकी ।।
(भा० प्र०, पुष्पादि वर्ग; 43)

खदिर

खदिरः कुष्ठघ्नानाम् ।
(च० सू०; 25/40)

खदिरः शीतलो दन्त्यः कण्डूकासारुचिप्रणुत् ।।
तिक्तः कषायो मेदोघ्नः कृमिमेहज्वरव्रणान् ।
श्वित्रशोथामपित्तास्रपाण्डुकुष्ठकफान् हरेत् ।।
(भा० प्र०, वटादि वर्ग; 31–32)

किराततिक्त

किराततिक्तः कैरातः कटुतिक्तः किरातकः ।।
काण्डतिक्तोऽनार्यतिक्तो भूनिम्बो रामसेनकः ।
किरातकोऽन्यो नैपालः सोऽर्द्धतिक्तो ज्वरान्तकः ।।
किरातः सारको रूक्षः शीतलस्तिक्तको लघुः ।
सन्निपातज्वरश्वासकफपित्तास्रदाहनुत् ।
कासशोथतृषाकुष्ठज्वरव्रणकृमिप्रणुत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 153–155)

कृष्णजीरक

तीक्ष्णोष्णं कटुकं पाके रुच्यं पित्ताग्निवर्धनम् ।
कटु श्लेष्मानिलहरं गन्धाढ्यं जीरकद्वयम् ।।
(सुश्रुत सू०; 46/229)

जरणा कटुरुष्णा च कफशोफनिकृन्तनी ।
रुच्याऽजीर्णज्वरघ्नी च चक्षुष्या ग्राहिणी परा ।।
(ध० नि०, शतपुष्पादि वर्ग; 71)

कुलत्थ

उष्णतः कुलत्थः रसतः कषायः कटुर्विपाके कफमारुतघ्नः ।
शुक्राश्मरीगुल्मनिषूदनश्च सांग्राहिकः पीनसकासहन्ता ।।
आनाहमेदोगुदकीलहिक्काश्वासापहः शोणित-पित्तकृच्च ।
(सुश्रुत सू०; 46/37)

कुलत्थः कटुकः पाके कषायः पित्तरक्तकृत् ।
लघुर्विदाही वीर्योष्णः श्वासकासकफानिलान् ।।
हन्ति हिक्काऽश्मरीशुक्रदाहानाहान् सपीनसान् ।
स्वेदसंग्राहको मेदोज्वरकृमिहरः सरः ।।
(भा० प्र०, धान्यवर्ग; 60–62)

कुष्ठ

कुष्ठं वातहराभ्यङ्गोपनाहोपयोगिनाम् ।
(च० सू०; 25/40)

कुष्ठमुष्णं कटु स्वादु शुक्रलंतिक्तकं लघु ।
हन्ति वातास्रवीसर्पकासकुष्ठमारुत्कफान् ।
(भा० प्र०, हरीतक्यादि वर्ग; 173)

कुष्ठं रुजाऽगदो व्याधिरामयं पारिभद्रकम् ।
रामं वानीरजं वाप्यं ज्ञेयं त्वग्दोषमुत्पलम् ।।
कुष्ठं कटूष्णं तिक्तं स्यात् कफमारुतकुष्ठजित् ।
विसर्पविषकण्डूति-खर्जूदद्रुघ्नकान्तिकृत् ।।
(रा० नि०, चन्दनादिवर्ग; 115–116)

कुटज

कुटजत्वक् श्लेष्मपित्तरक्त सांग्राहिकोपशोषणानाम् ।
(च० सू०; 25/40)

कुटजः कटुकस्तिक्तः कषायो रूक्षशीतलः ।
कुष्ठातीसारपित्तास्र गुदजानि विनाशयेत् ।।
(ध० नि०, शतपुष्पादि वर्ग; 14)

कुटजः कटुको रूक्षो दीपनस्तुवरो हिमः ।
अर्शोऽतिसार पित्तास्रकफतृष्णाऽऽमकुष्ठनुत् ।।
(भा० प्र०, गुडूच्यादिवर्ग; 118)

लवङ्ग

लवङ्गं देवकुसुमं श्रीसङ्गं श्रीप्रसूनकम् ।
लवङ्गं कटुकं तिक्तं लघुनेत्रहितं हिमम् ।।
दीपनं पाचनं रुच्यं कफपित्तास्रनाशकृत् ।
तृष्णां छर्दि तथाऽऽध्मानं शूलमाशुविनाशयेत् ।
कासंश्वासञ्च हिक्काञ्च क्षयं क्षपयति ध्रुवम् ।।
(भा० प्र०, कर्पूरादि वर्ग; 58–59)

लोध्र

लोध्रो ग्राही लघुः शीतः चक्षुष्यः कफपित्तनुत् ।
कषायो रक्तपित्तासृग्ज्वरातीसारशोथहृत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 216)

मदन

मदनफलं वमनास्थापनानुवासनोपयोगिनाम् ।
(च० सू०; 25/40)

मदनो मधुरस्तिक्तो वीर्योष्णो लेखनो लघुः ।
वान्तिकृद्विद्रधिहरः प्रतिश्यायव्रणान्तकः ।।
रूक्षः कुष्ठकफानाह शोथगुल्मव्रणापहः ।।
(भा० प्र०, हरीतक्यादि वर्ग; 160–161)

मिश्रेया

तिक्ता स्वादुर्हिमा वृष्या वुर्नामक्षयजिन्मिशिः ।
क्षतक्षीणहिता बल्या वातपित्तास्रदोषजित् ।।
(ध० नि०, शतपुष्पादि वर्ग; 5)

न्यग्रोध

वट : शीतो गुरुर्ग्राही कफपित्तव्रणापहः ।
वर्ण्यो विसर्पदाहघ्न : कषायो योनिदोषहृत् ।।
(भा० प्र०, वटादि वर्ग; 2)

वटः कषायो मधुर : शिशिर : कफपित्तजित् ।
ज्वरदाह तृषामोहव्रणशोफापहारक :।।
(रा० नि०, आम्रादि वर्ग; 118)

पाषाणभेद

पाषाणभेद मूत्र विरेचनीयानि भवन्ति ।।
(च० सू०; 4/35)

अश्मभेदो हिमस्तिक्तः कषायो बस्तिशोधनः ।।
भेदनो हन्ति दोषार्शोगुल्मकृच्छ्राश्महृद्रुजः ।
योनिरोगान्प्रमेहांश्च प्लीहशूलव्रणानि च ।।
(भा० प्र०, हरीतक्यादि वर्ग; 184–185)

पाठा

....पाठा स्तन्यशोधनानि भवन्ति ।
(च० सू०; 4/18)

पाठा तिक्तरसा वृष्या विषघ्नी कुष्ठकण्डुनुत् ।।
छर्दिहृद्रोगज्वरजित् त्रिदोषशमनी परा ।
पाठाऽतिसारशूलघ्नी कफपित्तज्वरापहा ।।
(ध० नि०, गुडूच्यादि वर्ग; 70–71)

पाठोष्णा कटुका तीक्ष्णा वातशलेष्महरी लघु : ।
(भा० प्र०, गुडूच्यादि वर्ग० 192½)

भग्नसन्धानकृत्पित्त-दाहातीसारशूलहृत् ।।
(रा० नि०, पिप्पल्यादि वर्ग; 121)

पूग

भेदि सम्मोहकृत्पूगं कषायं स्वादु रोचनम् ।
कफपित्तहरं रूक्षं वक्त्रक्लेदमलापहम् ।।
(ध० नि०, चन्दनादि वर्ग; 38)

पूगं गुरु हिमं रूक्षं कषायं कफपित्तजित् ।
मोहनं दीपनं रुच्यमास्यवैरस्यनाशनम् ।।
(भा० प्र०, आम्रादि वर्ग; 50)

पुनर्नवा (रक्त)

उष्णानि स्वादुतिक्तानि वातप्रशमनानि च ।
तेषु पौनर्नवं शाकं विशेषाच्छोफनाशनम् ।।
(सुश्रुत सू०; 46/255)

पुनर्नवाऽन्या रक्ताख्या क्रूरा मण्डलपत्रिका ।
रक्तकाण्डा वर्षकेतुर्लोहिता रक्तपत्रिका ।।
वैशाखी रक्तवर्षाभूः शोफघ्नी रक्तपुष्पिका ।
विकस्वरा विषघ्नी च प्रावृषेण्या च सारिवे ।।
वर्षाभवः शोणपत्रः शोणः सम्मीलितद्रुमः ।
पुनर्नवो नव्यो नव्यः स्याद्वार्विंशतिसंज्ञया ।।
रक्ता पुनर्नवा तिक्ता सारिणी शोफनाशिनी ।
रक्तप्रदरदोषघ्नी पाण्डुपित्तप्रमर्दिनी ।।
(रा० नि०, पर्पटादि वर्ग; 117–120)

सप्तपर्ण

सप्तपर्णः शुक्तिपर्णश्छत्रपर्णः सुपर्णकः ।
सप्तच्छदो गूढपुष्पस्तथा शाल्मलिपत्रकः ।।
त्रिदोषशमनो हृद्यः सुरभिर्दीपनः सरः ।
शूलगुल्मकृमीन् कुष्ठं हन्ति शाल्मलिपत्रकः ।।
(ध० नि०, चन्दनादि वर्ग; 79–80)

सप्तपर्णो व्रणश्लेष्मवातकुष्ठास्रजन्तुजित् ।
दीपनः श्वासगुल्मघ्नः स्निग्धोष्णस्तुवरः सरः ।।
(भा० प्र०, वटादि वर्ग; 75)

शटी

भवेद्गन्धपलाशी तु कषाया ग्राहिणी लघुः ।
तिक्ता तीक्ष्णा च कटुकाऽनुष्णा ऽऽस्यमलनाशिनी ।
शोथकासव्रणवासशूलसिध्मग्रहापहा ।।
(भा० प्र०, कर्पूरादि वर्ग; 100)

स्नुही

स्नुक्पयस्तीक्ष्णविरेचनानाम् ।
(चरक सू०; 25/40)

सेहुण्डो रेचनस्तीक्ष्णो दीपनः कटुको गुरुः ।
शूलामाष्ठीलिकाध्मानककफगुल्मोदरानिलान् ।।
उन्मादमेहकुष्ठार्शःशोथमेदोऽश्मपाण्डुताः ।
व्रणशोथज्वरप्लीहविषदूषीविषं हरेत् ।।
उष्णवीर्यं स्नुहीक्षीरं स्निग्धञ्च कटुकं लघु ।
गुल्मिनां कुष्ठिनाञ्चापि तथैवोदररोगिणाम् ।।
हितमेतद्विरेकार्थे ये चान्ये दीर्घरोगिणः ।
(भा० प्र०, गुडूच्यादि वर्ग; 73–76)

सूक्ष्मैला

.....एला...श्वासहराणि भवन्ति ।।
(च० सू०; 4/37)

सूक्ष्मैला मूत्रकृच्छ्रघ्नी श्वासकासक्षये हिता ।
सक्ष्मैला शीतला स्वादुर्हृद्या रोचनदीपनी ।।
(ध० नि०, शतपुष्पादि वर्ग; 45)

एला सूक्ष्मा कफश्वासकासार्शोमूत्रकृच्छ्रहृत् ।
रसे तु कटुका शीता लघ्वी वातहरी मता ।।
(भा० प्र०, कर्पूरादि वर्ग; 63)

शुण्ठी

स्निग्धोष्णा कटुका शुण्ठी वृष्या शोफकफारुचीन् ।
हन्ति वातोदरश्वासपाण्डुश्लीपदनाशिनी ।।
(ध० नि०, शतपुष्पादि वर्ग; 83)

शुण्ठी रुच्यामवातघ्नी पाचनी कटुका लघुः ।
स्निग्धोष्णा मधुरा पाके कफवातविबन्धनुत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 45)

स्वर्णपत्री

स्वर्णपत्री तु तिक्तोष्णा भवेत् सुखविरेचनी ।
स्वर्णपत्री कटुस्तिक्ता कषाया च रसे लघुः ।
तीक्ष्णोष्णा रेचनी कोष्ठशुद्धिकृन्मलबन्धनुत् ।।
(प्रि० नि०, शतपुष्पादि वर्ग; 62)

श्वेतजीरक

तीक्ष्णोष्णं कटुकं पाके रुच्यं पित्ताग्निवर्धनम् ।
कटु श्लेष्मानिलहरं गन्धाढ्यं जीरकद्वयम् ।।
(सुश्रुत सू०; 46/229)

गौराजाजी हिमा रुच्या कटुर्मधुरदीपनी ।
कृमिघ्ना विषहन्त्री च चक्षुष्याऽऽध्माननाशिनी ।।
(ध० नि०, शतपुष्पादि वग; 69)

जीरकत्रितयं रूक्षं कटूष्णं दीपनं लघु ।
संग्राहि पित्तलं मेध्यं गर्भाशयविशुद्धिकृत् ।।
ज्वरघ्नं पाचनं वृष्यं बल्यं रुच्यं कफापहम् ।
चक्षुष्यं पवनाध्मानगुल्मच्छर्द्यतिसारहृत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 84–85)

श्वेत सारिवा

सारिवे द्वे तु मधुरे कफवातास्रनाशने ।
कुष्ठकण्डूज्वरहरे मेहदुर्गन्धिनाशने ।।
(ध० नि०, गुडूच्यादि वर्ग; 160)

सारिवायुगलं स्वादु स्निग्धं शुक्रकरं गुरु ।
अग्निमान्द्यारुचिश्वासकासामविषनाशनम् ।
दोषत्रयास्रप्रदरज्वरातीसारनाशनम् ।।
(भा० प्र०, गुडूच्यादि वर्ग; 238)

तगर

तगरं स्यात् कषायोष्णं स्निग्धं दोषत्रयप्रणुत् ।
वृक्शीर्षविषदोषघ्नं भूतापस्मारनाशनम् ।।
(ध० नि०, चन्दनादि वर्ग; 52)

तगरं मधुरंतिक्तं कटु पाके रसे लघु ।
स्निग्धोष्णं तुवरं भूतमदापस्मारनाशनम् ।।
विषचक्षुः शिरोरोगरक्तदोषत्रयापहम् ।।
(कै० दे० नि०, औषधि वर्ग; 1275–1276)

तामलकी

भूधात्री वातकृत्तिका कषाया मधुरा हिमा ।
पिपासाकासपित्तास्रकफपाण्डु क्षतापहा ।।
(भा० प्र०, गुडूच्यादि वर्ग; 278)

तामलकी हिमा तिक्ता कषाया मधुरा लघुः ।
रोचनी पाण्डुपित्तास्रकफकुष्ठविषापहा ।
जयेच्छासतृषादाहहिध्माकासक्षतक्षयान् ।
(क० दे० नि०, औषधि वर्ग; 250)

भू धात्री तु कषायाम्लपित्तमेहविनाशिनी ।
शिशिरा मूत्ररोगार्त्तिशमनी दाहनाशिनी ।।
(रा० नि०, पर्पटादि वर्ग; 93)

त्वक्

वराङ्गं लघु तीक्ष्णोष्णं कफवातविषापहम् ।
कण्ठवक्त्ररुजो हन्ति शिरोहृद्बस्तिशोधनम् ।।
(ध० नि०, शतपुष्पादि वर्ग; 51)

त्वक्स्वाद्वी तु तन्त्वक्स्यात्तथा दारुसितामता ।।
उक्ता दारुसिता स्वाद्वी तिक्ता चानिलपित्तहृत् ।
सुरभिः शुक्ला बल्या मुखशोषतृषापहा ।।
(भा० प्र०, कर्पूरादि वर्ग; 66–67)

त्वक्पत्र

पत्रकं मधुरं किञ्चित्तीक्ष्णोष्णं पिच्छिलं लघु ।
निहन्ति कफवातार्शोहृल्लासारुचिपीनसान् ।।
(भा० प्र०, कर्पूरादि वर्ग; 68)

उदुम्बर

.....उदुम्बर...मूत्रसंग्रहणीयानि भवन्ति।।
(चरक सू०; 4/33)

न्यग्रोधादिर्गणो वृष्यः संग्राही भग्नसाधकः ।
रक्तपित्तहरो दाहमेदोघ्नो योनिदोषहृत् ।।
(सुश्रुत सू०; 38/49)

उदुम्बरो जन्तुफलो यज्ञाङ्गो हेमदुग्धकः ।
उदुम्बरो हिमो रूक्षो गुरुः पित्तकफास्रजित् ।।
मधुरतुवरो वर्ण्यो व्रणशोधनरोपणः ।।
(भा० प्र०, वटादि वर्ग; 8–9)

उपकुञ्चिका

..कुञ्चिका...। रोचनं दीपनं वातकफदौर्गन्ध्य-
नाशनम् ।।
(चरक सू०; 27/307)

पृथ्वीका कटुका पाके रुच्या पित्ताग्निदीपनी ।
श्लेष्माध्मानहराऽजीर्णजन्तुघ्नी च प्रकीर्तिता ।।६०।।
(रा० नि०, शतपुष्पादि वर्ग; 60)

जीरकत्रितयं रूक्षं कटूष्णं दीपनं लघु ।
संग्राहि पित्तलं मेध्यं गर्भाशयविशुद्धिकृत् ।।
ज्वरघ्नं पाचनं वृष्यं बल्यं रुच्यं कफापहम् ।
चक्षुष्यं पवनाध्मानगुल्मच्छर्द्यतिसारहृत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 84–85)

पृथ्वीका कटुतिक्तोष्णा वातगुल्मामदोषनुत् ।
श्लेष्माध्मानहराजीर्णजन्तुघ्नी दीपनी परा ।।
(रा० नि०, पिप्पल्यादि वर्ग; 64)

वरुण

वरुणादिः कफं मेदो मन्दाग्नित्वं नियच्छति ।
आढ्यवातं शिरः शूलं गुल्मं चान्तः सविद्रधिम् ।।
(अ० हृ०, सूत्र; 15/22)

वरुणः पित्तलो भेदी श्लेष्मकृच्छ्राश्ममारुतान् ।।
निहन्ति गुल्मवातास्रकृमींश्चोष्णोऽग्निदीपनः ।
कषायो मधुरस्तिक्तः कटुको रुक्षको लघुः ।।
(भा० प्र०, वटादि वर्ग; 65–66)

वासा

वासको वातकृत्स्वर्यः कफपित्तास्रनाशनः ।
तिक्तस्तुवरको हृद्यो लघुःशीतस्तृड्तिहृत् ।।
श्वासकासज्वरच्छर्दिमेहकुष्ठक्षयापहः ।
(भा० प्र०, गुडूच्यादि वर्ग; 89–90)

विडङ्ग

.... विडंगं कृमिघ्नानाम् ।
(च० सू०; 25/47)

रूक्षोष्णं कटुकं पाके लघु वातकफापहम् ।
ईषत्तिक्तं विषान् हन्ति विडङ्गं कृमिनाशनम् ।।
(ध० नि०, शतपुष्पादि वर्ग; 12)

पुंसि क्लीबे विडङ्गः स्यात्कृमिघ्नो जन्तुनाशनः ।
तण्डुलश्च तथा वेल्लममोघा चित्रतण्डुलः ।।
विडङ्गं कटु तीक्ष्णोष्णं रूक्षं वह्निकरं लघु ।
शूलाध्मानोदरश्लेष्मकृमिवातविबन्धनुत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 111–112)

विजया

विजया रञ्जिका भङ्गा तन्द्राकृद्बहुवादिनी ।
मादनी मादिका मातुः प्रोक्ता गञ्जाकिनिस्तथा ।।
भङ्गा कफहरी तिक्ता ग्राहिणी पाचनी लघुः ।
तीक्ष्णोष्णा पित्तला मोहमदवाग्वाह्निवर्धनी ।।
(ध० नि०, गुडूच्यादि वर्ग; 126–127)

यष्टी

मधुकं चक्षुष्यवृष्यकेश्यकण्ठ्यवर्ण्यविरजनीय-
रोपणीयानाम् ।
(चरक सू०; 25/40)

मधुयष्टी च यष्टी च यष्टीमधु मधुस्रवा ।
यष्टीकं मधुकं चैव यष्ट्याह्वं मधुयष्टिका ।।
मधुयष्टी स्वादुरसा शीता पित्तविनाशिनी ।
वृष्या शोषक्षयहरा विषच्छर्दिविनाशिनी ।।
(ध० नि०, गुडूच्यादिवर्ग; 138–139)

यष्टी हिमा गुरुः स्वाद्वी चक्षुष्या बलवर्णकृत् ।
सुस्निग्धा शुक्रला केश्या स्वर्या पित्तानिलास्रजित् ।
व्रणशोथविषच्छर्दि तृष्णाग्लानिक्षयापहा ।।
(भा० प्र०, हरीतक्यादि वर्ग; 146)

यवानी

यवानी पाचनी रुच्या तीक्ष्णोष्णा कटुका लघुः ।
दीपनी च तथा तिक्ता पित्तला शुक्रशूलहृत् ।
वातश्लेष्मोदरानाहगुल्मप्लीहकृमिप्रणुत् ।।
(भा० प्र०, हरीतक्यादि वर्ग; 76–77)

KVĀTH

वह्नौ तु क्वथितं द्रव्यं श्रृतमाहुश्चिकित्सकाः ।

(Cıraka saṁhitā, Sūtra Sthāna Adhyāya 4/ 8½.)

मृदौ चतुर्गुणं देयं मध्यमेऽष्टगुणं तथा ।
द्रव्ये तु कठिने देयं बुधैः षोडशिकं जलम् ।।

(Dravyaguṇa vijyāna, Paribhāsākhaṇḍa.)

ŚODHANA

उद्दिष्टैरौषधैः सार्द्धं क्रियते पेषणादिकम् ।
मलविच्छित्तये यत्तु शोधनं तदिहोच्यते ।।

(Rasataraṅgiṇi, Taraṅga 2; 52.)

DOLĀYANTRA

द्रवद्रव्येण भाण्डस्य पूरिताधोदकस्य च ।
मुखस्योभयतो द्वारद्वयं कृत्वा प्रयत्नतः ।।
तयोस्तु निक्षिपेद्दण्डं तन्मध्ये रसपोटलीम् ।
बद्ध्वा तु स्वेदयेदेतद्दोलायन्त्रमिति स्मृतम् ।।

(Rasaratnasamuccaya, Adhyāya 9; 3-4.)

BHĀVANĀ

यच्चूर्णितस्य धात्वादेर्द्रवैः सम्पेष्य शोषणम् ।
भावनं तन्मतं विज्ञैर्भाविना च निगद्यते ।।

(Rasataraṅgiṇī, Taraṅga 2; 49.)

दिवा दिवातपे शुष्कं रात्रौ रात्रौ निवासयेत् ।
श्लक्ष्णचूर्णी कृतं द्रव्यं सप्ताहं भावनाविधिः ।।

(Bhaiṣajya ratnāvalī, Paribhāṣāprakaraṇa; 50.)

KĀÑJIKA

अन्नं शाल्यादिसंसिद्धं प्रक्षिप्तं त्रिगुणे जले ।
धान्याम्लं सन्धितं प्रोक्तमारनालं च काञ्जिकम् ।।
शालिकोद्रवमण्डैर्वा सन्धितं काञ्जिकं भवेत् ।।

(Paribhāṣā Prabandha.)

CŪRṆODAKA

रक्तिद्वयोन्मितं चूर्णं पञ्चतोलकसंमिते ।
जले विनिक्षिपेत्प्राज्ञस्त्रियामं स्थापयेद् बुधः ।।
ततः सारकपत्रेण सारयेत्काचपात्रके ।
चूर्णोदकमिति ख्यातं तथैव च सुधोदकम् ।।

(Rasataraṅgiṇī, Taraṅga 11. 216-217.)

PUṬAPĀKA

पुटपाकस्य कल्कस्य स्वरसो गृह्यते यतः ।
अशस्तु पुटपाकानां युक्तिरत्रोच्यते मया ।।
पुटपाकस्य मात्रेयं लेपस्याङ्गारवर्णता ।
लेपं च द्वयंगुलं स्थूलं कुर्याद्वांगुष्ठमात्रकम् ।।
काश्मरीवटजम्ब्वादि पत्रैर्वेष्टनमुत्तमम् ।
पलमात्रं रसो ग्राह्यः कर्षमात्रं मधुक्षिपेत् ।।
कल्कचूर्णद्रवाद्यास्तु देयाः स्वरसवद्बुधैः ।

(Śaraṅgadharasaṁhitā, Madhyamakhaṇḍa Adhyāya 1; 23-25.)

CITRAKA ŚODHANA

रक्तचित्रक मूलं तु चूर्णतोये निमज्जयेत् ।
ततोनिदाघसंशुष्कं शुद्धिमायात्यनुत्तमाम् ।।

(Rasataraṅgiṇī, Taraṅga 24; 575.)

GUÑJĀ ŚODHANA

गुञ्जा काञ्जिकसंस्विन्ना शुद्धिमायाति यामतः ।

(Rasāmṛtam, Pariśiṣta 8; page 147.)

HIṄGU ŚODHANA

रामठं समशुद्धाज्यसंयुतं दर्विकागतम् ।
विपक्वमग्नितापेन शुद्धिमायात्यनुत्तमाम् ।।

(Rasataraṅgiṇī, Taraṅga 24; 578.)

KAMPILLA ŚODHANA

साधारणरसाः सर्वे मातुलङ्गार्द्रकाम्बुना ।
त्रिवारं भाविता शुष्का भवेयुर्दोषवर्जिताः ।।

(Ayurveda prakāsha, Adhyaya 2; 346.)

KARAVĪR ŚODHANA

दोलायन्त्रेण गोदुग्धे शोधयेत् करवीरकम् ।।

(Śāraṅgadhara saṁhitā, Madhyamakhaṇḍa, Adhyāya 12; 300.)

SNUHĪ ŚODHANA

पलद्वयं सुधादुग्धं तोलकद्वयसंमिते ।
चिञ्चादलद्रवे वस्त्रपूते घर्मे विशोषयेत् ।।
द्रवं विशुष्कं विज्ञाय सुधा दुग्धं समाहरेत् ।
ततः सर्वत्र योगेषु प्रयुञ्जीतभिषग्वरः ।।

(Rasataraṅgiṇī, Taraṅga 24; 517-518.)

VIJAYĀ ŚODHANA

विजयां वस्त्रबद्धां तु जलैः प्रक्षालयेद्बुधः ।
हरिद्वर्णं जलं यावत्ततः शुष्कां प्रयोजयेत् ।।

(Rasāmṛta, Pariśiṣta 8; page 147.)

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English equivalents of Ayurvedic clinical conditions and diseases

Sub Class A01D – Characterised by Rogas (Disease)

Group 1/00- Diseases of Eye

SubGroup

1/01-	Abhisyanda	Conjunctivitis(HR)
1/02-	Adhimantha	Glaucoma(MN)
1/03-	Ajkajata	Iris-prolapse or Anterior staphyloma
1/04-	Aklinnavartma	Ankyloblepharon or conjunctivitis
1/05-	Aksipakatyaya	Serpiginous ulcer(Cornea), Hypopyon ulcer, Panopthalmitis
1/06-	Alaji	Internal hordeolum/stye/lacrimal abscess/ Phylctenular keratitis
1/07-	Anjananamika	Stye, Style(HR) / External hordeolum/stye
1/08-	Arbuda(Vartmagata)	Lid tumour
1/09-	Arjuna	Subconjunctival Haemorrhage
1/10-	Arma	Pterygium(HR)
1/11-	Arsovartma	A form of Trachoma
1/12-	Asopha aksi paka	Uveitis or endopthalamitis
1/13-	Avrana sukla	Adherent leucoma(HR)/Corneal opacity
1/14-	Bahala vartma	Multiple chalazion
1/15-	Bisavartma	Porous condition of sebacious gland / xanthelasma
1/16-	Dhumadarsi	Smoky vision
1/17-	Divandhya	Day blindness(HR)
1/18-	Dristi daurbalya	Weak eye-sight(HR)
1/19-	Hatadhimantha	Atrophic bulbi/Phthisis bulbi due to acute congestive glaucoma
1/20-	Hrasvajadya	Retinitis pigmentosa/Choroiditis
1/21-	Kaphaja Abhisyanda	Acute Mucopurulent conjunctivitis or Allergic conjunctivitis
1/22-	Kaphaja Adhimantha	Chronic glaucoma
1/23-	Klinna vartma	A stage of Bleppharitis/conjunctivitis
1/24-	Klistavartma	Allergic conjunctivitis
1/25-	Krcchrunmilana	Blepharospasm or difficulty in opening the eyes
1/26-	Krimi granthi(Netra)	Blepharitis
1/27-	Kukunaka	Ophthalmia neonatorum or Acute conjunctivitis of infants
1/28-	Kukunaka	Conjunctivitis(HR)
1/29-	Kumbhikapadika	Cyst of Zeus gland
1/30-	Kuncana	Blepharospasm
1/31-	Lagana	Chalazion, Meibumiah cyst
1/32-	Linganasa	Cataract
1/33-	Naktandhya	Night blindness(HR)
1/34-	Netranadi	Chronic dacrocystitis or epiphora

1/35-	Netraroga	Diseases of the eye(HR)
1/36-	Netrasrava	Chronic dacrocystitis or epiphora
1/37-	Nimesa	Blinking of the eye lid
1/38-	Paittika Adhimantha	Acute congestive glaucoma
1/39-	Paittika Abhisyanda	Acute catarrhal conjunctivitis
1/40-	Paksmakopa	Trichiasis, Entropion
1/41-	Paksmasata	Falling of eye lashes(HR)/Madarosis
1/42-	Parvani	Phlyctenular conjunctivitis
1/43-	Pilla	Ankyloblepharon/symplepharon/ Blepharophimosis
1/44-	Pistaka	Pinguecula
1/45-	Pittavidagadhadrsti	Day blindness, central cataract
1/46-	Pothaki	Trachoma(HR)
1/47-	Puyalasa	Acute dacrocystitis and lacrimal abscess
1/48-	Raktaja Adhimantha	Congestive glaucoma, secondary glaucoma/ Iridocyclitis
1/49-	Raktaja Abhisyanda	Acute mucopurulent conjunctivitis
1/50-	Sasopha Aksipaka	Uveitis or Panophthalmitis
1/51-	Savrana sukla	Corneal ulcer/Ulcerative Keratitis/Adherent leucoma
1/52-	Sirajala	Scleritis, Haemangioma
1/53-	Sirapidika	Episcleritis
1/54-	Sirotpata	Allergic conjunctivitis, Angioneurotic odema, Episcleritis
1/55-	Sirotpraharsa	Allergic hyperaemia of the eye ball/Acute orbital cellulitis
1/56-	Slesmavidagdhadrsti	Night blindness, retinitis pigmentosa
1/57-	Suktika	Xerophthalmia
1/58-	Suskaksipaka	Xerophthalmia/Trachoma/Uveitis/ Ophthalmoplegia
1/59-	Suskarsa	Polyp of the palpebral conjunctiva
1/60-	Syavavartma	Inflammatory condition of the eye lid
1/61-	Timira	Cataract(HR)
1/62-	Upnaha	Lacrimal cyst or mucocele
1/63-	Utklistavartma	Allergic conjunctivitis
1/64-	Utsangini	Chalazion or Meibomian cyst in lower lid
1/65-	Vartamarsa	A form of Trachoma
1/66-	Vartmakardama	Secondary infection after allergic conjunctivitis
1/67-	Vartmasarkara	Lithiasis conjunctivae (A form of trachoma)
1/68-	Vartmavabandha	Imperfect closure of the lid following inflammatory swelling / Angio-neurotic oedma.
1/69-	Vata paryaya	Ocular pain due to chronic glaucoma or Trigeminal Neuralgia
1/70-	Vatahata vartma	Lagophthalmos/Opthalmoplegia
1/71-	Vataja Abhisyanda	Sub-acute catarrhal conjunctivitis
1/72-	Vatika Adhimantha	Acute congestive glaucoma

2/00- Diseases of Ear

2/01-	Kaphaja karna sula	Chronic suppurative otitis media/chronic otitis externa
2/02-	Karna roga	Ear diseases(HR)
2/03-	Karna srava	Otorrohea/ chronic suppurative otitis media/ otitis externa

2/04-	Karna samsrava	Otorrohea/ chronic suppurative otitis media/ otitis externa
2/05-	Karna paka	Otitis externa or furuncle in the external ear/Sepsis in the ear
2/06-	Karna gutha	Cerumen or wax in the ear
2/07-	Karna sula	Ear-ache/Otalgia(HR)
2/08-	Karna puya	Otitis media
2/09-	Karna nada	Tinnitus(MN)Tinnitus Aurium
2/10-	Karna ksveda	Tinnitus(HR)Tinnitus Aurium
2/11-	Karna vidradhi	Acute suppurative otitis media or acute serous otitis media
2/12-	Karna pratinah	Perforation of tympanic membrane/catarrh of eustachian tube / Acute obstruction of the eustachian tube
2/13-	Karna kandu	Itching sensation in the ear/ pruritis
2/14-	Krmi karna	Maggots in the ear
2/15-	Kucikarnaka	Congenital defermity of the lobule of pinna
2/16-	Palisosa	Atrophy of the pinna
2/17-	Pattika karna sula	Otitis externa/acute serous otitis media
2/18-	Putikarna	Chronic suppurative otitis media/attic suppuration
2/19-	Raktaja karna sula	Acute traumatic otitis
2/20-	Sannipataja karnasula	Acute or chronic suppurative otitis media
2/21-	Vadhirya	Deafness(HR)
2/22-	Vatika karna sula	Otitis externa/acute serous otitis media
2/23-	Vidarika	Dermatitis or eczema of the external ear

3/00- Diseases of Nose

3/01-	Bhransathu	Hypertrophic or chronic rhinitis/frontal sinusitis
3/02-	Dipta	Acute catarrhal condition of nasal mucus membrane
3/03-	Kaphaja Pratiṣyaya	Rhinitis with Kapha predominence
3/04-	Ksvathu	Allergic rhinitis/vasomotor rhinorrhoea
3/05-	Nasa sosa	Rhinitis sicca/atrophic rhinitis
3/06-	Nasanaha	Deviation of the septum/nasal obstruction
3/07-	Nasagata Arbuda	Nasal Tumour
3/08-	Nasapaka	Nasal furunculosis, fissure in nares / Herpes or dermatitis of the vestibule,
3/09-	Nasaparisosa	Rhinitis sicca/atrophic rhinitis
3/10-	Nasaparisrava	Acute or chronic rhinorrhoea
3/11-	Nasapratinaha	Deviation of the septum/nasal obstruction
3/12-	Nasarsa	Nasal polyps
3/13-	Nasasrava	Acute or chronic rhinorrhoea
3/14-	Pratisyaya	Rhinitis
3/15-	Putakaroga	Chronic rhinitis
3/16-	Putinasa	Artophic Rhinitis/Ozena
3/17-	Putinasya	Artophic Rhinitis/Ozena
3/18-	Puyarakta	Hypertrophic or chronic rhinitis/frontal sinusitis
3/19-	Nasagataroga	Naso pharyngeal diseases
3/20-	Pinasa	Ozaena, sinusitis(HR)

3/21-	Suryavarta	Chronic sinusitis(HR)
3/22-	Svayathu	Vasomotor rhinorrhoea
3/23-	Raktaja Pratisyaya	Acute influenza
3/24-	Paittika Pratisyaya	Acute Rhinitis
3/25-	Tridosaja Pratisyaya	Allergic rhinitis/vasomotor rhinorrhoea
3/26-	Slesmic Siroroga	Catarrhal / sinusitis
3/27-	Nasagata raktapitta	Epistaxis
3/28-	Kaphaja Pratisyaya	Hypertrophic rhinitis/chronic rhinitis
3/29-	Nasagata Arbuda	Nasal tumour
3/30-	Vatika Pratisyaya	Sub-acute Rhinitis

4/00- Diseases of Throat

4/01-	Abhighataja Ostha prakopa	Hare lip
4/02-	Adhijihvika	Ranula or cystic swelling
4/03-	Adhrusa	Palatitris or tonsilitis
4/04-	Alasa	Sublingual infected dermal cyst / Sublingual abscess or cancer
4/05-	Ostha roga	Disease of lips
4/06-	Arbuda (Talugata)	Epithilioma
4/07-	Balasa granthi	Pinguecula
4/08-	Ekavrnda	A Tumour in the throat
4/09-	Galarbuda	Benign throat tumour
4/10-	Galaudha	Retropharyngeal abscess
4/11-	Galaugha	Tumour in the throat(HR)
4/12-	Galavidradhi	Retropharyngeal or peritonsilar abscess
4/13-	Galayu	Tonsillitis(HR)
4/14-	Galsundika	Elongated uvula or uvulitis
4/15-	Gilayu	Benign growth or cyst
4/16-	Jihva kantaka	Leukoplakia
4/17-	Jihvagataroga	Disease related to tounge
4/18-	Jihvaroga	Diseases of tongue
4/19-	Jihvastambha	Paralysis of tongue(MN)
4/20-	Jalarbuda	Cyst in the lips
4/21-	Kacchapa	Adenoma of palate
4/22-	Kanthagat roga	Diseases of pharynx and larynx
4/23-	Kantha-roga	Diseases of throat(HR)
4/24-	Kanthasaluka	Adenoid or nasopharyngeal tonsil
4/25-	Kanthasundi	Elongated uvula or uvulitis
4/26-	Kaphaja Osthaprakopa	Herpes labialis
4/27-	Kaphaja jhvakantaka	Chronic Leucoplakia/ Superficial Glossitis
4/28-	Kaphaja Mukhapaka	Subacute or chronic Stomatitis
4/29-	Khandaustha Osthaprakopa	Hare lip
4/30-	Ksataja Osthaprakopa	Hare lip
4/31-	Mahasausira	Gangrinous stomatitis/Cancrum oris

4/32-	Mamsa samghata	Adenoma or fibroma of palate
4/33-	Mamsadusta Osthaprkopa	Epithelioma of lips
4/34-	Mamsatana	Cellulitis or cancer of the throat
4/35-	Mansasamghata	Fibroma or Adenoma
4/36-	Medoja Osthaprakopa	Macrochelia or herpes labialis, hypertrophy of the lips
4/37-	Mukha roga	Diseases of the mouth(HR)
4/38-	Mukhapaka	Stomatitis(HR)
4/39-	Paittika Jihvakantaka	Acute superficial Glossitis/Red glazed tongue
4/40-	Paittika Osthaprakopa	Herpes labialis or simplex or aphthous ulcer
4/41-	Pandara	Cancrum oris/Gangrenous stomatitis
4/42-	Pasana gardaha	Mumps / parotitis
4/43-	Pittaja Mukhapaka	Acute Stomatitis
4/44-	Raktaja Osthaprakopa	Lip-granuloma
4/45-	Rohini(VPKRT)	Diphtheria
4/46-	Sannipatika Osthaprakopa	Aphthous ulcer or carcinoma
4/47-	Sarvasara Mukhapaka	Stomatitis
4/48-	Slesmic Jihvakantaka	Chronic Leucoplakia/ Superficial Glossitis
4/49-	Svarabheda	Hoarseness(HR)
4/50-	Svaraghna	Paralysis of the larynx/ a stage of Asthma / Tuberculosis or cancer of the Larynx
4/51-	Talugat roga	Diseases of palate
4/52-	Talupaka	Palatitis or ulceration of the palate
4/53-	Talupata	Descended palate
4/54-	Talupupputa	Epulis or fibroma or cystic swelling
4/55-	Talusosa	Constitutional disease of cleft palate
4/56-	Tundikeri	Enlarged tonsil/ peritonsilar abscess
4/57-	Tundikeri	Elongated tonsils/Uvulitis(T)
4/58-	Upjihvika	Ranula or cystic swelling
4/59-	Valaya	Benign or malignant tumour in the throat
4/60-	Vataja Mukhapaka	Stomatitis with vata predominence
4/61-	Vatik Jihvakantaka	Chronic Glossitis
4/62-	Vatika Austhaprakopa	Cracked lips/Cheilosis
4/63-	Vidari	Retropharyngeal abscess(after bursting) / Gangrenous stomatitis, Retropharyngeal abscess(after bursting)
4/64-	Vrnda	Tumour of the throat / Pharyngitis

5/00- Dental Diseases

5/01-	Adhidanta	Extra tooth
5/02-	Adhimansa	Impacted wisdom tooth
5/03-	Bhranjanaka	Cracked or fissured tooth
5/04-	Dalana	Toothache/Odontina/cracked tooth
5/05-	Danta chala	Loose tooth
5/06-	Danta vaidarbha	Allergic gums

5/07-	Danta vesta	Pyorrhoea alveolaris(HR)
5/08-	Dantagata roga	Diseases of teeth/ Dental diseases(T)
5/09-	Dantaharsa	Odonitis due to exposed nerve filament, carious tooth/attrition Sensitive tooth(T)/Odontitis(MN)
5/10-	Dantamulagataroga	Disease of gums and toothroots
5/11-	Dantanadi	Sinuses of gums / Aleolar abscess
5/12-	Dantapupputa	Gum boil(HR)
5/13-	Dantapupputaka	Gingivitis, Gumboil, alveolar or apical abscess
5/14-	Dantasarkara	Tartar(MN)
5/15-	Dantavesta	Pyorrhoea alveolaris(HR)
5/16-	Dantavidradhi	Alveolar abscess
5/17-	Dantasula	Toothache
5/18-	Kapalika	Enamel separation
5/19-	Karala	Ill formed tooth
5/20-	Khalivardhani	Wisdom tooth(HR)
5/21-	Krmi danta	Carious tooth/dental caries
5/22-	Mahasausira	Gangrenous stomatitis
5/23-	Sausira	Apical abscess or chronic gingivitis / Gingivitis(HR)
5/24-	Sitada	Spongy gums/bleeding gums
5/25-	Syavadanta	Black tooth
5/26-	Vardhana	Extra tooth

6/00 Skin diseases

6/01-	Alsaka (Kshudra roga)	Lohobiesotich (Skin disease)
6/02-	Arunsika	Seborrhea (MN), ptyriasis capitisis Frunculosis or boils in scalp (HR)
6/03-	Agneya visarpa	Erysipelas vesiculosum
6/04-	Agnidagdha	Burns(HR),Thermal burn
6/05-	Ahiputana	Erythema, napkin rash(MN)
6/06-	Carmakustha	Xerodermia pigmentosa
6/07-	Carmaroga	Diseases of skin (HR)
6/08-	Cippa & kunakha	Onychia(HR)
6/09-	Carmadala	Excoriation
6/10-	Dadru	Ring worm (HR)
6/11-	Dagdha	Thermal or chemical injury
6/12-	Dandaka jvara	Dengue fever(MN)
6/13-	Dandapatanaka	Plenosthotonus(MN)
6/14-	Dhumopahat	Asphyxiation(24)
6/15-	Ekakustha	Erythrodersias
6/16-	Granthi visarpa	Erysiplas Postulosum
6/17-	Granthika jvara	Plague(HR)
6/18-	Gandalaji	Cellulitis of the Cheek
6/19-	Gandroga	Cellulitis of the Cheek
6/20-	Indralupta	Baldness

6/21-	Jatumani	Congenital mole
6/22-	Kacchu	Scabies, Itch(8)
6/23-	Kadara	Corn(MN)
6/24-	Kala jvara	Kalazar(MN)
6/25-	Kandu	Itching(HR)
6/26-	Khalitya	Alopecia
6/27-	Kitibha	Psoriasis
6/28-	Kotha	A kind of skin disease with large round spots (ringworm / impetigo)/Erythema
6/29-	Ksata	Lacerated wound
6/30-	Kunaka	Onychogryphosis
6/31-	Kustha	Leprosy/Skin disease(HR)
6/32-	Masaka	Elevated mole
6/33-	Medoja Granthi	Sebaceous cyst(MN)
6/34-	Nilika	Chloasma/melasmo/melanedermia
6/35-	Nyaccha	Capillary angiomata, naevi(11)
6/36-	Padadari	Chaffed soles(MN)Rhagades(MN)
6/37-	Padminikantaka	Pipilloma of the skin
6/38-	Palita	Premature grey hair / Cavities
6/39-	Pama	Eczema
6/40-	Panatyaya	Acute alcoholism
6/41-	Panavibhrama	Chronic alcoholism
6/42-	Sarkara(ksudra-roga)	Sebaccous horn(MN)
6/43-	Sataru	Erythemas
6/44-	Sita-varsa-anil dagdha	Frost bite(24)
6/45-	Sitapitta	Urticaria
6/46-	Svitra	Leucoderma/Vitiligo(T)
6/47-	Tilkalaka	Non elivated mole
6/48-	Usna-vatatapa dagdha	Heat stroke/Thermic fever(24)
6/49-	Daha	Burning sensation(HR)
6/50-	Vaipadika	Rhagades
6/51-	Vak-graha	Aphonia
6/52-	Vicarcika	Dry & weeping eczema(HR)
6/53-	Vidradhi	Abcess
6/54-	Vipadika	Cracks of skin (HR)
6/55-	Visphotaka	Eruptions(HR)
6/56-	Visarpa	Erysipelas
6/57-	Visarpa (Granthi)	Erysiplas postulosum
6/58-	Visarpa (Kardama)	Erysiplas gangrinosum
6/59-	Vrsana kacchu	Eczema of scrotum(MN)
6/60-	Vyanga	Chloasma of face
6/61-	Yuvana pidika	Acne vulgaris

7/00 Gastrointestinal diseases

7/01-	Adhman	Tympanitis / Flatulance
7/02-	Antrapuchha Pradah (shotha)	Appendicitis
7/03-	Arochaka	Anorexia
7/04-	Agnimandya	Dyspepsia/Loss of appetite(HR)
7/05-	Ahara visa	Food poisoning(HR)
7/06-	Ajirna	Indigestion(HR)
7/07-	Alasaka	Cholera sicca(I),Lichen, Lohobiesoitch(MN)
7/08-	Amaja sula	Intestinal colic(HR)
7/09-	Amlapitta	Hyperacidity(HR)
7/10-	Amlathuysita	Chemosis(Allergic)
7/11-	Anaha	Constipation(HR)
7/12-	Annadravasula	Gastric ulcer/Acute gastritis(HR)
7/13-	Antrasothaja atisara	Diarrhoea due to colitis(HR)
7/14-	Atisara	Acute diarrhoea(HR)
7/15-	Balchardi	Infantile vomiting
7/16-	Balaudarasula	Infantile abdominal pain
7/17-	Balyakrita & pleha vrddhi	Enlargement of liver & spleen
7/18-	Bhasmaka	Polyphagia / excessive hunger
7/19-	Bala Atisara	Infantile diarrhoea(HR)
7/20-	Bala-Jvaratisara	Infantile Diarrhoea with fever(HR)
7/21-	Bala-Malavarodha	Infantile Constipation(HR)
7/22-	Bala-Pravahika	Infantile Dysentry(HR)
7/23-	Bala-Raktatisara	Infantile Dysentry(HR) with bleeding
7/24-	Bala-roga	Diseases of childern and infants(HR)
7/25-	Chardi	Vomiting / Emesis
7/26-	Grahani	Sprue / Malabsorption Syndrome
7/27-	Halimaka	Chronic obstructive jaundice/Chlorosis(MN)
7/28-	Hrllasa	Nausea
7/29-	Jalodara	Ascites(HR)
7/30-	Jvaratisara	Diarrhea with fever(HR)
7/31-	Kamala	Jaundice(HR)
7/32-	Kloma roga	Diseases of pancreas
7/33-	Krmi roga	Worm infestation(HR)
7/34-	Montharaka	a type of fever
7/35-	Paravahika	Dysentry/Gastro-entrocolitis(HR)
7/36-	Parikartika	Fissure-in-ano(MN)
7/37-	Parinamasula	Duodenal ulcer(MN)
7/38-	Pitasmarijanya sula	Biliary colic (HR)
7/39-	Plihodara	Enlargement of spleen(HR)
7/40-	Raktatisara	Blood dysentry(HR)
7/41-	Rasayana	Geriatrics (drugs of)
7/42-	Rohini(VPKRT)	Diphtheria
7/43-	Sanniruddha-guda	Stricture of the rectum
7/44-	Udara-roga	Diseases of the abdomen(HR)

7/45-	Udavarta	Abdominal diseases characterised by retention of afeces(7)
7/46-	Vamana	Vomiting/Emesius(HR)
7/47-	Vatodara	Enlargement of abdomen(due to vata)(4)
7/48-	Vibandha	Constipation
7/49-	Vida vighata	Rectovesical fistula
7/50-	Visucika	Gastro-enteritis/Cholera(MN)
7/51-	Vilambika	Food poisoning
7/52-	Yakrtdalyodara	Enlargement of liver(HR)

8/00 Neurological diseases(CNS)

8/01-	Acaita	Unconciousness
8/02-	Aksepaka	Convulsions(HR)
8/03-	Aksepaka jvara	Meningitis(MN)
8/04-	Anantavata Siroroga	Trigiminal neuralgia
8/05-	Apasmara	Epilepsy
8/06-	Ardhava bhedaka	Hemicrania / Migraine
8/07-	Ardita	Facial Paralysis
8/08-	Bahyayama	Opisthotonus
8/09-	Dandaptanaka	Plenosthotonus
8/10-	Gadagadsvarta	Dysarthria
8/11-	Grahabadha	Seizures
8/12-	Grdhrasi	Sciatica
8/13-	Hanustambha	Lock-jaw(HR)
8/14-	Kalayakhanja	Lytharism(MN)
8/15-	Kampavata	Paralysis agitans/Tremors(HR)/Paralysis agitans
8/16-	Kaphaja Siro-roga	Catarrhal Siro-roga/Sinusitis
8/17-	Katisula	Lumbago(HR)
8/18-	Khalli	Cramps of ankle,knee,hip,wrist,joints
8/19-	Khanja vata	Lameness/Monoplegia(HR)
8/20-	Krmija Siroroga	Headache due to hydatid cyst / Taenia solium / Taenia Echinococcus
8/21-	Manyastambha	Torticolis(HR)
8/22-	Madatyaya	Alcoholism
8/23-	Minminata	Rhinophonia
8/24-	Mukata	Dysphonia
8/25-	Murccha	Syncope(HR)
8/26-	Panatyaya	Acute Alcoholism
8/27-	Panavibhrama	Chronic Alcoholism
8/28-	Paksaghata	Paralysis/Hemiplegia(HR)
8/29-	Pangu	Paraplegia(MN)
8/30-	Parsvasula	Pleurodyria and intercostal neuralgia
8/31-	Prstha sula	Lumbago
8/32-	Puyarakta	Hypertrophic or chronic rhinitis/frontal sinusitis
8/33-	Raktaj Siroroga	Headache due to hypertension / due to Alcohol

8/34-	Sanknak Siroroga	Lateral sinus thrombosis
8/35-	Saisaviva vata	Poliomyeletis(T)
8/36-	Sanyasa	Coma(HR)
8/37-	Sarvanga vata	Quadriplegia(MN)
8/38-	Sarvangata vata	Peripheral Polly neuritis(MN)
8/39-	Hanustambha	Tetanus(MN)
8/40-	Tandra	Drowsiness(T)
8/41-	Trika sula	Sacral pain
8/42-	Trsna	Polydipsia, excessive thirst(T)
8/43-	Tvakgata vata	Peripheral neuritis
8/44-	Unmada	Insanity(HR)/Psychosis(T)
8/45-	Urustambha	Stillness, loss of movement of leg
8/46-	Vata-Vyadhi	Diseases of nervous system(HR)
8/47-	Vatagraha	Aphonia
8/48-	Vatakantaka	Sprain of the ankle(HR)
8/49-	Vatika siroroga	Neuraligic headache
8/50-	Visvaci	Brachial neuralgia(HR)
8/51-	Yosa apasmara	Hysteria

9/00 Musculo - skeletal diseases

9/01-	Amavata	Rheumatism(HR)
9/02-	Asthi bhagna	Bone fracture
9/03-	Asthi Ksaya	Osteomyelitis
9/04-	Krostusirsa	Osteo-Arthritis of knee joint(HR)
9/05-	Phakka roga	Rickets
9/06-	Sandhibhagna	Dislocation of joint
9/07-	Vatarakta	Gout

10/00 Diseases of male genital organs

10/01-	Asthila	Enlarged prostate(HR)
10/02-	Avapatika	Paraphymosis
10/03-	Niruddhprakarsa	Phymosis
10/04-	Parivartika	Paraphymosis
10/05-	Sukadosa	Side effect of drugs applied externally on Penis for increasing its size
10/06-	Vrsana kacchu	Eczema of the scrotum
10/07-	Vrsana vrddhi	Inflammation and enlargement of scrotum(HR)

11/00 Respiratory diseases

11/01-	Ardra-kasa	Cough with expectoration(HR)
11/02-	Bala-kasa	Infantile cough(HR)

11/03-	Balasa	Benign or malignant tumour in the larynx or pharynx
11/04-	Bala Svasa	Infantile Asthama
11/05-	Chinna svasa	Chyne stroke respiration
11/06-	Dhumopahat	Asphyxiation
11/07-	Kasa	Cough/Bronchitis(HR)
11/08-	Jirna-kasa	Chronic cough(HR)
11/09-	Ksataja kasa	Cough due to internal chest injury
11/10-	Ksayaja kasa	Tubercular cough/cough due to weakness or emaciation
11/11-	Suska-kasa	Dry cough(HR)
11/12-	Kukkara kasa	Whooping cough(HR)
11/13-	Mahasvasa	Biot's breathing
11/14-	Rajayaksma	Tuberculosis, Pthysis(T)
11/15-	Rohini	Diptheria
11/16-	Svasa	Dyspnoea(HR)
11/17-	Svasnaka jvara	Pneumonia(HR)
11/18-	Tamaka svasa	Bronchial Asthma(T)
11/19-	Urah ksata	Pulmonary cavitation
11/20-	Urastoya	Pleurisy(HR)(Hydrothorax)(MN)
11/21-	Urdhva svasa	Stertorous breathing

12/00 Diseases related to Gynae and Obstt.

12/01-	Apatanaka	Post partum eclampsia
12/02-	Asrgdara	Metrorrhagia / Menorrhagia
12/03-	Bandhyathva	Infertility
12/04-	Bhaga-sotha	Vulvitis(HR)
12/05-	Garbhapata	Abortion / miscarriage
12/06-	Garbhasaya Bhransa	Pralapse of the Uterus
12/07-	Kastartava	Dysmenorrhoea
12/08-	Makkala Sula	After pains
12/09-	Mudagarbha	Foetal malpresentation
12/10-	Nastartava	Amenorrhoea
12/11-	Rajorodha	Amenorrhoea / oligomenorrhoea
12/12-	Rakta gulma	Uterine tumour
12/13-	Rakta pradara	Menorhagia / Metrorhagia
12/14-	Stanyadosa	Lactal disorder
12/15-	Stanya vidradhi	Abcess of the breast
12/16-	Striroga	Diseases of female genetal ograns
12/17-	Sutika jvara	Puerparial fever
12/18-	Sveta prada	Leucorrhoea
12/19-	Yoni daha	Vaginitis
12/20-	Yoni Kandu	Dryness and itching vagina

13/00 Diseases of Urinary system

13/01-	Haridrameha	Biluria
13/02-	Hastimeha	False incontinence of urine
13/03-	Iksumeha	Alimentary glycosuria(MN) / Glycosuria
13/04-	Kalameha	Melanuria
13/05-	Ksarameha	Alkaline urine
13/06-	Majjameha	Hemoglobinuria
13/07-	Hastimeha	Incontinence from overflow
13/08-	Raktameha	Haematuria
13/09-	Sukrameha	Spermaturia
13/10-	Udakameha	Polyuria, Diabetes inspidus
13/11-	Manjistha meha	Haemoglobinuriea
13/12-	Mutraghata	Retention of urine(HR)
13/13-	Mutraganthi	Enlarged prostate/tumour of the bladder
13/14-	Mutrajathara	Distended bladder/complete retention of urine
13/15-	Mutrakrcehra	Dysuria(HR)
13/16-	Mutraksaya	Anurea/suppression of urine
13/17-	Mutraroga	Diseases of the urinary system(HR)
13/18-	Mutrasada	Scanty urination
13/19-	Mutrasmari	Stone in Bladder/Urolythiasis/Calculus(HR)
13/20-	Mutrasukra	Spermaturia
13/21-	Mutratita	Incontinence of urine/partial retention of urine
13/22-	Mutrotsanga	Stricture of urethra
13/23-	Nilameha	Indican urea
13/24-	Pistameha	Chyluria
13/25-	Prameha / Meha	Urinary disorders(HR)/Poly urea(T)
13/26-	Pratyasthila	Recto vescular tumour
13/27-	Sandrameha	Phosphaturia(MN)
13/28-	Sikatameha	Lithuria
13/29-	Somaroga	Polyuria in female(Diabetes like disease)
13/30-	Surameha	Acetonuria(MN)
13/31-	Usnavata	Cystitis/urethritis
13/32-	Vasameha	Lipuria
13/33-	Vasti sula	Pain in urinary bladder
13/34-	Vastikundala	Atonic condition of bladder
13/35-	Vatabasti	Retention of urine
13/36-	Vatakundalika	Spasmodic stricture of urinay tract
13/37-	Vrkka roga	Diseases of the kidney (HR)
13/38-	Vrkka sula	Renal colic(HR)

14/00 Cardio vascular diseases

14/01-	Hrd-roga	Diseases of heart(HR)

14/02-	Hrdsula	Angina prectoris
14/03-	Krmija Hrdroga	Heart disease with infective pathology
14/04-	Paittika Hrdroga	Heart disease with Pitta predominence
14/05-	Pratamaka svasa	Cardiac Asthma(T)
14/06-	Vyanabala vaisamya	High blood pressure
14/07-	Siragranthi	Aneurysm(MN)
14/08-	Vatika Hrdroga	Heart disease with Vata predominence

15/00 Toxicological conditions

15/01-	Alarka visa	Rabies
15/02-	Dusivisa	Slow cumulative poisoning
15/03-	Jangama visa	Poisoning From animals and animal products(HR)
15/04-	Luta visa	Spider bite(HR)
15/05-	Maksika Dansa	Fly bite / Insect bite
15/06-	Madatyaya	Alcoholism(HR)
15/07-	Malla vikara	Arsenic poisoning(HR)
15/08-	Musaka visa	Rat bite poisoning(HR)
15/09-	Naga visa	Lead poisoning(HR)
15/10-	Panatyaya	Acute alcoholism
15/11-	Panavibhrama	Chronic alcoholism
15/12-	Parada vikara	Mercurial poisoning(HR)
15/13-	Parigarbhika	Pinning
15/14-	Sarpadansa	Snake bite(HR)
15/15-	Sthavara visa	Poisoning From vegetable products(HR)
15/16-	Visa	Poisoning(HR)
15/17-	Vrschika damsa visa	Scorpion sting poison(HR)

16/00 Endocrinal diseases

16/01-	Galaganda	Goitre
16/02-	Madhumeha	Diabetes mellitus(HR)
16/03-	Prameha pidika	Carbuncle(HR)
16/04-	Udakameha	Polyurea / Diabetes insipidus

17/00 Ano-Rectal diseases

17/01-	Arsa	Piles / Ano- rectal growths
17/02-	Bhagandara	Fistula-in-ano
17/03-	Guda Bhransa	Prolapse of rectum / prolapsus ani
17/04-	Guda roga	Disease of ano-rectum
17/05-	Parikartika	Fissure in ano
17/06-	Sanniruddha guda	Stricture of the rectum

18/00 Lymphatic diseases

18/01-	Apaci	Chronic lymphadenitis
18/02-	Gandamala	Scrofula
18/03-	Granthika jvara	Plague
18/04-	Slipada	Elephantiasis / Filariasis

19/00 Viral diseases

19/01-	Masurika	Small pox
19/02-	Romantika	Measles

20/00 Miscellaneous diseases

20/1 -	Abhinyasa Jvara	Meningitis
20/2 -	Antarayama	Opisthotonus
20/3 -	Antarika Vidradhi	Internal Abssess
20/4 -	Antra Vrddhi	Hernia
20/5 -	Antrika Jvara	Enteric Fever
20/6 -	Anyatovata	Referred pain in the eye / sphenoidal sinusitis
20/7 -	Arbuda	Tumour
20/8 -	Bala Jvara	Infantile Fever
20/9 -	Bhrama	Giddiness
20/10 -	Chinna Vrana	Excised Wound
20/11 -	Daha	Burning Sensation
20/12 -	Dandaka jvara	Dengue fever
20/13 -	Dhatuksaya	Neurasthenia, impairment of memory, impotency
20/14 -	Ghrsda Vrana	Abrasion
20/15 -	Granthi	Cyst
20/16 -	Gulma	Chronic Obstructive jaundice / Chlorosis
20/17 -	Hikka	Hiccough
20/18 -	Kala jvara	kalazar
20/19 -	Kaphaja javara	Fever with kapha predominance
20/20 -	Kaphodara	Enlargement of abdomen (due to kapha)
20/21 -	Krsata	Marasmus / Emaciation
20/22 -	Krmi roga	Worm infestatioon
20/23 -	Krmi janya sula	Pain due to worms
20/24 -	Ksayaja siroroga	Tuberculos headache
20/25 -	Medovrddhi	Obesity
20/26 -	Nava jvara	fever upto 7 days
20/27 -	Nadi	Sinus / Fistula / Pulse
20/28 -	Paittika Jvara	Fever with Pitta predominance
20/29 -	Pralepaka jvara	Hectic fever
20/30 -	Punaravartaka Jvara	Relapsing fever

20/31 -	Paittic Siro-roga	Bilious headache
20/32 -	Pandu	Anaemia
20/33 -	Raktapitta	Haemorrhagic diseases
20/34 -	Raktasrava	Bleeding
20/35 -	Sandhika Jvara	Rheumatic fever
20/36 -	Sannipatika jvara	Typhoid fever
20/37 -	Sirahsula	Headache
20/38 -	Snayuka roga	Dracontiasis, guinea worm
20/39 -	Sosa	Emaciation
20/40 -	Sotha	Oedema (HR)
20/41 -	Sula	Colic
20/42 -	Trsna	Polydipsia, Excessive thirst
20/43 -	Usna-vatatapadagdha	Heat stroke / thermic fever
20/44 -	Vata sleshmika jvara	Influenza
20/45 -	Vatika jvara	Fever with vata predominance
20/46 -	Visama jvara	Malaria / Inter mittent fever
20/47 -	Viddha vrana	Punctured wound
20/48 -	Vrana	Ulcer
20/49 -	Vrana Sotha	Inflammation
20/50-	Vataja Sula	Body ache
20/51-	Vata Vikar	Disease with Vata predominence
20/52	Kapha Vikar	Disease with Kapha predominence
20/53-	Pitta Vikar	Disease with Pitta predominence

A01E - Pharamaceutical Preparations Characterized by Action(Karm)

Groups

1/1 -	Adhamanakara	Causing flatulence
1/2 -	Adhobhagahara	Purgative
1/3 -	Agada	Anti-poison
1/4 -	Agnidaha	Cauterisation
1/5 -	Agnisadana	Depressing digestive fire
1/6 -	Agnivardhana	Promoting digestive fire
1/7 -	Aharya	Extractable
1/8 -	Amahara	Alleviating ama
1/9 -	Angamandaprasamana	Pacifying body ache
1/10 -	Anjana	Collyrium
1/11 -	Annadvesa	Aversion to food
1/12 -	Antah Parimarjana	Internal cleansing
1/13 -	Anulepa	After paste
1/14 -	Anupana	Intake of vehicle following drug
1/15 -	Anuvasana	Unduous enema

1/16 -	Anuvasanopaga	Supporting unctuous enema
1/17 -	Apakarsana	Extraction
1/18 -	Apatarpana	Desaturation
1/19 -	Arsoghna	Anti-haemorrhoid
1/20 -	Asthapanopaga	Supporting non-unctuous enema
1/21 -	Asukari	Immediately acting
1/22 -	Asyotana	Application of drops
1/23 -	Atapa	Sun
1/24 -	Ausadha-Pana	Potion
1/25 -	Avacuranana	Application as powder
1/26 -	Avagaha	Dipping in water
1/27 -	Avapidana	Hand Pressing
1/28 -	Avarodhana	Confinement
1/29 -	Avasadana	Depressing elevated wound
1/30 -	Avrsya	Non-aphrodisiac
1/31 -	Ayusya	Beneficial for life span
1/32 -	Ayusyakara	Providing longevity
1/33 -	Balya	Strength promoting
1/34 -	Bhedaniya	Useful for breaking
1/35 -	Brmhaniya	Beneficial for bulk promoting
1/36 -	Cakshusya	Beneficial for eyes
1/37 -	Chedana	Excision
1/38 -	Chhardinigrahana	Anti-emetic
1/39 -	Chhedaniya	Channel cleansing
1/40 -	Cusana	Sucking
1/41 -	Dahaprasamana	Pacifying bruning sensation
1/42 -	Dantagharsana	Rubbing the teeth
1/43 -	Dhavana	Running
1/44 -	Dhupana	Fumigation
1/45 -	Dipaniya	Useful for stimulating digestive fire
1/46 -	Drstiprasadana	Clearing vision
1/47 -	Gandanut	Alleviating enlarged gland
1/48 -	Gandusa	Gargle
1/49 -	Garbhapatana	Abortificient
1/50 -	Gudalepa	Pasting on anus
1/51 -	Gulmaghna	Destroying abdominal lump
1/52 -	Harsana	Exhilaration
1/53 -	Hikkanigrahana	Anti-hiccough
1/54 -	Hrdya	Wholesome for heart
1/55 -	Jivaniya	Vitaliser
1/56 -	Jvarahara	Antipyretic
1/57 -	Kamalahara	Alleviating Jaundice
1/58 -	Kandughna	Anti-pruritic
1/59 -	Kanthya	Beneficial for throat
1/60 -	Karna Purana	Ear drop
1/61 -	Karnasulaghna	Alleviating earache

1/62 -	Karnatarpana	Saturating the ears
1/63 -	Karsana	Emaciating
1/64 -	Karsana	Emaciating
1/65 -	Karsana	Reducing
1/66 -	Kasahara	Anti-tussive
1/67 -	Kavalagraha	Gargle
1/68 -	Kesya	Beneficial for hairs
1/69 -	Kilasaghna	Alleviating vitiligo
1/70 -	Kledana	Moistening
1/71 -	Klibata	Impotency
1/72 -	Kopana	Aggravating factor
1/73 -	Krimighna	Anthelmintic
1/74 -	Ksapana	Diminishing measure
1/75 -	Kusthaghna	Anti-dermal disease
1/76 -	Lekhaniya	Emaciating
1/77 -	Mutrasamgrahaniya	Anti-diuretic
1/78 -	Mutravirajaniya	Normalising colour of the urine
1/79 -	Mutravirecaniya	Diuretic
1/80 -	Nasya	Snuffing
1/81 -	Nirvapana	Extinguishing
1/82 -	Nispidana	Compression
1/83 -	Nivata	Wind-less
1/84 -	Ojovardhana	Energy providing
1/85 -	Osadhi-Dharana	Wearing herbs
1/86 -	Pacana	Ripening, Digestive Measures
1/87 -	Pana	Intake, potion
1/88 -	Pancakarma	Five (Evacuative) Measures
1/89 -	Pariseka	Sprinkling (Bath)
1/90 -	Patana	Incision
1/91 -	Pattabandhana	Cloth bandage
1/92 -	Picchabasti	Slimy enema
1/93 -	Picu	Swab, Tampon
1/94 -	Pindasveda	Bolus fomentation
1/95 -	Pracchadana	Covering
1/96 -	Pracchana	Scarifying
1/97 -	Pradeha	Unctuous paste
1/98 -	Praitmarsa	Nasal smearing
1/99 -	Prajasthapana	Foetus-Stabilising
1/100 -	Pralepa	Paste
1/101 -	Pratisarana	Local application
1/102 -	Purisasamgrahaniya	Anti-diarrhoeal
1/103 -	Purisavirajaniya	Normalising colour of the faces
1/104 -	Sadhaniya	Wholesome for union promoting
1/105 -	Samatarpana	Saturation
1/106 -	Samjnasthapana	Resuscitative
1/107 -	Samsodhana	Elimination

1/108 -	Santavana	Consoling
1/109 -	Saradaha	Cauterisation by (Iron) arrow
1/110 -	Satmya	Suitable
1/111 -	Secana	Sprinkling media
1/112 -	Seka	Sprinkling
1/113 -	Sirovasti	Head pouch
1/114 -	Sirovirecanopaga	Sub-errhine
1/115 -	Sirsavirecana	Head-evacuation
1/116 -	Sitaprasamana	Pacifying cold
1/117 -	Snana	Bath
1/118 -	Sneha Pana	Intake of uncting substance
1/119 -	Snehana	Unction
1/120 -	Snehopaga	Promoting unction
1/121 -	Sonitasthapana	Restoring normalcy of blood
1/122 -	Sosana	Absorption
1/123 -	Sothahara	Anti-inflammatory
1/124 -	Sramahara	Removing tiredness
1/125 -	Sramsana	Purgation
1/126 -	Sravana	Draining
1/127 -	Stambhana	Checking
1/128 -	Stanyajanana	Galactogogue
1/129 -	Stanyajsadhana	Galacto-depurant
1/130 -	Suci-todana	Pricking with needle
1/131 -	Sukrajanana	Semen-promoting
1/132 -	Sukrasodhana	Semen-depurant
1/133 -	Sulaprasamana	Relieving colics
1/134 -	Svasahara	Relieving dyspnoea
1/135 -	Sveda	Sudation
1/136 -	Svedana	Sudation (Fomentation)
1/137 -	Svedopaga	Co-diaphoretic
1/138 -	Tadana	Beating
1/139 -	Tadana	Pricking
1/140 -	Tarpana	Saturating
1/141 -	Tridosaghna	Pacifying three dosas
1/142 -	Trptighna	Alleviating feeling of satiety
1/143 -	Trsnanigrahana	Pacifying thirst
1/144 -	Tvacya	Beneficial for skin
1/145 -	Udardaprasamana	Pacifying allergic rashes
1/146 -	Udgharsana	Rubbing
1/147 -	Udvestana	Twisting
1/148 -	Unmadanasana	Alleviating insanity
1/149 -	Upacayakara	Increasing body weight
1/150 -	Upanaha	Poultice
1/151 -	Upavasa	Fasting
1/152 -	Upaya	Measure
1/153 -	Utkartana	Cutting

1/154 -	Utsadana	Elevating wound
1/155 -	Utsadana	Anointing
1/156 -	Vamanopaga	Sub-emetics
1/157 -	Varnya	Complexion promoting
1/158 -	Vayasthapana	Age-sustaining
1/159 -	Vedanasthapana	Analgesic
1/160 -	Vilayana	Compression
1/161 -	Vilekhana	Scraping
1/162 -	Vilepana	Posting
1/163 -	Virecana	Purgation
1/164 -	Virecanopaga	Sub-purgatives
1/165 -	Visaghna	Anti-poison
1/166 -	Vyayama	Exercise

Definitions

Rasa :

The term 'Rasa' refers to the direct and immediate actio of a drug when it comes in contact with the sense organ of taste i.e. tongue. The existence of different types of rasas (tastes) in different substances is attributed to their varying pancabhautika composition. The 'Rasa' of different substances have difinite relationship to the increase or decrease of Dosha and they have certain actions in the body. The drugs are selected keeping in view their(taste) and the predominate doshas in the body of the patient. There are six tupes of rasas (tastes) Katu(pungent) and kasaya(astringent) etc In other contexts the word rasa also applied to nutrition, to the end product of digestion of food, to the first dhatu(tissue)and to the principal metal drug Mercury etc.

1. Madura- Sweet	2. Amla- Sour	3. Lavana- salty
4. Katu(Pungent)	5. Tikta- Bitter	6. Kashaya- Astringent

Guna :

The term 'guna' refers to the physico-chemical and also the pharmacodynamic properties of drugs and dietary. Articles, which are responsible for the action of therespective drugs/diets in the body. A total of 41 gunas are discribed in Ayurveda but out of these twenty are more important.
These are

1. Guru- Heaviness	2. Laghu- Lightness
3. Sheet- cold	4. Ushna-Hot
5. Snigdha- Unctuousness	6. Ruksha-Non-unctousness or dryness
7. Manda- Dullness	8. Teelshana- Sharpness
9. Sthira- Immobility	10. Chala- Mobility
11. Mrudu- Softness	12. Kathina- Hardness
13. Vishada- Clarity	14. Picchila- Sliminess
15. Shlakshana-Smoothness	16. Khara- Roughness
17. Shkshama- Fineness	18. Sthlla- Bulkiness
19. Sandra- Densness	20. Drava- fluidity

Vipaka :

Vipaka is the aciton of the drug after it has undergone digestive and assimilative transformations. The Vipaka of a drug overcomes the action of ' rasa' (taste) but is itself overcome by virya; vipaka refers to drug metabolism i.e. action of a drug through drug metabolism. The texts describe three kinds of drug metabolism viz. Katu (pungent) amla(sour) madhura(sweet) responsible in turn for increase in vata,pitta and kapha respectively.

Virya :

Virya refers to the potency of a drug/drug action such an action is not accounted for the rasa, guna or vipaka of a drug. According to the most commonly held view virya is of two kinds: usna(Literal meaning; hot) and sita (literal menaning: cold).

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1.	Akārakarabha (Rt.)	*Anacyclus pyrethrum* DC.
2.	Akṣoda (Cotldn.)	*Juglans regia* Linn.
3.	Āmṛāta (St. Bk.)	*Spondias pinnata* (Linn. f.) Kurz.
4.	Apāmārga (W.P.)	*Achyranthes aspera* Linn.
5.	Aparājitā (Rt.)	*Clitoria ternatea* Linn.
6.	Ārdraka (Rz.)	*Zingiber officinale* Rosc.
7.	Arimeda (St.Bk.)	*Acacia leucophloea* Willd.
8.	Arjuna (St.Bk.)	*Terminalia arjuna* W.& A.
9.	Bhallātaka (Frt.)	*Semecarpus anacardium* Linn.
10.	Bhṛṅgarāja (W.P.)	*Eclipta alba* Hassk.
11.	Brāhmī (W.P.)	*Bacopa monnieri* (Linn.) Wettst.
12.	Bṛhatī (Rt.)	*Solanum indicum* Linn.
13.	Cavya (St.)	*Piper retrofractum* Vahl.
14.	Dāḍima (Sd.)	*Punica granatum* Linn.
15.	Dāruharidrā (St.)	*Berberis aristata* DC.
16.	Droṇapuṣpī (W.P.)	*Leucas cephalotes* Spreng.
17.	Ervāru (Sd.)	*Cucumis melo* var. *utilissimus* Duthie & Fuller
18.	Gajapippalī (Frt.)	*Scindapsus officinalis* Schoott.
19.	Gambhārī (Frt.)	*Gmelina arborea* Roxb.
20.	Gāṅgeru (St.Bk.)	*Grewia tenax* (Forsk.) Aschers & Schwf.
21.	Guñja (Rt.)	*Abrus precatorius* Linn.
22.	Ikṣu (St.)	*Saccharum officinarum* Linn.
23.	Indravāruṇī (Rt.)	*Citrullus colocynthis* Schrad.
24.	Indravāruṇī (Lf.)	*Citrullus colocynthis* Schrad.
25.	Jambu (Sd.)	*Syzygium cuminii* (Linn.) Skeels
26.	Jambu (St.Bk.)	*Syzygium cuminii* (Linn.) Skeels
27.	Jayapāla (Sd.)	*Croton tiglium* Linn.
28.	Jayantī (Lf.)	*Sesbania sesban* (Linn.) Merr.
29.	Jyotiṣmatī (Sd.)	*Celastrus paniculatus* Willd.
30.	Kadamba (St.Bk.)	*Anthocephalus cadamba* Miq.
31.	Kākamācī (W.P.)	*Solanum nigrum* Linn.
32.	Kamala (Fl.)	*Nelumbo nucifera* Gaertn.
33.	Kapittha (Frt.Pulp)	*Feronia limonia* (Linn.) Swingle
34.	Karamarda (St.Bk.)	*Carissa carandas* Linn.
35.	Karañja (Rt.Bk.)	*Pongamia pinnata* (Linn.) Merr.
36.	Karañja (Rt.)	*Pongamia pinnata* (Linn.) Merr.
37.	Karañja (St.Bk.)	*Pongamia pinnata* (Linn.) Merr.
38.	Karañja (Lf.)	*Pongamia pinnata* (Linn.) Merr.
39.	Kāravallaka (Fr. Frt.)	*Momordica charantia* Linn.
40.	Kaṭuka (Rz.)	*Picrorhiza kurroa* Royle ex Benth.
41.	Kokilākṣa (W.P.)	*Asteracantha longifolia* Nees
42.	Kokilākṣa (Rt.)	*Asteracantha longifolia* Nees
43.	Kokilākṣa (Sd.)	*Asteracantha longifolia* Nees
44.	Kozuppa (W.P.)	*Portulaca oleracea* Linn.
45.	Lajjālu (W.P.)	*Mimosa pudica* Linn.
46.	Madhuka (Fl.)	*Madhuca indica* J.F. Gmel.
47.	Matsyākṣī (W.P.)	*Alternanthera sessilis* (Linn.) R. Br.

48.	Methī (Sd.)	*Trigonella foenum-graecum* Linn.
49.	Mūlaka (W.P.)	*Raphanus sativus* Linn.
50.	Mūlaka (Rt.)	*Raphanus sativus* Linn.
51.	Murā (Rt.)	*Selinium candollei* DC.
52.	Mūrvā (Rt.)	*Marsdenia tenacissima* Wight. & Arn.
53.	Nāgakeśar (Stmn.)	*Mesua ferrea* Linn.
54.	Nilī (Lf.)	*Indigofera tinctoria* Linn.
55.	Nīlī (Rt.)	*Indigofera tinctoria* Linn.
56.	Nimba (Lf.)	*Azadirachta indica* A. Juss.
57.	Nimba (St.Bk.)	*Azadirachta indica* A. Juss.
58.	Palāśa (St.Bk.)	*Butea monosperma* (Lam.) Kuntze
59.	Pāribhadra (St.Bk.)	*Erythrina indica* Lam.
60.	Pippalīmūla (St.)	*Piper longum* Linn.
61.	Plakṣa (St.Bk.)	*Ficus lacor* Buch.-Ham.
62.	Prasārinī (W.P.)	*Paederia foetida* Linn.
63.	Priyāla (Sd.)	*Buchanania lanzan* Spreng.
64.	Priyaṅgu (Infl.)	*Callicarpa macrophylla* Vahl.
65.	Śāli (Rt.)	*Oryza sativa* Linn.
66.	Śaṅkhapuṣpī (W.P.)	*Convolvulus pluricaulis* Choisy
67.	Śaptalā (W.P.)	*Euphorbia dracunculoides* Lam.
68.	Śatāhvā (Frt.)	*Anethum sowa* Roxb. ex Flem.
69.	Śigru (Lf.)	*Moringa oleifera* Lam.
70.	Sthūlaelā (Sd.)	*Amomum subulatum* Roxb.
71.	Tejovatī (St.Bk.)	*Zanthoxylum armatum* DC.
72.	Tulasī (W.P.)	*Ocimum sanctum* Linn.
73.	Tulasī (Lf.)	*Ocimum sanctum* Linn.
74.	Vacā (Rz.)	*Acorus calamus* Linn.
75.	Vatsanābha (Rt.)	*Aconitum chasmanthum* Stapf ex Holmes
76.	Vidārī (Tub.Rt.)	*Pueraria tuberosa* DC.
77.	Yava (Frt.)	*Hordeum vulgare* Linn.
78.	Yavāsaka (W.P)	*Alhagi pseudalhagi* (Bieb.) Desv.

PHARMACOPOEIAL MONOGRAPHS TO BE PUBLISHED IN AYURVEDIC PHARMACOPOEIA OF INDIA PART-I, VOL. III :

1.	Āḍhakī (Rt.)	*Cajanus cajan* (Linn.) Millsp.
2.	Agnimantha (Rt.)	*Clerodendrum phlomidis* Linn. f.
3.	Ambaṣṭhakī (Rt.)	*Hibiscus sabdariffa* Linn.
4.	Āmra (Sd.)	*Mangifera indica* Linn.
5.	Āmra (St. Bk.)	*Mangifera indica* Linn.
6.	Āmrāta (St.)	*Spondias pinnata* (Linn.f.) Kurz.
7.	Apāmārga (Rt.)	*Achyranthes aspera* Linn.
8.	Araluka (St. Bk.)	*Ailanthus excelsa* Roxb.
9.	Arka (St. Bk.)	*Calotropis procera* (Ait.) R. Br.
10.	Asana (St. Bk.)	*Pterocarpus marsupium* Roxb.
11.	Asthisaṁhṛta (St.)	*Cissus quadrangularis* Linn.
12.	Ātmaguptā (Sd.)	*Mucuna prurita* Hook.
13.	Bhārangī (Rt.)	*Clerodendrum serratum* Linn.
14.	Bījapūra (Frt. Frt.)	*Citrus medica* Linn.
15.	Bilva (Rt.)	*Aegle marmelos* Corr.
16.	Bimbī (W.P.)	*Coccinia indica* W. & A.
17.	Cāṅgerī (W.P.)	*Oxalis corniculata* Linn.
18.	Cirabilva (Frt.)	*Holoptelea integrifolia* Planch
19.	Dantī (Rt.)	*Baliospermum montanum* Muell-Arg.
20.	Dhattūra (Sd.)	*Datura metel* Linn.
21.	Drākṣā (Frt.)	*Vitis vinifera* Linn.
22.	Dūrvā (Rt.)	*Cynodon dactylon* (Linn.) Pers.
23.	Eraṇḍa (Lf.)	*Ricinus communis* Linn.
24.	Eraṇḍa (Sd.)	*Ricinus communis* Linn.
25.	Gambhārī (St.)	*Gmelina arborea* Roxb.
26.	Gojihvā (Aer. Pt.)	*Onosma bracteatum* Wall.
27.	Granthiparṇī (Rt.)	*Leonotis nepetaefolia* R. Br.
28.	Haṁsapadī (W.P.)	*Adiantum lunulatum* Burm
29.	Hapuṣā (Frt.)	*Juniperus communis* Linn.
30.	Indravāruṇī (Frt.)	*Citrullus colocynthis* Schrad.
31.	Indrayava (Sd.)	*Holarrhena antidysenterica* Wall.
32.	Iśvarī (Rt.)	*Aristolochia indica* Linn.
33.	Jātī (Lf.)	*Jasminum officinale* Linn.
34.	Kadali (Rz.)	*Musa paradisiaca* Linn.
35.	Kākajanghā (Rt.)	*Peristrophe bicalyculata* Linn.
36.	Kākanāsikā (Sd.)	*Martynia annua* Linn.
37.	Kākolī (Tub. Rt.)	*Lilium polyphyllum* D. Don
38.	Kamala (Rz.)	*Nelumbo nucifera* Gaertn.
39.	Karavīra (Rt.)	*Nerium indicum* Mill.
40.	Kariṅkāra (Rt.)	*Carissa carandas* Linn.
41.	Kāśa (Rt.)	*Saccharum spontaneum* Linn.
42.	Kaṭphala (Frt.)	*Myrica esculenta* Buch.-Ham. ex D. Don
43.	Kaṭphala (St. Bk.)	*Myrica esculenta* Buch.-Ham. ex D. Don
44.	Kola (Frt. Pulp)	*Zizypus jujuba* Lam.
45.	Kola (St. Bk.)	*Zizypus jujuba* Lam.
46.	Koṣātakī (W.P.)	*Luffa acutangula* (Linn.) Roxb.
47.	Kumuda (Fl.)	*Nymphaea alba* Linn.
48.	Kuśa (Rt. St.)	*Desmostachya bipinnata* Stapf.

49.	Lāṅgalī (Rz.)	*Gloriosa superba* Linn.
50.	Laśuna (Bulb)	*Allium sativum* Linn.
51.	Mahābalā (Rt.)	*Sida rhombifolia* Linn.
52.	Mañjiṣṭhā (St.)	*Rubia cordifolia* Linn.
53.	Marica (Frt.)	*Piper nigrum* Linn.
54.	Māṣaparṇī (W.P.)	*Teramnus labialis* Spreng.
55.	Masūra (Sd.)	*Lens culinaris* Medic.
56.	Mudga (Sd.)	*Phaseolus radiatus* Linn.
57.	Mūlaka (Sd.)	*Raphanus sativus* Linn.
58.	Muṇḍitikā (Lf.)	*Sphaeranthus indicus* Linn.
59.	Mustā (Rz.)	*Cyperus rotundus* Linn.
60.	Nāgavallī (Lf.)	*Piper betle* Linn.
61.	Nārikela (Endo.)	*Cocos nucifera* Linn.
62.	Nicula (Frt.)	*Barringtonia acutangula* (Linn.) Gaertn.
63.	Nīli (W.P.)	*Indigofera tinctoria* Linn.
64.	Nirguṇḍī (Lf.)	*Vitex negundo* Linn.
65.	Padmaka (Ht. Wd.)	*Prunus cerasoides* D. Don
66.	Pāṭalai (Rt.)	*Stereospermum suaveolens* DC.
67.	Phalgu (Frt.)	*Ficus hispida* Linn.
68.	Phalgu (Rt.)	*Ficus hispida* Linn.
69.	Prapunnāḍa (Sd.)	*Cassia tora* Linn.
70.	Raktacandana (Ht.Wd.)	*Pterocarpus santalinus* Linn.
71.	Raktapunarnavā (Rt.)	*Boerhaavia diffusa* Linn.
72.	Rāmaśītalikā (W. P.)	*Amaranthus tricolor* Linn.
73.	Rāsnā (Lf.)	*Pluchea lanceolata* Oliver & Hiem.
74.	Sahacara (W.P.)	*Barleria prionitis* Linn.
75.	Sahadevī (W.P.)	*Vernonia cinerea* Lees.
76.	Śaileya (Lichen-'Thallus')	*Parmelia perlata* (Huds.) Ach.
77.	Śāka (Ht. Wd.)	*Tectona grandis* Linn.
78.	Śākhoṭaka (St. Bk.)	*Streblus asper* Lour.
79.	Śālaparṇī (Rt.)	*Desmodium gangeticum* DC.
80.	Śāli (Frt.)	*Oryza sativa* Linn.
81.	Śālmalī (St.Bk.)	*Bombax ceiba* Linn.
82.	Śaṇa (Seed)	*Crotolaria juncea* Linn.
83.	Sara (Rt.)	*Saccharum bengalense* Retz.
84.	Sarala (Ht. Wd.)	*Pinus roxburghii* Sargent
85.	Sarala (Rt.)	*Pinus roxburghii* Sargent
86.	Sarṣapa (Sd.)	*Brassica campestris* Linn.
87.	Śatapatrikā (Fl.)	Dalbergia *sissoo* Roxb.
88.	Śiṁśapā (Ht. Wd.)	*Rosa centifolia* Linn.
89.	Śiṁśapā (St. Bk.)	*Dalbergia sissoo* Roxb.
90.	Śirīṣa (St. Bk.)	*Albizzia lebbeck* Benth.
91.	Sthauṇeya (Lf.)	*Taxus baccata* Linn.
92.	Sūraṇa (Corm.)	*Amorphophallus campanulatus* (Roxb.) Bl.
93.	Śvetacandana (Ht.Wd.)	*Santalum album* Linn.
94.	Śyonāka (Rt.)	*Oroxylum indicum* Vent.
95.	Tāla (Infl.)	*Borassus flabellifer* Linn.
96.	Trivṛta (Rt.)	*Operculina turpethum* (Linn.) Silva Manso
97.	Tumbinī (Frt. Frt.)	*Lagenaria siceraria* (Mol.) Standl.
98.	Udambara (Frt.)	*Ficus glomerata* Roxb.
99.	Uśīra (Rt.)	*Vetiveria zizanioides* (Linn.) Nash
100.	Utpala (Fl.)	*Nymphaea stellata* Willd.