

**THE AYURVEDIC PHARMACOPOEIA
OF INDIA**

THE AYURVEDIC PHARMACOPOEIA OF INDIA

**PART -I
VOLUME -II
First Edition**



सत्यमेव जयते

**GOVERNMENT OF INDIA
MINISTRY OF HEALTH AND FAMILY WELFARE
DEPARTMENT OF ISM & H.**

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CONTENTS

	<u>PAGE</u>
LEGAL NOTICES	viii
GENERAL NOTICES	ix - xii
PREFACE	xiii-xvii
INTRODUCTION	xix - xxix

MONOGRAPHS

1. Akarakarabha (Rt.)	<i>Anacyclus pyrethrum</i> DC.	1-2
2. Aksoda (Cotldn.)	<i>Juglans regia</i> Linn.	3-4
3. Amrata (St. Bk.)	<i>Spondias pinnata</i> Linn. f. Kurz.	5-6
4. Apamarga (W.P.)	<i>Achyranthes aspera</i> Linn.	7-9
5. Aparajita (Rt.)	<i>Clitoria ternatea</i> Linn.	10-11
6. Ardraka (Rz.)	<i>Zingiber officinale</i> Rosc.	12-14
7. Arimeda (St.Bk.)	<i>Acacia leucophloea</i> Willd.	15-16
8. Arjuna (St.Bk.)	<i>Terminalia arjuna</i> W. & A.	17-18
9. Bhallataka (Fr.)	<i>Semecarpus anacardium</i> Linn.	19-20
10. Bhrrngaraja (W.P.)	<i>Eclipta alba</i> Hassk.	21-24
11. Brahmi (W.P.)	<i>Bacopa monnieri</i> (Linn.) Wettst.	25-26
12. Brhati (Rt.)	<i>Solanum indicum</i> Linn.	27-28
13. Cavya (St.)	<i>Piper retrofractum</i> Vahl.	29-30
14. Dadima (Sd.)	<i>Punica granatum</i> Linn.	31-32
15. Daruharidra (St.)	<i>Berberis aristata</i> DC.	33-34
16. Dronapuspi (W.P.)	<i>Leucas cephalotes</i> Spreng.	35-37
17. Ervaru (Sd.)	<i>Cucumis melo</i> var. <i>utilissimus</i> Duthie & Fuller.	38-39
18. Gajapippali (Fr.)	<i>Scindapsus officinalis</i> Schoott.	40-41
19. Gambhari (Fr.)	<i>Gmelina arborea</i> Roxb.	42-43
20. Gangeru (St.Bk.)	<i>Grewia tenax</i> (Forsk.) Aschers & Schwf.	44-45
21. Gunja (Rt.)	<i>Abrus precatorius</i> Linn.	46-47
22. Iksu (St.)	<i>Saccharum officinarum</i> Linn.	48-49
23. Indravaruni (Rt.)	<i>Citrullus colocynthis</i> Schrad.	50-51
24. Indravaruni (Lf.)	<i>Citrullus colocynthis</i> Schrad.	52-53
25. Jambu (Sd.)	<i>Syzygium cuminii</i> (Linn.) Skeels	54-55
26. Jambu (St.Bk.)	<i>Syzygium cuminii</i> (Linn.) Skeels	56-57
27. Jayapala (Sd.)	<i>Croton tiglium</i> Linn.	58-59
28. Jayanti (Lf.)	<i>Sesbania sesban</i> (Linn.) Merr.	60-61
29. Jyotismati (Sd.)	<i>Celastrus paniculatus</i> Willd.	62-63
30. Kadamba (St.Bk.)	<i>Anthocephalus cadamba</i> Miq.	64-65
31. Kakamaci (W.P.)	<i>Solanum nigrum</i> Linn.	66-68
32. Kamala (Fl.)	<i>Nelumbo nucifera</i> Gaertn.	69-70
33. Kapittha (Fr.Pulp)	<i>Feronia limonia</i> (Linn.) Swingle	71-72
34. Karamarda (St.Bk.)	<i>Carissa carandas</i> Linn.	73-74
35. Karanja (Rt.Bk.)	<i>Pongamia pinnata</i> (Linn.) Merr.	75-76
36. Karanja (Rt.)	<i>Pongamia pinnata</i> (Linn.) Merr.	77-78
37. Karanja (St.Bk.)	<i>Pongamia pinnata</i> (Linn.) Merr.	79-80
38. Karanja (Lf.)	<i>Pongamia pinnata</i> (Linn.) Merr.	81-82
39. Karavallaka (Fresh Fr.)	<i>Momordica charantia</i> Linn.	83-84
40. Katuka (Rz.)	<i>Picrorhiza kurroa</i> Royle ex Benth.	85-87
41. Kokilaksa (W.P.)	<i>Asteracantha longifolia</i> Nees.	88-90
42. Kokilaksa (Rt.)	<i>Asteracantha longifolia</i> Nees.	91-92
43. Kokilaksa (Sd.)	<i>Asteracantha longifolia</i> Nees	93-94
44. Kozuppa (W.P.)	<i>Portulaca oleracea</i> Linn.	95-97

45.	Lajjalu (W.P.)	<i>Mimosa pudica</i> Linn.	98-101
46.	Madhuka (Fl.)	<i>Madhuca indica</i> J.F. Gmel.	102-103
47.	Matsyakshi (W.P.)	<i>Alternanthera sessilis</i> (Linn.) R. Br.	104-106
48.	Methi (Sd.)	<i>Trigonella foenum-graecum</i> Linn.	107-108
49.	Mulaka (W.P.)	<i>Raphanus sativus</i> Linn.	109-111
50.	Mulaka (Rt.)	<i>Raphanus sativus</i> Linn.	112-113
51.	Mura (Rt.)	<i>Selinum candollei</i> DC.	114-115
52.	Murva (Rt.)	<i>Marsdenia tenacissima</i> Wight. & Arn.	116-117
53.	Nagakesar (Stmn.)	<i>Mesua ferrea</i> Linn.	118-119
54.	Nili (Lf.)	<i>Indigofera tinctoria</i> Linn.	120-121
55.	Nili (Rt.)	<i>Indigofera tinctoria</i> Linn.	122-123
56.	Nimba (Lf.)	<i>Azadirachta indica</i> A. Juss.	124-125
57.	Nimba (St.Bk.)	<i>Azadirachta indica</i> A. Juss.	126-127
58.	Palasa (St.Bk.)	<i>Butea monosperma</i> (Lam.) Kuntze	128-130
59.	Paribhadra (St.Bk.)	<i>Erythrina indica</i> Lam.	131-132
60.	Pippalimula (Stm.)	<i>Piper longum</i> Linn.	133-134
61.	Plaksa (St.Bk.)	<i>Ficus lacor</i> Buch. Ham.	135-136
62.	Prasarini (W.P.)	<i>Paederia foetida</i> Linn.	137-140
63.	Priyala (Sd.)	<i>Buchanania lanzan</i> Spreng.	141-142
64.	Priyangu (Infl.)	<i>Callicarpa macrophylla</i> Vahl.	143-144
65.	Sali (Rt.)	<i>Oryza sativa</i> Linn.	145-146
66.	Sankhapuspi (W.P.)	<i>Convolvulus pluricaulis</i> Choisy	147-149
67.	Saptala (W.P.)	<i>Euphorbia dracunculoides</i> Lam.	150-152
68.	Satahva (Fr.)	<i>Anethum sowa</i> Roxb. Ex Flem.	153-154
69.	Sigru (Lf.)	<i>Moringa oleifera</i> Lam.	155-157
70.	Sthulaela (Sd.)	<i>Amomum subulatum</i> Roxb.	158-159
71.	Tejovati (St.Bk.)	<i>Zanthoxylum armatum</i> DC.	160-161
72.	Tulasi (W.P.)	<i>Ocimum sanctum</i> Linn.	162-164
73.	Tulasi (Lf.)	<i>Ocimum sanctum</i> Linn.	165-167
74.	Vaca (Rz.)	<i>Acorus calamus</i> Linn.	168-170
75.	Vatsanabha (Rt.)	<i>Aconitum chasmanthum</i> Stapf Ex Holmes	171-172
76.	Vidari (Tub.Rt.)	<i>Pueraria tuberosa</i> DC.	173-174
77.	Yava (Fr.)	<i>Hordeum vulgare</i> Linn.	175-176
78.	Yavasaka (W.P.)	<i>Alhagi pseudalhagi</i> (Bieb.) Desv.	177-179

APPENDIX -1

1.1 Apparatus for Tests and Assays	180-182
1.1.1 -Nessler Cylinder	
1.1.2 -Sieves	
1.1.3 -Thermometers	
1.1.4 -Volumetric Glass-Ware	
1.1.5 -Weights and Balances	

APPENDIX -2

2.1 Testing of Drugs	183-189
2.1.1 -Systematic Study of Crude Drugs	
2.1.2 -Microscopic Methods of Examining Crude Vegetable Drugs	
2.1.3 -Types of Stomata	
2.1.4 -Determination of Stomatal Index	
2.1.5 -Determination of Palisade Ratio	
2.1.6 -Determination of Vein-Islet Number	
2.1.7 -Determination of Stomatal Number	

2.2 Determination of Quantitative Data for Vegetable Drugs	189-196
2.2.1 –Sampling of Drugs	
2.2.2 –Foreign Matter and Determination of Foreign Matter	
2.2.3 –Determination of Total Ash	
2.2.4 –Determination of Acid Insoluble Ash	
2.2.5 –Determination of Water Soluble Ash	
2.2.6 –Determination of Alcohol Soluble Extractive	
2.2.7 –Determination of Water Soluble Extractive	
2.2.8 –Determination of Ether Soluble Extractive (Fixed Oil Content)	
2.2.9 –Determination of Moisture Content (Loss on Drying)	
2.2.10 –Determination of Volatile Oil in Drugs	
2.2.11 –Special Processes used in Alkaloidal Assays	
2.2.11-a –Continuous Extraction of Drugs	
2.2.11-b –Tests for Complete Extraction of Alkaloids	
2.2.12 –Thin Layer Chromatography (TLC)	
2.3 Limit Tests	197-205
2.3.1 –Limit Test for Arsenic	
2.3.2 –Limit Test for Chlorides	
2.3.3 –Limit Test for Heavy Metals	
2.3.4 –Limit Test for Iron	
2.3.5 –Limit Test for Lead	
2.3.6 –Sulphated Ash	
2.3.7 –Limit Test for Sulphates	
APPENDIX –3	
3.1 Physical Tests and Determinations	205-208
3.1.1 –Powder Fineness	
3.1.2 –Refractive Index	
3.1.3 –Weight Per Millilitre and Specific Gravity	
APPENDIX –4	
4.1 Reagents and Solutions	209-261
APPENDIX –5	
5.1 –Weights and Measures	262
5.2 –Approximate Equivalents of Doses in Indian System and Metric System	
APPENDIX –6	
6.1 Classical Ayurvedic References	263-348
INDEX	349-368

LEGAL NOTICES

In India there are laws dealing with drugs that are the subject of monographs which follow. These monographs should be read subject to the restrictions imposed by 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. II, is the book of standards for single drugs included therein and the standards prescribed in the Ayurvedic Pharmacopoeia of India, Part-I, Vol. II would be official. If considered necessary these standards can be amended and the Chairman of the Ayurvedic Pharmacopoeia Committee authorised to issue such amendments. Whenever such amendments are issued the Ayurvedic Pharmacopoeia of India, Part-I, Vol. II, would be deemed to have been amended accordingly.

GENERAL NOTICES

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

Name 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 drug as found in 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, scientific name of the drug in Latin with short description about its habit, distribution and method of collection, if any.

Synonyms - Synonyms of each 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 a 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 description as large number of drugs have got no specific odour. The "odour" is examined by directly smelling 25 g 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 re-examined after 15 minutes. If the odour persists to be discernible, 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 and applying it on tongue previously rinsed with water. This may not be done in case of poisonous drugs, indicated in monograph.

Mesh Number - Wherever the powdering of the drug has been required the sieve "Mesh Number 85" has been used. This will not apply for drugs containing much 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 20°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" 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 in 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, be within the permitted and specified limits for lead, arsenic and heavy metals, and show no abnormal odour, colour, sliminess, mould or other evidence of deterioration.

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 Pharmacopoeial Method. In suitable instances the methods of microanalysis, 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.

Standards - For statutory purpose, statements appearing in the API, Part-I, Vol. II, under Description, those of definition of the part and source plants, and Identity, Purity and Strength, shall constitute standards.

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

Quantities to be weighed for Assays and Tests - In all description 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 on further ignition.

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

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

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 millilitres of product.

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

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

Percentage of alcohol - All statements of percentage of alcohol (C₂H₅OH) refer to percentage by volume at 15.56 °C.

Temperature - Unless otherwise specified all temperatures refer to 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 test 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 of volume of solvent, at a stated temperature, are intended to apply at that temperature. Statements of approximate solubilities for which no figures are given, are intended to apply at ordinary room temperature.

Pharmacopoeial chemicals when dissolved may show slight physical impurities, such as fragment of filter papers, 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 indicate its solubility.

The following table indicates the meaning of such terms :-

<i>Descriptive terms</i>	<i>Relative quantities of solvent</i>
Very soluble	Less than 1 part.
Freely soluble	From 1 to 10 parts.
Soluble	From 10 to 30 parts.
Sparsingly 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 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.	Centimeter
μ	Micron (0.001 mm)
Kg.	Kilogram
g.	Gramme
mg.	Milligram
ml.	Millilitre
IN.	Normal solution
0.5 N	Half-normal solution
0.1 N	Decinormal solution
1M.	Molar solution
Fam.	Family
PS.	Primary Standards

Abbreviations used for languages

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

PREFACE

India, due to its unique variety of geographical and climatic factors, has 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 even used 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 on 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 drugs which were originally equated with the classical Ayurvedic drug, but later assumed the name of the very same classical drug and continued to be locally collected, sold and used in that name 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 the 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 cultural heritage of India out of patriotism. All such drugs with a multiple claim on the 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 practicing 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 Dravyas" (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 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 drug 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 but to purchase 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 patient.

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 also 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 of independence of the country. But it gave the necessary momentum and after independence, not only Ayurvedic education but Ayurvedic drugs and their marketing were 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 recommendation for compilation of an Ayurvedic Pharmacopoeia. Thereafter, the Dave Committee (1955) reiterated the recommendations for compilation of an Ayurvedic Pharmacopoeia.

8. The Government of Bombay, was specially interested in the survey of resources of Ayurvedic Drugs, their collection, cultivation, 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 Member Secretary. The Bapalal Committee has very elaborately recommended the compilation of the Ayurvedic Pharmacopoeia as an urgent prerequisite 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 (1958) which had strongly highlighted the urgency of the compilation of an 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 and Siddha was entrusted to the Central Council for Research in Ayurveda & Siddha. The PLIM, 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 under taking the work of Ayurvedic Pharmacopoeia of India.

10. After publication of the First and the Second part of the Ayurvedic Formulary of India, Part III of the Formulary is under preparation. A list of single drugs which enter into the formulations has been prepared and the Committee could now apply its mind to the task of collection of data from published material and to entrust experimental work to produce data necessary to supplement the information already available as well as to verify experimentally some of the information previously gathered.

11. The First and Second Part of the Ayurvedic Formulary of India comprising of some 444 and 191 formulations respectively cover more than 351 single drugs of plant origin. This takes up 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 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 with a formidable armoury of mostly synthetic drugs, chemo-therapeutic agents and later antibiotics, slowly realised that they also had adverse side effects and toxicity which would damage human systems. The western world slowly started appreciating the value of herbal medicines, and understanding the basic comprehensive philosophy of Ayurveda, which initially appeared to be rather abstract and difficult to interpret in terms of modern medical sciences.

13. With the introduction of a uniform system of Ayurvedic education all over the country, a process initiated some 50 years ago, there would 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 needing to 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 preview of the Drugs and Cosmetic 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 authorities, implementing Drugs and Cosmetics Act, the Ayurvedic Pharmacopoeia Committee has made a modest effort to lay down earlier some norms of single drugs based on experimental data worked out at the PLIM, 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. Endeavors to determining the above were made by researchers all over the world and out of this common pool of scientific data the pharmacopoeial 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 scratch.

18. While incorporating the experimental data like macroscopic and microscopic pharmacognostic descriptions and chemical norms, one must admit that modern pharmacognosy had its genesis in Texts of Ayurvedic Nighantus where entire drug and drug plant have been minutely studied and eloquent sanskrit terms used to describe the parts of plant so that it projects a convincing picture of the drug and the drug plant before the reader. The description of the Castor oil plant –(Ricinus communis Linn.) given by Bhavprakash 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 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 monographs, the title of each drug had been given in Sanskrit as already obtained in the Ayurvedic Formulary of India. Then comes the definition of the drug giving its iden-

tity 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 the other Indian regional languages. The monographs then record the detailed gross or Microscopic description of the drug and its Microscopic tissue structures, the individual elements, deposition of crystals, starch grains, hairy out growths etc, each having a pharmacognostic value in identification, especially when the drug is 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 has 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 wide variation in crude drugs (raw materials) of plant origin in respect of their chemical contents, due to varied climatic conditions, geographical distribution, source and season of collection and lack of scientific methods of storage and preservation. Therefore, the variation in the chemical data created a great difficulty in fixing the standards for 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 of 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 manufactures 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 Ayurvedic Pharmacopoeia of India Part I, Vol. II comprising of 78 single drugs of vegetables origin, as per the format and procedure laid down, the different research units under Deptt. of ISM & H under the Ministry of Health and Family Welfare would plan their research enquiries such that the output of work would be accelerated. At the same time, these 78 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, 1998, Part-I, Vol II may also be notified by Government as a book of reference for implementation of the Drugs and Cosmetics Act, 1940 all over India as Ayurvedic Pharmacopoeia of India Vol. I is already included in the First Schedule of Drugs & Cosmetics Act 1940.

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, Scientists and Ayurvedic Scholars for their whole hearted co-operation in preparing the monographs on Single Drugs. I thank all members of the Ayurvedic Pharmacopoeia Committee especially Km. Savita Satkapan without whose co-operation this volume would not have seen the light of day. I sincerely thank Vaidya S.K. Mishra, Ex. Adviser (Ay. & Siddha) and Ex. Member-Secretary of the Committee and his colleagues like Dr. C.H.S. Shastry, Ex. Dy. Adviser (Ay.), Dr. S.K. Sharma, Adviser Incharge (Ay) and Dr.M.L.Sharma, Dy. Adviser (Ayu.). Dr. R.U. Ahmad, Director, PLIM, Ghaziabad and his colleagues viz.

Dr. P.C. Srivastava, Sr. Scientific Officer (Chem.); Dr. Rajeev Kumar Sharma, Senior Scientific Officer (Pharmacognosy); Shri N.S. Mahara, R. O. (Phg.), Dr. Jai Prakash, R.O.(Chem.), Shri B.B. Prasad, R.A.(Bot.), Shri C. Arunachalam, R.A.(Bot.) and other technical staff who have carried out scientific work in preparing this pharmacopoeia without whose active co-operation it would have been impossible to bring out this volume, deserve my sincere thanks. Thanks are also extended to Dr. Chhote Lal, Dr. A.K.S. Bhadoria, Dr. M.N. Ragne, Mr. Padam Kumar, Mr. Ashok Kumar and Section Officer (APC) and also other office colleagues who have done a wonderful task in convening the meetings of the committee and completion of this work.

Prof. A.N. Namjoshi
Chairman
Ayurvedic Pharmacopoeia Committee

New Delhi
Dated

INTRODUCTION

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 :-

- i. The manufacture should be carried under prescribed hygienic conditions, under supervision of a person having a prescribed qualification;
- ii. The raw materials used in the preparation of drugs should be genuine and properly identified; and
- iii. 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 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 formulation could be expected to conform to uniform standards. The requirements that the list of ingredients be displayed on the label will enable analysts in important cases to verify label claims and to that extent will bind the manufacture to a true claim. Arrangements to evolve and lay down physical, chemical and biological tests, where necessary, to identify 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, Drug 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 Committees 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 member :-

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| 1. Col. Sir Ram Nath Chopra, Drugs Research Laboratory, Srinagar. | <i>Chairman</i> |
| 2. Vaidya B.V. Gokhale, 29/14-15, Erandavane, Deccan Gymkhana, Poona-4. | <i>Member</i> |
| 3. Vaidya D.A. Kulkarni, Principal, Post Graduate, Training Centre in Ayurveda, Jamnagar. | <i>Member</i> |

4. Kaviraj B.N. Sircar, 779-780, Nicholson Road, Kashmere Gate, Delhi-6.	<i>Member</i>
5. Shri A.N. Namjoshi, Navyug Mansion, 19-A, Sleater Road, Bombay-7.	<i>Member</i>
6. Dr. B.B. Gaitonde, Profossor of Pharmacology, Grant Medical College, Bombay.	<i>Member</i>
7. Dr. C.G. Pandit, Director, Indian Council of Medical Research, New Delhi.	<i>Member</i>
8. Dr. G.K. Karandikar, Dean, Medical College, Aurangabad.	<i>Member</i>
9. Dr. G.S. Pande, Honorary Director, Indian Drug Research Association, 955-Sadashiv Peth, Lakshmi Road, Poona-2.	<i>Member</i>
10. Dr. M.V. Venkataraghava, Chellakoti, Nungabakkum, Madras-34.	<i>Member</i>
11. Ayurvedachara Kaladi K. Parameswaran Pillai, Laksmivilasam Vaidyasala, Vanchiyur, Trivandrum.	<i>Member</i>
12. Dr. V. Narayanaswamy, 70, Tana Street, Vepeity, Madras-7.	<i>Member</i>
13. Vaidya P.V. Dhamankar Shastri, Pardeshi Lane, Panvel, District Kolaba, Bombay.	<i>Member</i>
14. S.K. Borkar, Drug Controller (India), Directorate General of Health Services, Government of India, New Delhi.	<i>Member</i>
15. Shri Bapalal G. Vaidya, Principal, O.H. Nazar Ayurveda Mahavidyalaya, Surat.	<i>Member</i>
16. Kumari Savita Satakopan, Drugs Control Laboratory, Near Polytechnic, Highway 8, Baroda.	<i>Member</i>
17. Vaidya Vasudev M. Dwivedi, Director of Ayurveda, Government of Gujrat, Ahmedabad.	<i>Member</i>
18. Shri P.V. Bhatt, M.Sc., Chemist, The Ayurvedic Rasashala, Deccan Gymkhana, Poona.	<i>Member</i>
19. Vaidya Ram Sushill Singh, Assistant Director of Ayurveda, Director of Medical Services, (Ayurveda), Govt. of U.P.	<i>Member</i>
20. Dr. Y. Kondal Rao, Secretary, Indian Medical Practitioner's Cooperative Pharmacy & Stores Limited, Adyar, Madras-20.	<i>Member</i>
21. Dr. V. Srinivasan, M.Sc., M.B.B.S., Ph.D., Director, Sarabhai Chemicals Research Institute, Shahibag, Ahmedabad-4.	<i>Member</i>
22. Dr. C. Dwarakanath, Adviser in Indian System of Medicine, Ministry of Health, New Delhi.	<i>Member Secretary</i>

The Committee was assigned the following function :-

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 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 functions 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 a 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 and Sports, Maharashtra State, Sachivalaya, Bombay-32-Br. Chairman
 2. Vaidya Vasudev M. Dwivedi, "Maruti", 1, Master Society, Vice-Rajkot-2. Chairman
 3. The Drugs Controller (India), Government of India, Ministry of Health, Nirman Bhawan, New Delhi. Member
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 Research 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

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| 14. Kaviraj K.P. Areya, Principal's Staff Quarter, Ayurvedic Unani Tibbia College, Karol Bagh, New Delhi. | <i>Member</i> |
| 15. Kaviraj Ashutosh Majumdar, 90/8-Cannaught Circus, New Delhi-I. | <i>Member</i> |
| 16. Vaidya P. V. Sharma, Professor of Dravyaguna, Post Graduate Institute of Indian Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi. | <i>Member</i> |
| 17. Dr. V.N. Sharma, Professor of Pharmacology, S.M.S. Medical College, Jaipur (Rajasthan). | <i>Member</i> |
| 18. Shri Prajapati Joshi, Office-in-Charge, Amalgamated Unit (CCRIM & H), Government Pharmaceutical Laboratory, Ranikhet. | <i>Member</i> |
| 19. Dr. (Mrs.) Assema Chatterji, Professor of Chemistry, Calcutta University, Calcutta | <i>Member</i> |
| 20. Dr. P.N.V. Kurup, Adviser, Indigenous Systems of Medicine, Department of Health, Nirman Bhawan, New Delhi-II. | <i>Member Secretary</i> |

The reconstituted Committee initiated the work of identification and authentication of single drugs of plant, animal and mineral sources as 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-I. The Committee after thorough 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 format 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

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| 1. Prof. A.N. Namjoshi, A-19, Navyug Mansion, N. Bharucha Road, Bombay-400007., (Maharashtra). | <i>Chairman</i> |
| 2. Vd. Vasudev M. Dwivedi, "Maruti", 1, Master Society, Rajkot, (Gujarat). | <i>Member</i> |

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

The following seven members were further nominated and added to this committee:

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| 1. Km. Savita Satakopan, Senior Scientific Officer, Food & Drugs Laboratory, Near Polytechnic, Vadodara-390002 (Gujarat). | <i>Member</i> |
| 2. Dr. S.A. Vasavada, (Ashirvad), Opp. Pratap Vilas, Jamnagar 361001 (Gujarat). | <i>Member</i> |
| 3. Dr. Lalitha Michael, Cheif Superintendent, Govt. Central Pharmacy, Ashoka Pillar Circle, I Block, Jayanagar, Bangalore-560011. | <i>Member</i> |
| 4. Dr. Nagesh Dwivedi, Director of Indigenous Systems of Medicine, Govt. of Bihar, Patna (Bihar). | <i>Member</i> |
| 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). | <i>Member</i> |
| 6. Prof. C.P. Shukla, "Anil" 3, Patel Colony, Jamnagar -361008 (Gujarat). | <i>Member</i> |
| 7. Shri Nanak Chand Sharma, Ayurvedacharaya and Ayurved Brahaspati, Kayamaya Ayurvedic Pharmaceutical Works (Pvt.) Ltd., 8/3552, Regar Pura, Karol Bagh, New Delhi-110005. | <i>Member</i> |

Functions :-

- (a) To prepare remaining parts of the official formulary of compound preparation 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, purity 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. K. J. A. T. Sharma, Behrampur	Member
3. Vd. Vasudev Dwivedi, Rajkot	Do.
4. Vd. Hari Dutt Shastri, New Delhi	Do.
5. Vd. K.S. Warriar, Coimbatore	Do.
6. Vd. S.K. Mishra	Member-Secretary

Functions :

1. To suggest priority formulations to be included in next part 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, Rajkot	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 finalised the Ayurvedic Formulary of India Part-II and the revised Hindi Version of Part-I of Ayurvedic Formulary of India which has been printed.

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.

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| 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 Drugs Laboratory, Vadodara, Standardisation Units of the Central Council of Research in Ayurveda and Siddha, all State Director 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 monographs 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 and published the same as Ayurvedic Pharmacopoeia of India Part I, Vol. I, in the year 9-12-1986. 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 innovation. 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.

Realising the importance of laying down of the Pharmacopoeial Standards of the single drugs and compound formulation as a long term and continuous nature of scientific work, the Government of India, Ministry of Health & Family Welfare has again reconstituted the Ayurvedic Pharmacopoeial Committee in the year 1988 vide their notification No. X-19011/9/88-APC, dated August 1988 with the following members and the functions assigned as under :-

1. Prof. A.N. Namjoshi, A-19, Navyug Mansion, N. Bharucha Road, Bombay-400007, (Maharashtra). *Chairman*
2. Prof. P.V. Sharma, 39, Gurudham Colony, Varansi-221010. *Member*
3. Miss. S. Satakopan, 8, Kalpana, Stadium North Road, Vadodara-390005. *Member*
4. Vaidya Sri Ram Sharma, Agarwal Nagar, Dr. Ambedkar Road, Matunga, Bombay-400019. *Member*
5. Vaidya Veni Madhav Ashvani Kumar Shastry, Prof. of Kaya Chikitsa & Head of the Deptt., Govt. Ayurved College, Gwalior. *Member*
6. Vaidya Indra Mohan Jha, P.O. Ranti, Madhubani, Bihar-847211. *Member*
7. Vaidya Amar Nath Shastry, 1550, Sector-7 C, Chandigarh-160019. *Member*
8. Vaidya B. Vaidyanathan, Secretary, Indian Medical Practitioners Cooperative Pharmacy & Stores, 34/37 Lattice Bridge Road, Thiruvanniyur, Madras-600041. *Member*
9. Dr. N.Hanumanta Rao, Director, Academy of Ayurveda, Vijyawada-520003. *Member*
10. Dr. Surinder Kumar Sharma, Associate Prof. & Head, Deptt. of Shalya Shalakya, Govt. Ayurvedic College, Paprola, Distt., Kangra, Himachal Pradesh-176115. *Member*
11. Vaidya D. Triguna, 143, Sarai Kale Khan, Nizam-ud-din, New Delhi-110013. *Member*
12. Vaidya P.K. Warriar, Arya Vaidya Shala, Kottakal. (Kerala)-676503. *Member*
13. Dr. Rajendra Gupta, Project Coordinator (M & AP), National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi-110012. *Member*
14. Prof. S.S. Handa, Deptt. of Pharmaceutical Sciences, Punjab University, Chandigarh-160014. *Member*
15. Managing Director, Indian Medicine Pharmaceutical Corporation, Via Ram Nagar, Mohan (U.P.). *Member (Ex-Officio)*
16. Director, Central Council for Research in Ayurveda & Siddha, S-10, Dharmabhavan, Green Park, New Delhi. *Member (Ex-Officio)*
17. Drugs Controller (India), Directorate General of Health Services, New Delhi. *Member (Ex-Officio)*
18. Adviser (Ay & S), Ministry of Health & Family Welfare., Nirman Bhawan, New Delhi. *Member Secretary*

Functions :-

- (a) To prepare remaining parts of the official formulary of compound preparations which are currently used in Ayurvedic practice in the country including standardised compositions, methods of preparations, dosage, toxicity and administration with various anupanas or vehicles.
- (b) To prepare a Pharmacopoeia of Ayurveda of single drugs which have been included in the official formulary.
- (c) To prescribe the working standards for compound formulations including tests for identity, purity 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.

The Ayurveda Pharmacopoeia Committee was further re-constituted in the year 1994 by the Government of India, vide their notification No. X-19011/6/94-APC, dated 2.9.94 with the following members and the assigned functions :

1. Prof. A.N. Namjoshi, A-19, Navyug Mansion, N. Bharucha Road, Bombay-400007.	<i>Chairman</i>
2. Prof. P.V. Sharma, 39, Gurudham Colony, Varansi-221010.	<i>Member</i>
3. Miss. S. Satakopan, 40-A, Ist Main Road, Nanganallur, Madras-600061.	<i>Member</i>
4. Dr. S.K. Mishra, 503, Apartment, Swasthya Vihar, Delhi-110092.	<i>Member</i>
5. Vd. S.T. Gujar, 16/6 Erandavan, Plot. No. 3, Erandavan Cooperative Housing Society, Behind Patavardhan Bagh, Pune -411004.	<i>Member</i>
6. Prof. Jharkhand Ojha, Deptt. of Dravyaguna, Institute of Medical Science, Banaras Hindu University, Varansi (U.P.) -221005.	<i>Member</i>
7. Vd. Sreerama Murthy, Director, Venkateswara Ayurveda Nilayam Pvt. Ltd., Chintaluru, East Godavari Distt., Andhra Pradesh -533232.	<i>Member</i>
8. Vd. B. Vaidyanathan, No.1, Ganapathy Ist Street, Avvai Nagar, Tiruvanmayur, Madras-600041.	<i>Member</i>
9. Dr. N. Hanumanta Rao, Director, Academy of Ayurveda, Vijyawada -520003.	<i>Member</i>
10. Vd. Nanak Chand Sharma, Kaya Maya Pharmacy, A-1, Tughlaqabad, M.B. Road, New Delhi -110044.	<i>Member</i>
11. Vd. Brihaspati Dev Triguna, 143, Sarai Kale Khan, Nizam-ud-din, New Delhi-110013.	<i>Member</i>
12. Vaidya P.K. Warriar, Arya Vaidya Shala, Kottakal (Kerala) -676503.	<i>Member</i>
13. Prof. C. Shantamma, Prof. & Principal Investigator, UGC Sponsored Project (Med. Plants), Deptt. of Studies in Botany, Manasa Gangotri, Mysore-750006.	<i>Member</i>

- | | |
|---|---------------------------------|
| 14. Prof. S.S. Handa, Director, Regional Research Laboratory (CSIR), Canal Road, Tawi, Jammu-180001. | <i>Member</i> |
| 15. Managing Director, Indian Medicine Pharmaceutical Corporation Ltd., (Via Ram Nagar), Mohan (U.P.). | <i>Member
(Ex. Officio)</i> |
| 16. Dr. R.U. Ahmad, Director, Pharmacopoeial Laboratory for Indian Medicine, C.G.O. Complex, Kamla Nehru Nagar, Ghaziabad (U.P.). | <i>Member
(Ex-Officio)</i> |
| 17. Director, Central Council for Research in Ayurveda and Siddha, Adjacent to Tihar Jail, Near Lajwanti Garden, Janakpuri, New Delhi-11. | <i>Member
(Ex-Officio)</i> |
| 18. Drug Controller (India), Directorate General of Health Services, Nirman Bhawan, New Delhi -110011. | <i>Member
(Ex-Officio)</i> |
| 19. Dr. S.K. Sharma, Adviser Incharge (Ay. & S), Ministry of Health & Family Welfare, Nirman Bhawan, New Delhi-110011. | <i>Member
Secretary</i> |

Functions :-

- (a) To prepare remaining parts of the official formulary of compound preparations which are currently used in Ayurvedic practice in the country including standardised compositions, methods of preparations, dosage, toxicity and administration with various anupanas or vehicles.
- (b) To prepare a Pharmacopoeia of Ayurveda of single drugs which have been included in the official formulary.
- (c) To prescribe the working standards for compound formulations including tests for identity, purity 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.

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 installments, on single drugs and compound formulations could be effectively carried.

ABBREVIATIONS FOR PARTS OF PLANTS

Cotldn.	Cotyledon
Fl.	Flower
Fresh Fr.	Fresh Fruit
Fr. Pulp.	Fruit Pulp
Fr.	Fruit
Infl.	Inflorescence
Lf.	Leaf
Rt. Bk.	Root Bark
Rt.	Root
Rz.	Rhizome
Sd.	Seed
St.	Stem
St. Bk.	Stem Bark
Stmn.	Stamen
Tub. Rt.	Tuberous Root
W.P.	Whole Plant

ĀKĀRAKARABHA (Root)

Ākārakarabha consists of dried roots of *Anacyclus pyrethrum* DC. (Fam. Asteraceae); an annual, hairy herb with numerous spreading prostrate or ascending branched stems.

SYNONYMS –

Sansk. : Ākallaka

Assam. : --

Beng. : Akarakara

Eng. : Pellitory

Guj. : Akkalkaro, Akkalgaro

Hndi. : Akalkara

Kan. : Akkallakara, Akkallakara, Akallaka Hommugulu, Akalakarabha

Mal. : Akkikaruka, Akravu

Mar. : Akkalakara, Akkalakada

Ori. : Akarakara

Punj. : Akarakarabh, Akarakara

Tam. : Akkaraka, Akkarakaram

Tel. : Akkalakarra

Urdu. : Aqarqarha

DESCRIPTION –

a) Macroscopic :

Roots tough, cylindrical, 7-15 cm in length, tapering slightly at both ends, with a few hairy rootlets and occasionally topped by bristly remains of leaves, external surface rough, brown, shrivelled, bark upto 3 mm thick, not easily separable, odour, slightly aromatic, taste, characteristically astringent and pungent, on chewing gives tingling sensation to tongue and lips and causes excessive flow of saliva.

b) Microscopic :

Root – Mature root shows cork consisting of tabular cells, many of which developed as sclerenchyma; a few inner cork cells contain rosette crystals of calcium oxalate; secondary cortex consisting of isodiametric or tangentially, elongated, thin-walled, parenchymatous cells; a few sclerenchymatous cells also found scattered in secondary cortex; secondary phloem consisting of usual elements, cambium 2-5 layered, secondary xylem very wide consisting of xylem vessels, tracheids and xylem parenchyma; vessels pitted, more or less in groups distributed throughout xylem, more and wider vessels found towards periphery, xylem fibres thick-walled, 1.37-28.8 μ in width, 53.2 – 231 μ in length having narrow lumen, medullary rays numerous, running straight, bi to tri and multiseriate, uniseriate rays very rare, starting from primary xylem and reaching upto secondary

cortex; ray cells thick-walled, radially elongated, inulin present in cells of secondary cortex, secondary phloem and medullary rays; oleo-resinous schizogenous glands found scattered in secondary cortex, secondary phloem and medullary rays; calcium oxalate crystals in rosette form present in secondary cortex, secondary phloem, secondary xylem and medullary ray cells.

Powder – Ash coloured; shows vessels having scalariform thickening, rosette crystals of calcium oxalate and fragments of sclerenchyma; also gives positive tests for inulin.

IDENTITY, PURITY AND STRENGTH –

Foreign mater	-	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 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 8 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not more than 22 per cent, Appendix 2.2.7.

CONSTITUENTS – Volatile oil and Alkaloid (Pyrethrin).

PROPERTIES AND ACTION –

Rasa	: Kaṭu
Guṇa	: Rūkṣa, Tikṣṇa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Pittahara, Kaphahara, Śukrala, Vājikara, Svedakara, Dīpana, Buddhivardhaka, Balakāraka

IMPORTANT FORMULATIONS – Kumāryāsava, Kastūryādi (Vāyu) Guṭikā, Nāgavallabha Rasa.

THERAPEUTIC USES – Pratiśyāya, Śoṭha, Ajīrna, Kāsa, Svāsa, Grdhrasī, Pakṣāghāta, Udararoga, Naṣṭārtava, Śūlaroga, Dantaśūla.

DOSE – 0.5 – 1 g. of the drug in powder form.

AKṢODA (Cotyledon)

Akṣoda consists of dried cotyledons of *Juglans regia* Linn. (Fam. Juglandaceae); a large deciduous, monoecious tree with tomentose shoots, found throughout the Himalayas upto an altitude of 900-3300 m.

SYNONYMS -

<i>Sansk.</i>	: Akṣoṭa, Sailabhava, Karparala
<i>Assam.</i>	: Akalbasing
<i>Beng.</i>	: Aakharotu
<i>Eng.</i>	: Walnut
<i>Guj.</i>	: Akharoda
<i>Hindi.</i>	: Akharot
<i>Kan.</i>	: Akrod pappu
<i>Kash.</i>	: --
<i>Mal.</i>	: Akrottu
<i>Mar.</i>	: Akroḍ
<i>Ori.</i>	: Akhrot
<i>Punj.</i>	: Akharota
<i>Tam.</i>	: Akrotu
<i>Tel.</i>	: Akrotu
<i>Urdu</i>	: Akhrot

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Cotyledon -Shows 1-2 layered, radially elongated, thin-walled, parenchymatous cells, raised stomata with more or less curved guard cells, followed by more or less compressed, collapsed, parenchymatous cells having vascular bundles; under this, indistinct tangentially elongated cells present; endosperm mostly single layered; cotyledons consisting of a wide zone of oval to polygonal, thin-walled, parenchymatous cells; small aleurone grains and fat present in endosperm and cotyledons.

Powder - Cream coloured; shows groups of cells of cotyledon, abundance of round oil globules and rarely vessels.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 5 per cent, Appendix 2.2.2.
Total ash	-	Not more than 2 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 10.0 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 7.0 per cent, Appendix 2.2.7.

CONSTITUENTS – Walnut oil and Tannin.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guṇa	: Guru, Snigdha, Sara
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Vātahara, Kaphakara, Br̥ṇhāṇa, Śukral, Balya, Vṛṣya, Viṣṭambhi, Hṛdyā

IMPORTANT FORMULATIONS - Amṛtaprāsa Ghr̥ta.

THERAPEUTIC USES - Kṣata, Kṣaya, Vātaroga.

DOSE - 10 - 25 g.

ĀMRĀTA (Stem Bark)

Āmrāta consists of dried stem bark of *Spondias pinnata* Linn. f. Kurz. Syn. *S. mangifera* Willd.; *S. acuminata* Roxb. non Gamble (Fam. Anacardiaceae); a small aromatic, deciduous tree, upto 27 m high and 2.5 m in girth, found wild or cultivated almost throughout the country and in the Andamans ascending upto an altitude of 1500 m in the Himalayas.

SYNONYMS –

Sansk. : Āmrātaka, Markatāmra

Assam. : --

Beng. : Amada, Amra

Eng. : Indian Hog Plum, Wild Mango

Guj. : Ambada, Ambado, Rānamba, Jangali Ambo, Ranambo

Hindi. : Ambada, Amra, Jangli Aam

Kan. : Ambate, Amvara

Kash. : --

Mal. : Mampusli, Ambalam, Ambazham, Mampuiti, Ampozham Njettikuzhiyan mavu.

Mar. : Ambado

Ori. : --

Punj. : Amada

Tam. : Mambulichi Amputtai, Ambadam

Tel. : Amratakamu, Anbalamu, Adavimamidi

Urdu. : Jangli Aam

DESCRIPTION –

a) Macroscopic :

Drug occurs in the form of 2-7 cm long cut pieces, curved, thin, external surface smooth, grey having lenticels, internal surface reddish-yellow; fracture, laminated.

b) Microscopic :

Stem Bark – Mature bark shows cork as a wide zone of 15-25 rows, consisting of tangentially elongated, radially arranged, thin-walled cells, a few outer cells exfoliated; secondary cortex consisting of tangentially elongated, parenchymatous cells, which are thick-walled towards periphery, first followed by a zone of compactly arranged cells filled with rosette and prismatic crystals of calcium oxalate and next by another wider zone of compactly arranged stone cells; rest of the cells following the stone cell zone are thin-walled, tangentially elongated, parenchymatous, with reddish-brown contents, and also rosette crystals of calcium oxalate; simple, round to oval starch grains measuring 2.75-14 μ in dia., a few prismatic crystals present in this zone; secondary phloem consisting of usual elements, phloem fibres arranged in tangential bands, thick-walled, ligni-

fied, alternating with the patches of phloem fibres, prominent lysogenous cavities are present, surrounded by a number of tannin sacs; phloem parenchyma consisting of thin-walled cells, containing rosette crystals and starch grains, similar to those found scattered in secondary cortex.

Powder – Light brown; shows cork cells, stone cells, phloem fibres measuring 800-1000 μ in length and 14-28 μ in width, rosette and prismatic crystals of calcium oxalate and numerous rounded to oval starch grains, measuring 3-14 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 1 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 3 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 7 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica Gel 'G' using n-Butanol : Acetic acid : Water (4:1:5) shows three spots at Rf. 0.33, 0.40 and 0.87 (all greyish brown). Under U.V. (366 nm) one fluorescent zone is visible at Rf. 0.96. On spraying with 5% Methanolic-Phosphomolybdic acid reagent and heating the plate for about ten minutes at 110° three spots appear at Rf. 0.33, (greyish brown), 0.87 (blue) and 0.96 (blue).

CONSTITUENTS – Tannin and Starch.

PROPERTIES AND ACTION -

Rasa	: Kaṣāya, Amla
Guṇa	: Guru, Sara
Vīrya	: Uṣṇa
Vipāka	: --
Karma	: Vātahara, Pittakara, Kaphakara, Rucikṛt, Kaṇṭhya, Āmadoṣahara Hr̥dya, Vahnikara

IMPORTANT FORMULATIONS - Dād̥hika Ghṛta.

THERAPEUTIC USES - Raktapitta, Kṣaya, Dāha, Kṣata.

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

APĀMĀRGA (Whole Plant)

Apāmārga consists of **dried whole plant** of *Achyranthes aspera* Linn. (Fam. Amaranthaceae); a stiff, erect, 0.3-0.9 m high herb, found commonly as a weed throughout India upto 900 m.

SYNONYMS -

Sansk. : Mayūra, Mayūraka, Pratyakpuṣpa, Kharamañjar, Śikhari

Assam. : --

Beng. : Apamg

Eng. : Prickly Chaff Flower

Guj. : Aghedo

Hindi. : Chirchita, Latjira

Kan. : Uttarani

Kash. : --

Mal. : Katalati

Mar. : Aghada

Ori. : --

Punj. : Puthakanda

Tam. : Nayuruvi

Tel. : Uttarenu

Urdu. : Chirchita

DESCRIPTION -

a) Macroscopic :

Root - Cylindrical tap root, slightly ribbed, 0.1-1.0 cm in thickness, gradually tapering, rough due to presence of some root scars, secondary and tertiary roots present, yellowish-brown; odour, not distinct.

Stem - 0.3 - 0.5 cm in cut pieces, yellowish-brown, erect, branched, cylindrical, hairy, solid, hollow when dry.

Leaf - Simple, sessile, exstipulate, opposite, decussate, wavy margin, obovate, slightly acuminate and pubescent due to the presence of thick coat of long simple hairs.

Flower - Arranged in inflorescence of long spikes, greenish-white, numerous, sessile, bracteate with two bracteoles, one spine lipped, bisexual, actinomorphic, hypogynous; perianth segments 5, free, membranous, contorted or quincuncial, stamens 5, opposite, the perianth lobes, connate forming a membranous tube-like structure, alternating with truncate and fimbriate staminodes, filament short; anther, two celled, dorsifixed; gynoecium bicarpellary, syncarpous; ovary superior, unilocular with single ovule; style, single; stigma, capitate.

Fruit - An indehiscent dry utricle enclosed within persistent, perianth and bracteoles.

Seed - Sub-cylindric, truncate at the apex, round at the base, endospermic, brown.

b) Microscopic :

Root - Mature root shows 3-8 layered, rectangular, tangentially elongated, thin-walled cork cells; secondary cortex consisting of 6-9 layers, oval to rectangular, thin-walled, parenchymatous cells having a few scattered single or groups of stone cells; followed by 4-6 discontinuous rings of anomalous secondary thickening composed of vascular tissues; small patches of sieve tubes distinct in phloem parenchyma, demarcating the xylem rings; xylem composed of usual elements; vessels simple pitted; medullary rays 1-3 cells wide; small prismatic crystals of calcium oxalate present in cortical region and numerous in medullary rays.

Stem - Young stem shows 6-10 prominent ridges, which diminish downwards upto the base where it becomes almost cylindrical; epidermis single layered, covered by thick cuticle having uniseriate, 2-5 celled, covering trichomes and glandular with globular head, 3-4 celled stalk; cortex 6-10 layered, composed of parenchymatous cells, most of them containing rosette crystals of calcium oxalate; in the ridges cortex collenchymatous; vascular bundles lie facing each ridge capped by pericyclic fibres; transverse section of mature stem shows lignified, thin-walled cork cells; pericycle a discontinuous ring of lignified fibres; vascular tissues show anomalous secondary growth having 4-6 incomplete rings of xylem and phloem; secondary phloem consisting of usual elements form incomplete rings; cambial strip present between secondary xylem and phloem; secondary xylem consisting of usual elements, fibres being absent; vessels annular, spiral, scalariform and pitted, fibres pitted, elongated, lignified; pith wide consisting of oval to polygonal, parenchymatous cells; two medullary bundles, either separate throughout or found in some cases, present in pith; microsphenoidal silica crystals present in some epidermal, cortical and pith cells.

Leaf -

Petiole - Shows crescent-shaped outline, having single-layered epidermis with thick-cuticle; ground tissues consisting of thin-walled, parenchymatous cells containing rosette crystals of calcium oxalate; 4-5 vascular bundle situated in mid region.

Midrib - Shows a single layered epidermis, on both surfaces; epidermis followed by 4-5 layered collenchyma on upper side and 2-3 layered on lower side; ground tissue consisting of thin-walled, parenchymatous cells having a number of vascular bundles; each vascular bundle shows below the xylem vessels, thin layers of cambium, followed by phloem and a pericycle represented by 2-3 layers of thick-walled, non-lignified cells; rosette crystals of calcium oxalate found scattered in ground tissues.

Lamina - Shows single layered, tangentially elongated epidermis cells covered with thick cuticle having covering trichomes which are similar to those of stem found on both surfaces; mesophyll differentiated into palisade and spongy parenchyma; palisade 2-4 layered of thick parenchyma larger, slightly elongated in upper, while smaller and rectangular in lower surface; spongy parenchyma 3-5 layers thick, more or less isodiametric parenchymatous cells; idioblast containing large rosette crystals of calcium oxalate distributed in palisade and spongy parenchyma cells; stomata anisocytic and anomocytic in both surface; stomatal index 4.5-9.0 on upper surface, 9.0-20.0 on lower surface; palisade ratio 7.0-11; vein islet number 7-13 per sq. mm.

Powder – Light yellow; shows fragments of elongated, rectangular, thin-walled epidermal cells, aseptate fibres, vessels with annular, spiral, scalariform and pitted thickening, uniseriate hair with bulbous base, rosette and 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 17 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 12 per cent, Appendix 2.2.7.

CONSTITUENTS – Saponins.

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta
Guṇa	: Tikṣṇa, Sara
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphahara, Vātahara, Medohara, Chedana, Dīpana, Pācana, Vāmaka, Śirovirecana

IMPORTANT FORMULATIONS - Apāmārgakṣāra, Apāmārgakṣāra Taila, Abhaya Lavana, Guḍapippalī, Jyotiṣmati Taila.

THERAPEUTIC USES - Śūla, Udara roga, Apaci, Arsa, Kaṇḍu, Medoroga.

DOSE - 20-50 g. of the drug for decoction.

APARĀJITĀ (Root)

Aparājitā consists of dried root of *Clitoria ternatea* Linn. (Fam. Fabaceae); a perennial climber with slender downy stem, found throughout the tropical regions of the country being cultivated in gardens every where and often also found growing over hedges and thickets.

SYNONYMS -

<i>Sansk.</i>	: Girikarṇikā, Viṣṇukrāntā
<i>Assam.</i>	: Aparajita
<i>Beng.</i>	: Aparajita
<i>Eng.</i>	: Clitoria
<i>Guj.</i>	: Gokarni
<i>Hindi.</i>	: Aparajita
<i>Kan.</i>	: Girikarnika Balli, Girikarnika
<i>Kash.</i>	: --
<i>Mal.</i>	: Shankhapushapam
<i>Mar.</i>	: Gokarna, Aparajita
<i>Ori.</i>	: Aparajita
<i>Punj.</i>	: Koyal
<i>Tam.</i>	: Kakkanam
<i>Tel.</i>	: Dintena
<i>Urdu.</i>	: --

DESCRIPTION -

a) Macroscopic :

Drug consisting of a stout tap root with a few tortuous branches, cylindrical, 1-5 mm in thickness, a few places show cracks due to presence of lenticels, colour, light-brown, fracture, fibrous; taste, bitter.

b) Microscopic :

Root - Shows 10-20 or more layers of rectangular, thin-walled, tangentially elongated exfoliating cork cells; secondary cortex consists of 10-12 rows of large, polygonal, thin-walled cells filled with starch grains, a few cells contain prismatic crystals of calcium oxalate in this region; single or groups of 2-10 lignified cortical fibres, distributed in the lower half of the cortex; secondary phloem consists of usual elements; phloem fibres 2-8 in groups, a few solitary fibres also present, very long, thin-walled with narrow lumen and pointed tips; secondary xylem consists of usual elements; vessels pitted with oblong, bordered pits and have short conical tail at one end, mostly occur 2 or 3 in groups; xylem fibres similar to those of phloem fibres, a few showing slit-like pits; medullary rays 1-5 cells wide, oblong and pitted; xylem parenchyma irregular in shape and pitted walls;

starch grains simple as well as compound having 2-6 components, single grains measuring 3-13 μ in dia., found in secondary cortex, phloem and xylem parenchyma.

Powder – Yellowish-brown; shows simple and compound starch grains, measuring 3-13 μ in dia., vessels with oblong bordered pits and fragments of fibres.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 2 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 8 per cent, Appendix 2.2.7.

TLC –

T.L.C. of alcoholic extract of the drug on Silica gel 'G' using Chloroform : Ethylacetate : Formic Acid (5:4:1) v/v shows one spot at Rf. 0.79 (dull yellow) in visible light. Under UV (366 nm) a spot is seen at Rf. 0.79 (blue). On exposure to Iodine vapour two spots appear at Rf. 0.54 and 0.79 (both yellow). On spraying with 10% aqueous solution of Ferric Chloride and heating the plate at 105°C for about fifteen minutes one spots appears at Rf. 0.79 (grey).

CONSTITUENTS – Tannin, Starch, Resin, Taraxerol & Taraxerone.

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṣāya, Kaṭu
Guṇa	: -
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Vātahara, Pittahara, Kaphahara, Kanṭhya, Medhya, Cakṣuṣya, Viṣahara, Buddhiprada

IMPORTANT FORMULATIONS - Miśraka Sneha, Vātaraktāntaka Rasa.

THERAPEUTIC USES – Mūtraroga, Kuṣṭha, Śoṭha, Vraṇa, Śūla.

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

ĀRDRAKA (Rhizome)

Ādraka consists of **fresh rhizome** of *Zingiber officinale* Rosc. (Fam. Zingiberaceae); a herbaceous rhizomatous perennial, reaching up to 90 cm in height, widely cultivated in India. Rhizomes are dug in January-February, buds and roots are removed and washed well.

SYNONYMS -

<i>Sansk.</i>	: Kaṭubhadra, Śṛṅgavera
<i>Assam.</i>	: --
<i>Beng.</i>	: Ada
<i>Eng.</i>	: Ginger
<i>Guj.</i>	: Adu
<i>Hindi.</i>	: Adarakha
<i>Kan.</i>	: Alla, Hasishunti
<i>Kash.</i>	: --
<i>Mal.</i>	: Inchi
<i>Mar.</i>	: Ardrak, Ale
<i>Ori.</i>	: --
<i>Punj.</i>	: Adi, Adrak
<i>Tam.</i>	: Inji, Injee, Allam, Lakottai
<i>Tel.</i>	: Allamu, Allam
<i>Urdu.</i>	: Adrak

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Rhizome - Shows a few layered, irregularly arranged, tangentially elongated, brown cells of outer cork and 6-12 rows of thin-walled, colourless, radially arranged cells of inner cork; secondary cortex consisting of hexagonal to polygonal, isodiametric, thin-walled, parenchymatous cells containing numerous circular to oval starch grains with striations and hilum at one end with clear concentric striations, measuring 5-25 μ in dia., idioblasts containing large yellowish to brownish globules of oleo-resin; walls of oil cells suberised; numerous closed, conjoint, collateral, cortical fibro-vascular bundles scattered

throughout cortical zone, greater number occurring in inner cortical region, larger bundles consists of 2-7 vessels, small cells of sieve tube, polygonal cells of parenchyma and group of fibres; vessels showing reticulate, scalariform and spiral thickening; fibres septate with a few oblique pores on their walls; endodermis single layered, free from starch; pericycle single layered enclosing central stele; stele consisting of thin-walled polygonal, isodiametric cells of parenchyma, filled with abundant starch grains, oleo-resin cells similar to those present in cortex; fibrovascular bundles of two types, those arranged along pericycle in a definite ring are smaller in size and devoid of fibres, vessels 2-5 in number, larger bundles found scattered throughout stele, composed of xylem, phloem, parenchyma and sheath of sclerenchyma.

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 0.5 per cent, Appendix 2.2.2.
Total ash	-	Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 2 per cent, Appendix 2.2.7.
Moisture content	-	Not More than 90 per cent Appendix 2.2.9.

T.L.C. –

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

CONSTITUENTS – Volatile Oil containing Cineole zingiberol, and sesquiterpene like zingiberene, bisobolene and sesqui phellandrene, gingerol in the oleo-resin.

PROPERTIES AND ACTION -

Rasa	: Kaṭu
Guṇa	: Tīkṣṇa, Rūkṣa, Guru
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Vātahara, Kaphahara, Rocana, Dīpana, Bhedana, Svarya, Hr̥dyā, Vṛṣya.

IMPORTANT FORMULATIONS - Ārdraka Khaṇḍāvāleha, Sāraswatāriṣṭa.

THERAPEUTIC USES - Vibandha, Ānāha, Sūla, Śopha, Kaṇṭharoga.

DOSE - 2-3 ml. of the drug in juice form with honey.

ARIMEDA (Stem Bark)

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

SYNONYMS -

<i>Sansk.</i>	: Irimeda, Vidkhadir
<i>Assam.</i>	: --
<i>Beng.</i>	: Guyababla, Sadababla
<i>Eng.</i>	: --
<i>Guj.</i>	: Haramibaval, Pilobaval, Haribaval
<i>Hindi.</i>	: Arimeda
<i>Kan.</i>	: --
<i>Kash.</i>	: --
<i>Mal.</i>	: Karivelam, Velvelam, Velvelakam
<i>Mar.</i>	: Pandal Babal
<i>Ori.</i>	: Arimeda
<i>Punj.</i>	: --
<i>Tam.</i>	: Velvelam
<i>Tel.</i>	: --
<i>Urdu.</i>	: Guar Babool

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

bers containing a prismatic crystals of calcium oxalate in each chamber; medullary rays multiseriate dilating towards outer side, composed of thin-walled, radially elongated cells.

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 14 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 13 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of drug on Silica gel 'G' plate using Chloroform : Ethylacetate : Formic Acid (5.4.1) only one spot at Rf. 0.69 (grey) is seen in visible light. Under UV (366 nm) two fluorescent zones appear at Rf. 0.78 and 0.91 (both blue). On exposure to Iodine vapour a yellow coloured tailing appears from Rf. 0 to 0.39 and a spot at Rf. 0.91 (yellow). On spraying with 10% aqueous Ferric Chloride solution a bluish grey coloured tailing appears from Rf. 0 to 0.39 and a spot at Rf. 0.91 (bluish grey).

CONSTITUENTS n-Hexacosanol, β -Amyrin, β -Sitosterol and Tannin.

PROPERTIES AND ACTION -

Rasa : Kaṣāya, Tikta.
Guna : Uṣṇa
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Kaphaśosaka, Medaśośaka, Viśanāśana

IMPORTANT FORMULATIONS - Khadirādi Guṭikā (Mukharoga), Arimedādi Taila .
(for external use i.e. Kavalagraha and Nasya).

THERAPEUTIC USES - Kuṣṭha, Meha, Mukharoga, Kaṇḍu, Viśajavrana, Śopha, Atisāra, Viśarpa, Pāṇḍu, Dantaroga, Kāsa, Krmi, Udardapra śamana.

DOSE - 40 g. for decoction,
3-5 g. in powder form.

ARJUNA (Stem Bark)

Arjuna consists of the **stem bark** of *Terminalia arjuna* W.& A. (Fam. Combretaceae); a large deciduous tree, commonly found throughout the greater parts of the country.

SYNONYMS -

Sansk. : Kakubha, Pārtha, Svetavāha
Assam. : Arjun
Beng. : Arjuna
Eng. : --
Guj. : Sadad, Arjuna, Sajada
Hindi. : Arjuna
Kan. : Matti, Bilimatti, Neermatti, Mathichakke, Kudare Kivimase
Kash. : --
Mal. : Nirmasuthu, Vellamaruthi, Kellemasuthu, Mattimora, Torematti
Mar. : Arjuna, Sadada
Ori. : Arjuna
Punj. : Arjon
Tam. : Marudam
Tel. : Maddi
Urdu. : Arjun

DESCRIPTION -

a) Macroscopic :

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

Microscopic :

Stem Bark -Mature bark shows cork consisting of 9-10 layers of tangentially elongated cells, a few outer layers filled with brown colouring matter; cork cambium and secondary cortex not distinct and medullary rays observed traversing almost upto outer bark; secondary phloem occupies a wide zone, consisting of sieve tubes, companion cells, phloem parenchyma and phloem fibres, traversed by phloem rays, usually uniseriate but biseriate rays also occasionally seen; in the middle and outer phloem region, sieve tubes get collapsed and form ceratenchyma; phloem fibres distributed in rows and present in groups of 2-10; rosette crystals of calcium oxalate measuring 80-180 μ in dia., present in most of the phloem parenchyma, alternating with fibres; idioblasts consisting of large cells having aggregates of prismatic and rhomboidal crystals of calcium oxalate in row throughout the

zone, measuring 260-600 μ in dia., starch grains, mostly simple, compound of 2-3 components, sometimes upto 5 components, round to oval, elliptical, measuring 5-13 μ in dia., distributed throughout the tissue (absent in *T. alata*); in a tangential section the uniseriate phloem rays 2-10 cells high and biseriate, 4-12 cells high; in longitudinal section rosette crystals of calcium oxalate found in the form of strands in phloem parenchyma.

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Tannins.

PROPERTIES AND ACTION -

Rasa : Kaṣāya

Guṇa : Rūkṣa

Virya : Śīta

Vipāka : Kaṭu

Karma : Kaphahara, Pittahara, Hṛdya, Vraṇanāśana, Bhagnasandhānakara, Vyaṅga hara

IMPORTANT FORMULATIONS - Pārthādyariṣṭa, Nāgārjunābhra Rasa, Arjuna Ghṛta.

THERAPEUTIC USES- Hṛdroga, Kṣataksaya, Medoroga, Prameha, Vraṇa, Trṣā, Vyaṅga.

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

BHALLĀTAKA (Fruit)

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

SYNONYMS –

<i>Sansk</i>	: Aruṣkara, Bhallāta
<i>Assam</i>	: Bhelaguti
<i>Beng.</i>	: Bhela
<i>Eng.</i>	: Marking Nut
<i>Guj.</i>	: Bhilamu
<i>Hindi.</i>	: Bhilawa
<i>Kan.</i>	: Bhallataka
<i>Kash.</i>	: --
<i>Mal.</i>	: Chera
<i>Mar.</i>	: Bibba
<i>Ori.</i>	: Bhollataki, Bholai
<i>Punj.</i>	: Bhilawa
<i>Tam.</i>	: Tatamkottai, Scramkotati
<i>Tel.</i>	: Nallajidi, Nallajidiginga
<i>Urdu.</i>	: Baladur, Bhilavan

DESCRIPTION –

a) Macroscopic :

Fruit laterally flattened, drupaceous, dark brown, nut 2.5-3 cm long, obliquely ovoid, smooth, shining with residual receptacle.

b) Microscopic :

Fruit - Pericarp differentiated into epicarp, mesocarp and endocarp; in longitudinal section pericarp shows outer epicarp consisting of single layer of epidermal cells which are elongated radially and lignified, characteristic glands found in pericarp which exude oil globules and arise as small protuberances in epicarp and due to pressure exerted by cells of mesocarp, some of epidermal cells and cuticle rupture and oil globules exude from oil glands; mesocarp a very broad zone, 30-40 layers thick, composed mostly of parenchymatous cells having lysigenous cavities and fibro-vascular bundles, below epidermis a few outer cells of parenchyma smaller as compared to rest; rosette crystals of calcium oxalate found scattered in parenchymatous cells, some cells get dissolved and form lysigenous cavities which increase in size with maturity of fruit, cavities do not have any special lining and contain an acrid and irritant yellowish oily secretion; endocarp consists of two distinct layers, innermost prismatic, very much elongated radial walls, being highly

thickened, outer layer shorter and thinner than prismatic layer but cells similar to the former; number of mesocarp parenchyma contain rosette crystals of calcium oxalate and oil drops in oil glands; lysigenous cavities of mesocarp contain oily vesicating substance, insoluble in water and soluble in alcohol, ether, chloroform.

Powder - Dark-brown; shows rosette crystals of calcium oxalate and oil globules.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 1 per cent, Appendix 2.2.2.
Total ash	-	Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 11 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 5 per cent, Appendix 2.2.7.

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

PROPERTIES AND ACTION -

Rasa	: Madhura, Kaṭu, Tikta, Kaṣāya
Guṇa	: Laghu, Tikṣṇa, Snigdha
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Vātahara, Kaphahara, Dīpana, Pācana, Chedi, Bhedi, Medhya

IMPORTANT FORMULATIONS - Bhallātaka Rasāyana, Bhallātakādi Modaka, Amṛta Bhallātaka Leha, Sañjivani Vaṭī.

THERAPEUTIC USES - Ānāha, Grahaṇī, Gulma, Arsa, Krimi, Kuṣṭha.

DOSE - 1.2 g. of the drug in Ksirapaka form.

Note - For Bhallātaka Sodhan see A.F.I., Part-I.

BHRŅGARĀJA (Whole Plant)

BhrŅgarĀja consists of **whole plant** of *Eclipta alba* Hassk. (Fam. Asteraceae); a herbaceous annual, 30 - 50 cm high, erect or prostrate, much branched, strigosely hirsute, often rooting at nodes, a common weed of moist places found throughout India ascending upto 1700 m.

SYNONYMS -

Sansk. : KeśarĀja, TekarĀja, BhrŅga, MĀrkava, BhrŅgaja
Assam. : BhrŅgaraja
Beng. : Bheemraja, Kesuriya, Kesari
Eng. : --
Guj. : Bhangaro, Bhangro
Hindi. : Bhangara, Bhangaraiya
Kan. : Garujalu, Gurugada Soppu, Keshavardhana, Kodigaraju
Kash. : --
Mal. : Kayyonni, Knnunni
Mar. : Bhangra, Bhringiraja, Maka
Ori. : --
Punj. : Bhangra
Tam. : Karisalankanni, Karisalanganni, Karisalai
Tel. : Guntakalagara, Guntagalagara
Urdu. : Bhangra

DESCRIPTION -

a) Macroscopic :

Root - Well developed, a number of secondary branches arise from main root, upto about 7 mm in dia., cylindrical, greyish.

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

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

Flower - Solitary or 2, together on unequal axillary peduncles; involucre bracts about 8, ovate, obtuse or acute, herbaceous, strigose with oppressed hairs; ray flowers ligulate, ligule small, spreading, scarcely as long as bracts, not toothed, white; disc flowers tubular, corolla often 4 toothed; pappus absent, except occasionally very minute teeth on the

top of achene; stamen 5, filaments epipetalous, free, anthers united into a tube with base obtuse; pistil bicarpellary; ovary inferior, unilocular with one basal ovule.

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

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

b) Microscopic :

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

Leaf -

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

Midrib - cut at basal region shows both upper and lower single layered epidermis, externally covered with cuticle, a few epidermal cells elongate outwards to form uniseriate hairs; epidermis followed by cortex, consisting of 3-5 layered collenchymatous cells on both sides; section cut at middle region shows 3-4 layered collenchymatous cells on dorsal and 1-3 layered on ventral side, while the section cut at apical region, shows 2 layered collenchymatous cells on both sides, similarly transverse section cut at a basal, middle

and apical regions shows 4-6 layered parenchymatous cells on dorsal side and 6-9 layered parenchyma on ventral side, in section cut at basal region 4-6 layered parenchyma on both the sides in the middle region with thin-walled cells and intercellular spaces, 2-3 layered parenchymatous cells on both side in the apical region; in the basal region section shows vascular bundle similar to that of petiole while in the section cut at middle and apical region section shows 4 smaller bundles shifting towards lamina.

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

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 22 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 11 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 15 per cent, Appendix 2.2.7.

CONSTITUENTS – Alkaloids, Ecliptine and Nicotine.

PROPERTIES AND ACTION -

Rasa : Katu, Tikta
Guṇa : Rūkṣa, Tikṣṇa
Virya : Uṣṇa
Vipāka : Katu
Karma : Vātahara, Kaphahara, Āmahara, Balya, Rasāyana, Keśya, Tvacya,
Dantya, Cakṣusya, Viśahara.

IMPORTANT FORMULATIONS - Bhṛṅgāmalakādi Taila, Bhṛṅgarāja Taila,
Nīli Bhṛṅgādi Taila, Bhṛṅgarājāsava,
Tekarāja marica.

THERAPEUTIC USES - Yakṛdroga, Kṛmiroga, Śoṭha, Pāṇḍu, Svāsa, Kāsa, Śirah śūla,
Hṛdroga.

DOSE - 3 - 6 ml of the drug in juice form.
12 - 36 g. of the drug in powder form for decoction.

BRĀHMĪ (Whole Plant)

Brāhmī consists of **dried whole plant** of *Bacopa monnieri* (Linn.) Wettst., Syn. *Herpestis monniera* (Linn.) H.B.& K. (Fam. Scrophulariaceae); a glabrous, succulent, small, prostrate or creeping annual herb, found throughout India in wet and damp places.

SYNONYMS –

<i>Sansk.</i>	: Saraswatī, Kapotavaṅka
<i>Assam.</i>	: Brahmi
<i>Beng.</i>	: --
<i>Eng.</i>	: Thyme Leaved Gratiola
<i>Guj.</i>	: Neerbrahmi, Bamaneveri
<i>Hindi.</i>	: Manduka Parni
<i>Kan.</i>	: Nirubrahmi, Valabrahmi, Ondelaga, Mandukaparni
<i>Kash.</i>	: --
<i>Mal.</i>	: Bhahmi
<i>Mar.</i>	: Jalnam, Brahmi, Birami
<i>Ori.</i>	: Brahmi
<i>Punj.</i>	: Brahmibuti
<i>Tam.</i>	: Nirabrahmi, Brahmi vazhukkai
<i>Tel.</i>	: Sambarenu, Sambarani
<i>Urd.</i>	: Brahmi

DESCRIPTION –

a) Macroscopic :

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

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

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

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

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

b) Microscopic :

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

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

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

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Alkaloids.

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṣāya, Madhura
Guṇa	: Laghu, Sara
Virya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Kaphahara, Rasāyana, Āyuṣya, Medhya, Matiprada, Swarya, Prajāsthāpana, Viśahara, Mohahara

IMPORTANT FORMULATIONS - Sāraswatāriṣṭa, Brāhmī Ghrta, Ratnagiri Rasa, Brāhmī Vaṭi, Sāraswata Cūrṇa, Smṛtisāgara Rasa.

THERAPEUTIC USES - Kuṣṭha, Jwara, Śopha, Pāṇḍu, Prameha, Mānasavikāra.

DOSE - 1-3 g. in powder form.

BRHATĪ (Root)

Brhatī consists of **dried root** of *Solanum indicum* Linn. (Fam. Solanaceae); a very prickly, much branched perennial under shrub, upto 1.8 m high, mostly found throughout warmer parts of the country upto an elevation of 1500 m.

SYNONYMS -

<i>Sansk.</i>	: Śanhika
<i>Assam.</i>	: Tilabhakuri
<i>Beng.</i>	: Byakud
<i>Eng.</i>	: --
<i>Guj.</i>	: Umimuyaringani, Ubhibharingani, Ubhibhuyaringa
<i>Hindi.</i>	: Vanabharata, Badikateri
<i>Kan.</i>	: Kirugullia, Heggulla, Gulla
<i>Kash.</i>	: --
<i>Mal.</i>	: Cheru Vazhuthina, Putirichunda
<i>Mar.</i>	: Dorli, Chichuriti, Dorale
<i>Ori.</i>	: Dengabheji
<i>Punj.</i>	: Kandiarivaddi
<i>Tam.</i>	: Papparamulli, Chiru vazhuthalai, Mullamkatti
<i>Tel.</i>	: Tella Mulaka
<i>Urdu.</i>	: Kateli

DESCRIPTION -

a) Macroscopic :

Root well developed, long, ribbed, woody, cylindrical, pale yellowish-brown, 1-2.5 cm in dia., a number of secondary roots and their branches present, surface rough due to presence of longitudinal striations and root scars, fracture, short and splintery; no distinct odour and taste.

b) Microscopic :

Root - Shows thin cork composed of 5 - 15 layers of thin-walled, tangentially elongated, rectangular cells filled with yellowish-brown content; cork cambium single layered; secondary cortex composed of 5 - 9 layers of thin-walled, oval and tangentially elongated cells; stone cells present in singles or in groups of 2-5 or more in this region; secondary phloem composed of sieve elements, parenchyma and stone cells, traversed by phloem rays; phloem parenchyma much abundant, thin-walled; stone cells present in outer phloem region in singles or in groups of 2-5, varying greatly in shape and size; phloem rays 1-3 cells wide, isodiametric to slightly radially elongated in inner phloem region and radially elongated in outer phloem region, occasionally stone cells also found in medullary rays; wood occupies bulk of root and composed of vessels, tracheids, fibres

and xylem parenchyma, traversed by xylem rays, all elements being lignified, vessels occur singly or in groups of 2-5 with simple pits; xylem fibres moderately thick-walled with simple pits and pointed ends found in abundance; xylem parenchyma have simple pits or reticulate thickening; xylem rays uni to biseriate, thick-walled, cells radially elongated and pitted, microsphenoidal crystals of calcium oxalate as sandy masses and simple starch grains present in some cells of secondary cortex, phloem and medullary rays; simple and rounded to oval starch grains, measuring 5.5 - 11.6 μ in diameter.

Powder - Cream coloured; shows groups of thin-walled, parenchymatous cells, aseptate fibres, vessels with simple pits, oval to elongated stone cells and simple, rounded to oval starch grains, measuring 5.5 - 11.6 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 6.5 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 4 per cent, Appendix 2.2.7.

CONSTITUENTS – Steroidal Alkaloids and Steroids.

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta
Guṇa	: Laghu
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Dīpana, Pācana, Hr̥dya, Grāhī

IMPORTANT FORMULATIONS - Daśamūla Ghr̥ta, Daśamūlāriṣṭa.

THERAPEUTIC USES - Hr̥droga, Jvara, Śvāsa, Śūla, Agnimāndya.

DOSE - 10-20 g. of the drug for decoction.

CAVYA (Stem)

Cavya consists of **dried stem** of *Piper retrofractum* Vahl. Syn. *P. chaba* Hunter non Blume., *P. officinarum* DC. (Fam. Piperaceae); a glabrous, fleshy climber, cultivated mainly in Southern India.

SYNONYMS –

<i>Sansk.</i>	: Cavika
<i>Assam.</i>	: Chepaan
<i>Beng.</i>	: Chei
<i>Eng.</i>	: Cubeb
<i>Guj.</i>	: Chavka, Chavaka
<i>Hindi.</i>	: Chavya
<i>Kan.</i>	: Kadumenasinaballi, Chavya
<i>Kash.</i>	: --
<i>Mal.</i>	: Kattumulaku, Kattumulakunveru
<i>Mar.</i>	: Chavaka
<i>Ori.</i>	: Chainkath
<i>Punj.</i>	: Chabak
<i>Tam.</i>	: Chavyam, Chevuyam
<i>Tel.</i>	: Chevyamu
<i>Urdu.</i>	: Peepal Chab, Kababah

DESCRIPTION –

a) Macroscopic :

Drug consists of dried cut pieces of stem of variable length and usually 0.5-2.0 cm in width, cylindrical and somewhat twisted, greyish-brown, surface smooth with a few longitudinal wrinkles, nodes and internodes distinct, fracture, short; odour, peppery; taste, acrid.

b) Microscopic :

Stem – Shows a thin cork consisting of 3-4 layers of rectangular, brownish cells; cork cambium not distinct; secondary cortex a wide zone, consisting of round, oval to rectangular, thin-walled, parenchymatous cells with prominent intercellular spaces; plenty of simple starch granules present; endodermis single layered; stelar region composed of five wedge-shaped vascular bundles alternating with wide medullary rays; phloem lies towards outer side and composed of sieve elements, parenchyma and phloem fibres occurring singly or in groups; xylem lies towards centre and composed of vessels, tracheid, fibres and xylem parenchyma; isolated vessels barrel-shaped with pitted and reticulate thickenings; fibres needle and spindle-shaped, medullary rays multiseriate, cells thin-walled, filled with simple, round to oval, starch grains, measuring 3 - 14 μ in diameter.

Powder – Greyish-brown; shows fragments of vessels, fibres and simple, round to oval starch grains, measuring 3-14 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 10 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 6 per cent, Appendix 2.2.7.

CONSTITUENTS – Alkaloids, Glycosides and Steroids.

PROPERTIES AND ACTION -

Rasa	: Kaṭu
Guṇa	: Laghu, Rūkṣa, Tīkṣṇa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Dīpana, Pācana, Recana, Bhedana

IMPORTANT FORMULATIONS - Prāṇadā Guṭikā, Candrāmṛta Rasa.

THERAPEUTIC USES - Arśa, Krimi, Pliḥā Roga, Gulma, Ānāha, Udara Roga, Sūla.

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

DĀDĪMA (Seed)

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

SYNONYMS -

Sansk. : Dādimācchada, Lohitapuṣpa, Dantabīja

Assam. : --

Beng. : Dadima

Eng. : Pomegranate

Guj. : Dadama

Hindi. : Anar

Kan. : Dalimba

Kash. : --

Mal. : Matalam

Mar. : Dadimba

Ori. : --

Punj. : Anar

Tam. : Madalai, Maadalai, Madalam.

Tel. : Danimma

Urdu. : Anar, Rumman

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

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

T.L.C.

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

CONSTITUENTS - Sugars, Vitamin C, Sitosterol, Ursolic acid, Protein, Fat and Mineral matters, Nicotinic acid, Pectin, Riboflavin, Thiamine, Delphinidin diglycoside, Aspartic, Citric, Ellagic, Gallic and Malic acids, Glutamine, Isoquercetin, Estrone and Punicic acid.

PROPERTIES AND ACTION -

	<u>Madhura</u>	<u>Madhura Amla</u>
Rasa	: Madhura (Kaṣayānūrasa)	Madhura, Amla
Guṇa	: Laghu, Snigdha	Laghu
Vīrya	: Uṣṇa	--
Vipāka	: Madhura	--
Karma	: Vātahara, Pittahara, Kaphahara; Tarpaṇa, Śukrala, Hṛḍya, Kaṇṭhya, Mukhagandhahara, Grāhī, Medhya, Balya	

IMPORTANT FORMULATIONS - Dāḍimāṣṭaka Cūrṇa, Dāḍima Ghr̥ta, Dādhika Ghr̥ta, Bhāṣkara Lavaṇa, Śukra Mātrka Vaṭī.

THERAPEUTIC USES - Tr̥ṣṇā, Dāha, Jwara.

DOSE - 5 to 10 g. of the drug in powder form.

DĀRUHARIDRĀ (Stem)

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

SYNONYMS -

- Sansk.* : Dārvī, Katamkateri
Assam. : --
Beng. : Daruharidra
Eng. : Indian Berberry
Guj. : Daruharidra, Daruhuladur
Hindi. : Daruhaldi, Darhald
Kan. : Maradarishana, Maradarishina, Daruhaladi
Kash. : --
Mal. : Maramannal, Maramanjnal
Mar. : Daruhalad
Ori. : Daruharidra, Daruhalidi
Punj. : Sumalu
Tam. : Gangeti, Varatiu manjal
Tel. : Manupasupu
Urdu. : Darhald

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Stem -Shows rhytidoma with cork consisting of 3-45 rectangular and squarish, yellow coloured, thin-walled cells, arranged radially; sieve elements irregular in shape, thin-walled, a few cells containing yellowish-brown contents; phloem fibres arranged in tangential rows, consisting of 1-4 cells, each fibre short thick-walled, spindle-shaped, lignified having wide lumen; half inner portion of rhytidoma traversed by secondary phloem rays; phloem rays run obliquely consisting of radially elongated parenchymatous cells, almost all phloem ray cells having single prismatic crystals of calcium oxalate, a few cells of rhytidoma also contain prismatic crystals of calcium oxalate; stone cells also

found scattered in phloem ray cells in groups, rarely single, mostly elongated, a few rounded, arranged radially, some of which contain a single prism of calcium oxalate crystals; secondary phloem, a broad zone, consisting of sieve elements and phloem fibres, traversed by multiseriate phloem rays; sieve elements arranged in tangential bands and tangentially compressed cells alternating with single to five rows of phloem fibres, phloem fibres short, lignified, thick-walled having pointed ends; secondary xylem broad consisting of xylem vessels, tracheids, xylem fibres and traversed by multiseriate xylem rays; xylem vessels numerous, small to medium sized, distributed throughout xylem region in groups or in singles, groups of vessels usually arranged radially; isolated vessels cylindrical with rounded or projected at one or both ends with spiral thickening; xylem fibres numerous, lignified, large, thick-walled with wide lumen, and pointed tips; xylem rays quite distinct, straight, multiseriate, consisting of radially arranged rectangular cells, each ray 30-53 cells high, 8-12 cells wide, a few ray cells containing brown contents.

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Alkaloids.

PROPERTIES AND ACTION -

Rasa	: Tikta
Guṇa	: Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: --
Karma	: Stanya Śodhana, Stanya Doṣahara, Doṣa Pācana.

IMPORTANT FORMULATIONS- Aśvagandhādyarīṣṭa, Bhr̥ṅgarāja Taila, Khadirādi Gutīkā, Khadirārīṣṭa, Jātyādi Taila, Triphalā Ghr̥ta.

THERAPEUTIC USES - Āmātisāra, Medoroga, Urustambha, Kapharoga, Karṇaroga, Mukharoga, Nētraroga, Kaṇḍu, Vraṇa, Meha.

DOSE - 5-10 ml of the drug in Kvatha form.

DRONAPUŠPĪ (Whole Plant)

DronapušpĪ consists of dried whole plant of *Leucas cephalotes* Spreng. (Fam. Lamiaceae), an annual, erect, scaberulous, stout herb, about 0.6-0.9 m in high, found on the Himalayas at an altitude of 600-1800 m and on waste lands throughout the country.

SYNONYMS -

Sansk. : Katumba
Assam. : Dronaphool
Beng. : Bholghasiya
Eng. : --
Guj. : Kubo
Hindi. : Guma
Kan. : Tumbe
Kash. : --
Mal. : Tumba
Mar. : Tumba
Ori. : Gaisha
Punj. : Gomobati, Gumma, Mal-Bheda
Tam. : Tumbai
Tel. : Tummi
Urdu. : --

DESCRIPTION -

a) Macroscopic :

Root - Cylindrical, zig-zag, smooth, long with numerous wiry, fine rootlets, size variable, fracture, fibrous; taste, characteristic.

Stem - Light greenish-yellow, surface rough, hairy, quadrangular with four prominent furrows, upto 4 mm thick, nodes and internodes distinct; taste, slightly bitter.

Leaf - Yellowish-green, 3-9 cm long, 1-2.5 cm wide, ovate or ovate-lanceolate, subacute, more or less pubescent, crenate, serrate; taste, pungent.

Inflorescence - Sessile, white, crowded in dense, globose, about 2-3.5 cm across, surrounded by numerous foliaceous bracts, thin, lanceolate, acute, ciliate, 1.2-1.5 cm long and 0.3-0.35 cm wide; calyx, tubular, slightly curved, 1-2.25 cm long, glabrous in lower part, hairy on upper part, 10 dentate with a villous throat; corolla, white, 1.7-2 cm long, bilipped, upper lip about 4 mm long, wooly, lower lip nearly twice as long as upper one; lateral lobes small.

Fruit - Schizocarpic carcerule, nutlets 3 mm smooth, brown.

Seed - 0.3 cm long and 0.1 cm wide, oblong, trigonous, smooth, dark brown.

b) Microscopic :

Root - Shows a single layered epidermis composed of rectangular, thin-walled cells; secondary cortex consists of thin-walled, tangentially elongated, parenchymatous cells; secondary phloem consists of sieve elements and phloem parenchyma; secondary xylem consists of vessels, tracheids, fibres and xylem parenchyma; vessels long with spurs, vessels and tracheids have simple pits, xylem fibres much elongated with pointed ends and have moderately thick walls, some having simple pits; medullary rays 1-2 seriate, upto 8 cells high.

Stem - Shows squarish outline with four ridges and furrows, consists of a single layered epidermis, composed of oval to rectangular, thin-walled cells having a number of uni to tricellular trichomes; secondary cortex 5-9 layered, consisting of 3-5 layers of circular, oval or irregular collenchymatous cells at the ridge and 2-4 layers of thin-walled, tangentially elongated, parenchymatous cells; endodermis single layered, consisting of barrel-shaped, thin-walled cells; pericycle single layered of thin-walled cells comparatively smaller than the cells of endodermis, a few pericyclic cells converted into pericyclic fibres; phloem very narrow consisting of usual elements; xylem consists of vessels, tracheids, fibres and large amount of xylem parenchyma; vessels mostly cylindrical with simple pits and spiral thickening; tracheids and xylem parenchyma have simple pits on their walls; pith wide consisting of circular to oval, thin-walled, parenchymatous cells.

Leaf -

Petiole - shows a single layered epidermis, uni to tricellular trichomes with pointed ends, cortex consisting of single layered, round to angular collenchyma; parenchyma consists of thin-walled cells containing prismatic crystals of calcium oxalate, vascular bundles 4, 2 smaller located towards each corner and 2 larger in centre.

Midrib - shows epidermis on either side with uni to tricellular trichomes, followed by 1-2 layers collenchyma towards lower surface, 3-4 layers towards upper surface, followed by round to oval parenchyma, 4-7 layered; vascular bundle arc-shaped, present in centre.

Lamina - shows epidermis on either side with uni to tricellular trichomes rarely on upper surface; palisade single layered; spongy parenchyma 3-5 layered, irregular, thin-walled cells; a few veins present in this region; stomata diacytic, present on both surfaces; stomatal index 16.6-40.5 on lower surface, 16.6-30.7 on upper surface; palisade ratio 7-9.

Powder - Dull yellow; shows groups of round to polygonal parenchymatous cells, pitted and spiral vessels, aseptate fibres, uni to tricellular trichomes and diacytic stomata.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 17 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 5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 14 per cent, Appendix 2.2.7.

CONSTITUENTS – Alkaloid, Glycoside, β -Sitosterol and Flavonoid.

PROPERTIES AND ACTION -

Rasa	: Madhura, Lavana, Kaṭu
Guṇa	: Guru, Rūkṣa, Tikṣṇa
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Vātakara, Pittakara, Kaphahara, Bhedani, Rucya

IMPORTANT FORMULATIONS - Pliḥāri Vaṭikā, Gorocanādi Vaṭi.

THERAPEUTIC USES - Kāmalā, Sotha, Tamaka svāsa, Kāsa, Agnimāndya, Viṣamajvara.

DOSE - 1-3 g. of the drug in powder form.
5-10 ml. of the drug in juice form.

ERVĀRU (Seed)

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

SYNONYMS -

Sansk. : Bahukanda, Brhatphala, Hastipani, Karkaṭī

Assam. : --

Beng. : Kakur, Karikuda

Eng. : Snake Cucumber

Guj. : Kakadi

Hindi. : Kakri, Kakadi

Kan. : Saute

Kash. : --

Mal. : Kamkadi, Vellarika

Mar. : Kakadi, Valnka

Ori. : --

Punj. : Kakri

Tam. : Kakkarikkay, Vellarikkai

Tel. : Dosakaya

Urdu. : Kakari

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 1 per cent, Appendix 2.2.2.
Total ash	-	Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 5 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (90:10) shows one fluorescent zone at Rf.0.91 (blue) under U.V. (366 nm). On exposure to Iodine vapour ten spots appear at Rf. 0.19,0.26, 0.35, 0.51, 0.58, 0.64, 0.77,0.83,0.91 and 0.97 (all yellow) .On spraying with 5% Methanolic Phosphomolybdic acid reagent and on heating the plate for fifteen minutes at 105° C ten spots appear at Rf. 0.19, 0.26, 0.35, 0.51, 0.58, 0.64, 0.77, 0.83, 0.91 and 0.97 (all grey).

CONSTITUENTS – Oil & Sugars.

PROPERTIES AND ACTION -

Rasa : Madhura, Tikta

Guṇa : Guru, Rūkṣa

Vīrya : Śīta

Vipāka : Madhura

Karma : Vātakara, Kaphakara, Pittahara, Rucya, Dīpana, Bhedi, Raktadoṣakara, Grāhī

IMPORTANT FORMULATIONS - Dādhika Ghṛta.

THERAPEUTIC USES - Aśmarī, Mūtrakṛcchra, Gulma, Raktapitta, Trṣṇā, Dāha, Jvara.

DOSE - 3-6 g. of seeds.

GAJAPIPALĪ (Fruit)

Gajapipalī consists of dried, transversely cut pieces of mature female spadix of *Scindapsus officinalis* Schoott. (Fam. Araceae); a large epiphytic climber, found all along the sub-Himalayan tract between an altitude of 330-1000 m in West Bengal, Orissa, Andhra Pradesh and the Andaman Islands.

SYNONYMS -

<i>Sansk.</i>	: Gajakṛṣṇa, Hastipalī
<i>Assam.</i>	: --
<i>Beng.</i>	: Gajapeepal
<i>Eng.</i>	: --
<i>Guj.</i>	: Motopeepar
<i>Hindi.</i>	: Gajapeepal
<i>Kan.</i>	: Adkebeeluvalli
<i>Kash.</i>	: --
<i>Mal.</i>	: Attipali
<i>Mar.</i>	: Gajapipalee
<i>Ori.</i>	: --
<i>Punj.</i>	: Gajapeepal
<i>Tam.</i>	: Anaitippalee
<i>Tel.</i>	: Enugopippal
<i>Urdu.</i>	: --

DESCRIPTION -

a) Macroscopic :

Fruit - Occurs in transversely cut circular pieces of about 2.0-3.0 cm in diameter and 2.0-3.5 cm thick, brownish-grey, rough and scaly, cut surface has a central core, surrounded by fruits enclosing the seed covered partly by aril, odour and taste not distinct.

Seed - Kidney-shaped, 0.3-0.4 cm wide, 0.4-0.6 cm long, smooth, shiny, greyish-brown with a dent; odour and taste not distinct.

b) Microscopic :

Fruit - Shows more or less loosely arranged, thin-walled, parenchymatous cells having more or less isodiametric cells filled with brown content and numerous acicular crystals of calcium oxalate.

Seed - Shows a single layered, oval to polygonal, thin-walled testa followed by 2-3 layered, thick-walled, oval to polygonal, non-lignified, sclereid-like cells having wide lumen and concentric striations; 2-4 layered, oval to polygonal, thick-walled, lignified

stone cells having very narrow lumen, pitted and with concentric striations; thin-walled, irregular parenchymatous cells containing oil globules and aleurone grains.

Powder - Dark brown; shows lignified, oval to polygonal stone cells having lumen and striations; numerous needle-like acicular crystals of calcium oxalate, measuring 120-130 μ in length and oil globules.

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 1.5 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 11 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of drug on Silica gel 'G' plate using Chloroform : Methanol (1:1) shows two spots at Rf. 0.65 and 0.73 both light yellow) in visible light. Under U.V. (366 nm) four fluorescent zones at Rf. 0.27, 0.65, 0.73 and 0.93 (all blue) are visible. On exposure to Iodine vapour five spots appear at Rf. 0.20, 0.27, 0.65, 0.73 and 0.93 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C. three spots appear at Rf. 0.65, 0.73 (both light brown) and 0.93 (brown).

CONSTITUENTS – Glucosides viz. Scindapsin A & Scindapsin B, Sugars & Fixed Oil.

PROPERTIES AND ACTION -

Rasa	: Kaṭu
Guṇa	: Rūkṣa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Agnivardhaka, Kanṭhya, Dipana, Malaviśoṣana, Stanya, Varṇya

IMPORTANT FORMULATIONS - Punarnavāsava, Sivāgūṭikā,
Mahāyogarāja Guggulu, Prasārini taila,
Candraprabhāvatī.

THERAPEUTIC USES - Svāsa, Kṛmiroga, Atisāra, Kanṭha Roga.

DOSE - 2-3 g. in extract (Phant) form.

GAMBHARI (Fruit)

Gambhari consists of **dried fruit** of *Gmelina arborea* Roxb. (Fam. Verbenaceae), an unarmed tree, found scattered in deciduous forests throughout the greater part of the country upto an altitude of 500 m, planted in gardens and also as an avenue tree.

SYNONYMS -

<i>Sansk.</i>	: Kāsmari, Kāsmarya, Pitakarohini, Sriparni, Bhadraparni
<i>Assam.</i>	: Gomari
<i>Beng.</i>	: Gamargachha, Gambar
<i>Eng.</i>	: --
<i>Guj.</i>	: Seevan
<i>Hindi.</i>	: Gambhari
<i>Kan.</i>	: Seevani, Shivani, Hannu,
<i>Kash.</i>	: --
<i>Mal.</i>	: Kumbil, Kumizhu
<i>Mar.</i>	: Sivan
<i>Ori.</i>	: Gambhari, Bhodroparni,
<i>Punj.</i>	: Khambhari
<i>Tam.</i>	: Perunkurmizh, Komizhpazham
<i>Tel.</i>	: Gumad iteku
<i>Urdu.</i>	: Gambhari

DESCRIPTION -

a) Macroscopic :

Fruit - A drupe, ovoid, crinkled, black, 1.5-2.0 cm long, sometimes with portion of attached pedicel, two seeded, sometimes one seeded; taste, sweetish sour.

Seed - Seed ovate, 0.5-1 cm long, 0.4-0.6 cm wide, light yellow, surface smooth, seed coat thin, papery; taste, oily.

b) Microscopic :

Fruit - Shows pericarp differentiated into single layered epicarp, multilayered, fleshy mesocarp, hard and stony endocarp: epicarp consisting of single layered, thin-walled cells; mesocarp a wide zone consisting of isodiametric, thin-walled, parenchymatous cells; endocarp consisting of multilayered sclerenchymatous cells.

Seed - Shows outer integument consisting of 3-5 rows of crushed, parenchymatous cells followed by inner integument consisting of 2-3 rows of thin-walled, tangentially elongated, parenchymatous cells; cotyledons consisting of single layered, radially elongated

epidermal cells; mesophyll consisting of thin-walled cells, filled with oil globules and aleurone grains.

Powder - Blackish-brown; shows stone cells, oil globules and aleurone grains.

IDENTITY, 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.
Acid-insoluble ash	-	Not more than 0.4 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 25 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform:Methanol (4:1) shows one spot at Rf. 0.98 (yellow) in visible light. Under U.V. (366 nm) five fluorescent zones appear at Rf. 0.03, 0.12, 0.22, 0.94 and 0.98 (all blue). On exposure to Iodine vapour eight spots appear at Rf. 0.03, 0.08, 0.18, 0.26, 0.42, 0.52, 0.93 and 0.98 (all yellow). On spraying with Dragendorff reagent followed by 5% Ethanol-Sulphuric acid reagent one spot appears at Rf. 0.98 (orange).

CONSTITUENTS - Butyric acid, Tartaric acid, Alkaloid, Resin and Saccharine.

PROPERTIES AND ACTION -

Rasa	: Madhura, Amla, Kaṣāya.
Guṇa	: Guru, Snigdha, Sara
Virya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittahara, Rasāyana, Br̥ṇhana, Keśya, Medhya, Śukrala, Hṛdya

IMPORTANT FORMULATIONS - Arvindāsava, Drākṣādi Kvātha Cūrṇa.

THERAPEUTIC USES - Rakta pitta, Dāha, Tr̥ṣṇā, Kṣata, Kṣaya, Mūtrakṛcchra, Hṛdroga.

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

GÄNGERU (Stem Bark)

Gängeru consists of dried stem bark of *Grewia tenax* (Forsk.) Aschers & Schwf., Syn. *Grewia populifolia* Vahl, (Fam. Tiliaceae), a shrub 0.6-1.0 m high, occurring in North Western and central part of the country and in Deccan Peninsula.

SYNONYMS -

<i>Sansk.</i>	: Gāṅgeruki
<i>Assam.</i>	: --
<i>Beng.</i>	: Garakshachakule
<i>Eng.</i>	: --
<i>Guj.</i>	: Gangeti
<i>Hindi.</i>	: Gangeran
<i>Kan.</i>	: Turuve
<i>Kash.</i>	: --
<i>Mal.</i>	: Oorakam
<i>Mar.</i>	: Gangeti
<i>Ori.</i>	: Ghodaguli
<i>Punj.</i>	: Ganger
<i>Tam.</i>	: Achchu
<i>Tel.</i>	: Gangeruki
<i>Urdu.</i>	: Gangeran

DESCRIPTION -

a) Macroscopic :

Drug occurs as cut pieces; 1.5-5 cm long, light yellow, channelled, fibrous; external surface smooth; fracture, fibrous; taste, mucilaginous.

b) Microscopic :

Stem Bark - Shows a wide cork, consisting of 12-20 layered, rectangular, radially arranged cells, a few inner cells contain rectangular crystals of calcium oxalate; secondary cortex wide, consisting of tangentially elongated, thin-walled, parenchymatous cells, a few cortical cells towards cork also contain prismatic crystals of calcium oxalate; oval, elliptical, thick-walled, lignified cells with wide lumen and clear pit canals, moderately large in size, a few stone cells, found scattered in groups throughout secondary cortex and in a row towards inner cortical region; secondary phloem composed of sieve elements, parenchyma and numerous thick-walled, cellulosic fibres with wide lumen, blunt tips and moderately long in size, arranged in radial groups, traversed by wide phloem rays; a few ray cells contain prismatic crystals of calcium oxalate.

Powder - Light yellow and fibrous; under microscope shows phloem fibres in groups or singles, stone cells and prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 1 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 6 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 8 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (90 :10). Two spots are seen at Rf. 0.17, 0.35 (both light yellow) in visible light. Under U.V. (366 nm) six fluorescent zones visible at Rf. 0.08 (blue) 0.13 (blue), 0.29 (blue), 0.35 (dark blue), 0.55 (blue) & 0.64 (blue). On exposure to Iodine vapour ten spots appear at Rf. 0.08, 0.17, 0.27, 0.35, 0.41, 0.48, 0.55, 0.61, 0.68 & 0.88 (all yellow). On spraying with Anisaldehyde-Sulphuric acid reagent seven spots appear at Rf. 0.08 (violet), 0.17 (light violet), 0.27 (light violet), 0.35 (violet), 0.48 (violet), 0.68 (light violet) & 0.88 (light violet).

CONSTITUENTS – Sugar, Tannin and Sterols (Triacontan-1-ol, α -amyirin, β -amyirin etc.).

PROPERTIES AND ACTION -

Rasa : Madhura, Amla, Kaṭu, Tikta, Kaṣāya
Guṇa : Guru
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Tridoṣahara, Saṅgrāhaka

IMPORTANT FORMULATIONS - Jīrakādi Modaka.

THERAPEUTIC USES - Vraṇa, Pittavikāra.

DOSE : 2-3 g. of the drug in powder form.

GUNJĀ (Root)

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

SYNONYMS -

<i>Sansk.</i>	: Raktikā, Kakananti
<i>Assam.</i>	: Rati
<i>Beng.</i>	: Kunch, Shonkainh
<i>Eng.</i>	: Jequirity
<i>Guj.</i>	: Rati, Chanothee, Chonotee
<i>Hindi.</i>	: Ratti, Ghungchi
<i>Kan.</i>	: Guluganji, Gulagunja
<i>Kash.</i>	: --
<i>Mal.</i>	: Kunni, Cuvanna Kunni
<i>Mar.</i>	: Gunja
<i>Ori.</i>	: Kainch
<i>Punj.</i>	: Ratti
<i>Tam.</i>	: Kunrimani, Kundumani
<i>Tel.</i>	: Gurigingā, Gurivinda
<i>Urdu.</i>	: Ghongchi, Ratti

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Root - Shows thin cork of 3-5 layers of narrow, tangentially elongated cells, some with brownish content; cork cambium, when distinct, composed of 1-2 cells wide, thin-walled, comparatively larger and slightly tangentially elongated cells, followed by 2-4 rows of spherical ovoid or slightly elongated stone cells with thick, pitted walls, small groups of 4-10 sclerenchymatous cells, smaller than stone cells, present at short intervals; secondary phloem consists of usual elements traversed by medullary rays diverging towards periphery; parenchyma thin-walled, mostly tangentially elongated with occasional patches of sieve elements in somewhat collapsed form; small groups of sclerenchyma,

similar to those occurring in cortex are also present; cells in inner phloem region appear circular to polyhedral; in older samples phloem elements usually found in compressed condition forming obliquely and tangentially arranged irregular patches; medullary rays distinct and 1-6 cells wide, thin-walled and rectangular, tangentially elongated towards distal end of ray and radially elongated in xylem parts and bast region, mostly containing starch grains of various sizes; cambium forms a complete ring of 1-2 rows of very narrow cells outside the wood; wood composed of narrow concentric, annular bands of very thick-walled wood fibres alternating with similar but wider zone of thick-walled parenchyma; vessels of varying sizes with thick, pitted walls; medullary rays usually uni or biseriate but a few broader rays, 5-10 or more rows of cells occasionally present; parenchyma cells of wood and bast filled with simple, rounded to oval starch grains measuring 5.5-13.75 μ in diameter.

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Glucoside (Glycyrrhizin).

PROPERTIES AND ACTION -

Rasa	: Madhura, Tikta
Guṇa	: Rūkṣa, Śīta
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittahara, Keśya

IMPORTANT FORMULATIONS - Nīlī Bhṛṅgādi Taila.

THERAPEUTIC USES - Indralupta, Mukhasoṣa, Śūla.

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

IKṢU (Stem)

Ikṣu consists of the **dried stem** of *Saccharum officinarum* Linn. (Fam. Poaceae), a shrub, grown and generally cultivated in all hotter parts and in warm climate throughout India.

SYNONYMS -

<i>Sansk.</i>	: Ikṣu
<i>Assam.</i>	: Kusiya
<i>Beng.</i>	: Ganna
<i>Eng.</i>	: Sugarcane
<i>Guj.</i>	: Sherdi, Serdi
<i>Hindi.</i>	: Ikha, Ganna
<i>Kan.</i>	: Kabbu
<i>Kash.</i>	: --
<i>Mal.</i>	: Karumbu, Karimpu
<i>Mar.</i>	: Ush
<i>Ori.</i>	: Akhu
<i>Punj.</i>	: Ganna
<i>Tam.</i>	: Karumbu
<i>Tel.</i>	: Gheraku
<i>Urdu.</i>	: Ganna, Naishkar

DESCRIPTION -

a) Macroscopic :

Stem upto 6 m high, cylindrical, solid, with, distinct node and internode, 3-8-12 cm long and 2-4 cm in dia; smooth, shining and polished pale or dark green to dark yellow, red violet and often striped having a bud at each node; odour, characteristic; taste, juicy and sweet.

b) Microscopic :

Stem - Shows a single layered epidermis consisting of thick-walled, lignified, rectangular cells followed by 2-3 layers of sclerenchymatous hypodermis; ground tissue consisting of thin-walled, parenchymatous cells having a number of collateral, conjoint, closed type of vascular bundles, scattered throughout the ground tissue, more numerous and closer towards periphery; each vascular bundle surrounded by a fibrous sheath of sclerenchyma, thickness of the sheath gradually decreasing in the bundles towards the centre; besides the xylem and phloem elements, each bundle surrounds a water containing cavity.

Powder - Powder light brick red; shows pieces of epidermis, ground tissue, vessels and sclerenchyma.

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 2.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 15 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 17 per cent, Appendix 2.2.7.

CONSTITUENTS – Sucrose.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guṇa	: Śara, Snigdha, Guru
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittahara, Kapahara, Mūtrala, Balya, Vṛṣya, Bṛṛhāṇa

IMPORTANT FORMULATIONS - Balā Taila, Navaratnarājamrgāṅka Rasa.

THERAPEUTIC USES - Raktapitta, Mūtra Kṣaya.

DOSE - 200 – 400 ml. in the juice form.

INDRAVĀRUNĪ (Root)

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

SYNONYMS -

- Sansk.* : Indravallī, Indravāruṇikā, Endrī, Gavākṣī, Śatakratulatā
Assam. : --
Beng. : Rakhāl Sasa Mul
Eng. : Colocynth, Bitter Apple
Guj. : Indravarān, Indrayān, Indramānoa, Indarvarānava
Hindi. : Indrayān
Kan. : Havumekke, Havumakke, Indravaruni, Tuntikai, Kadukavadi
Kash. : --
Mal. : Valiyakattuvell, Valiya Pekkumatti, Cheeyakattuvellari
Mar. : Endrayāna, Indravarāna
Ori. : Gothakakucti, Indrayānalata, Garukhiya
Punj. : Kaudatumma, Tumbi
Tam. : Paikamatti, Paythumatti, Varithummati, Aruthummati
Tel. : Chedu Puchcha
Urdu. : Hanzal, Indrayān

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Root - Mature root shows wavy outline consisting of 6-10 layers of rectangular, thick-walled, tangentially elongated cork cells, a few filled with dark brown contents; secondary cortex consists of 10-15 layers of elliptical, tangentially elongated, thin-walled, parenchymatous cells; secondary phloem a narrow-zone, composed of sieve elements, parenchyma and medullary rays; xylem forms bulk of root, consisting of vessels, fibres, parenchyma and medullary rays; vessels mostly solitary or in groups of two to four having reticulate and spiral thickenings; fibres aseptate, thick-walled, pitted, elongated with pointed ends, lying around vessels; medullary rays poorly developed and uniseriate; starch grains oval to round in shape 2.5-7.5 μ in dia. mostly simple or rarely compound having 2-3 components, found scattered throughout but more abundantly in phloem parenchyma.

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 8 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 6.5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 20 per cent, Appendix 2.2.7.

T.L.C. -

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

CONSTITUENTS – Saponin and traces of Alkaloid.

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṭu
Guṇa	: Laghu, Sara
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Pittahara, Kaphahara, Recana

IMPORTANT FORMULATIONS - Abhayāriṣṭa, Rodhrāsava, Mṛtasañjivani Surā, Br̥hatmañjiṣṭhādi Kvātha Cūrṇa, Nārāyaṇa Cūrṇa, Miśraka Sheha, Triphalādi Taila, Mahāviṣagarbha Taila.

THERAPEUTIC USES - Kāmalā, Pliḥāroga, Śvāsa, Kāsa, Kuṣṭha, Gulma, Kṛmiroga, Prameha, Viṣavikāra, Vraṇa, Apaci, Gandamālā.

DOSE - 1 – 3 g. of the drug in powder form.

INDRAVĀRUNI (Leaf)

Indravāruṇī consists of **dried leaves** of *Citrullus colocynthis* Schrad. (Fam. Cucurbitaceae); an annual or perennial, wild herb with prostrate or climbing stem, occurring throughout the country.

SYNONYMS

<i>Sansk.</i>	: Eandri, Indravallī, Satakratulatā, Indravāruṇikā, Gavākṣī
<i>Assam.</i>	: Nantiyah
<i>Beng.</i>	: Rahhalasa, Makhāl
<i>Eng.</i>	: Colocynth, Bitter Apple
<i>Guj.</i>	: Indrayana, Indrayanoa, Insbak
<i>Hindi.</i>	: Indrayana
<i>Kan.</i>	: Havumekke Kayi, Havamikke
<i>Kash.</i>	: --
<i>Mal.</i>	: Katu vellari, Kadu Indrayan, Peykommuti
<i>Mar.</i>	: Indrayana, Kodu indrayan
<i>Ori.</i>	: Gothkakudi, Mahakal
<i>Punj.</i>	: Tumma, Jamtumma
<i>Tam.</i>	: Peyakkumutti, Peytumatti, Peyththumatti, Peykhumutti, Verittumatti
<i>Tel.</i>	: Chedupuchcha
<i>Urdu.</i>	: Hanzal, Indrayan

DESCRIPTION –

a) Macroscopic :

Leaves very variable, 3.6-6.3 cm long, 2.5-5.0 cm wide, pinnately lobed in outline, generally 3 lobed; sometimes 3-7 lobed, middle lobe largest, each lobe deeply pinnatifid; petiole 1.3-2.5 cm long, entire leaf densely hirsute; taste, very bitter.

b) Microscopic :

Leaf –

Petiole – shows ridged outline; epidermis single layered consisting of oval to rounded cells, covered with thick cuticle; hairs uniseriate, 2-4 celled, present on both surfaces; cortex consisting of 3-7 layers, round collenchymatous cells, followed by a single layered endodermis; pith consisting of thin-walled, isodiametric, parenchymatous cells; vascular bundles generally eight, arranged in discontinuous ring, bicollateral, each bundle surrounded by semilunar patches of sclerenchymatous cells towards endodermis.

Midrib – shows single layered epidermis, covered with cuticle on both surface; hair present on both surfaces, uniseriate, consisting of 2-3 cells, apical cells being pointed or blunt; cortex consisting of 2-3 layers of collenchymatous cells on dorsal side, followed by

thin-walled, parenchymatous cells; vascular bundles present, two well developed, one smaller and other larger, conjoint, bicollateral, composed of xylem and phloem.

Lamina –shows single layered epidermis covered with cuticle, hairs similar to those of midrib and present on both surfaces, but more abundant on lower surface; palisade single layered, spongy parenchyma generally 5-8 layered, composed of thin walled, almost isodiametric cells, filled with chlorophyll contents and traversed by a number of veins, vein islet number 29-38 per sq. mm; palisade ratio 2.75-3.75; stomata anomocytic present on both surfaces, stomatal index on upper surface 12.5-28.5 and on lower surface 25.0-31.2.

Powder – Coarse, olive green; shows entire or broken pieces of hairs; epidermal cells polygonal, moderately thick-walled, 27.5-49.5 μ long and 19-27 μ wide; spongy parenchyma cells, anomocytic type of stomata and xylem vessels.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 18 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 6 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 7 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 18 per cent, Appendix 2.2.7.

T.L.C. –

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using n-Butanol : Acetic acid : Water (4:1:5) shows under U.V. (366 nm) five fluorescent zones at Rf. 0.46, 0.61, 0.75, 0.94 (all green) and 0.97 (red). On spraying with 5% Methanolic-Sulphuric acid reagent and on heating the plate for ten minutes at 105°C four spots appear at Rf. 0.61 (green), 0.75 (green), 0.83 (grey) and 0.94 (grey).

CONSTITUENTS – Colocynthin, traces of an Alkaloid and Flavonoids.

PROPERTIES AND ACTION -

Rasa : Kaṭu, Tikta
Guṇa : Laghu, Sara
Virya : Uṣṇa
Vipāka : Kaṭu
Karma : Pittahara, Kaphahara, Recana

IMPORTANT FORMULATIONS - Nīlibhr̥ṅādi Taila.

THERAPEUTIC USES - Kesapāta, Palita, Kuṣṭharoga.

DOSE - For external use only.

JAMBŪ (Seed)

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

SYNONYMS -

<i>Sansk.</i>	:	
<i>Assam.</i>	:	
<i>Beng.</i>	:	Badjam, Kalajam
<i>Eng.</i>	:	Jambul tree
<i>Guj.</i>	:	Gambu, Jamun
<i>Hindi.</i>	:	Jamuna
<i>Kan.</i>	:	Nerale Beeja, Jambu Nerale
<i>Kash.</i>	:	--
<i>Mal.</i>	:	Njaval
<i>Mar.</i>	:	Jambul
<i>Ori.</i>	:	Jam Kol, Jamu Kol
<i>Punj.</i>	:	Jaamun
<i>Tam.</i>	:	Naval
<i>Tel.</i>	:	Alla Nereduchettu, Neredu chettu
<i>Urdu.</i>	:	Jamun

DESCRIPTION: -

a) Macroscopic :

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

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 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 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 6 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 15 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (90 : 10) shows under U.V. light (366 nm) one fluorescent zone at Rf. 0.30 (blue). On exposure to Iodine vapour four spots appear at Rf. 0.12, 0.20, 0.30 and 0.95 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 105°C, three spots appear at Rf. 0.20, 0.30 and 0.95 and 0.95 (all violet).

CONSTITUENTS – Glycoside (Jamboline), Tannin, Ellagic acid and Gallic acid.

PROPERTIES AND ACTION -

Rasa : Madhura, Amla, Kaṣāya
Guṇa : Guru, Rūkṣa
Vīrya : Śīta
Vipāka : Kaṭu
Karma : Vātala, Pittahara, Kaphahara, Viṣṭambhi, Grāhī

IMPORTANT FORMULATIONS - Puṣyānuga Cūrṇa.

THERAPEUTIC USES - Madhumeha, Udakameha.

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

JAMBŪ (Stem Bark)

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

SYNONYMS -

<i>Sansk.</i>	: Mahajambu, Ksudrajambu
<i>Assam.</i>	: Jam
<i>Beng.</i>	: Jaam
<i>Eng.</i>	: ---
<i>Guj.</i>	: Jambu, Jambuda
<i>Hindi.</i>	: Jomuna, Raja Jambu
<i>Kan.</i>	: Merale, Jamneralae, Jambu, Neralamara
<i>Kash.</i>	: --
<i>Mal.</i>	: Njaval, Naval
<i>Mar.</i>	: Jambhool
<i>Ori.</i>	: Jamukoli, Jamu, Jam
<i>Punj.</i>	: Jammu
<i>Tam.</i>	: Naaval, Navval Sambu, Mahamaram, Nagal
<i>Tel.</i>	: Nesedu
<i>Urdu.</i>	: Jamun

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 9 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 11 per cent, Appendix 2.2.7.

CONSTITUENTS – Tannins.

PROPERTIES AND ACTION -

Rasa	: Kaṣāya
Guna	: Rūkṣa
Virya	: Sita
Vipaka	: Kaṭu
Karma	: Kaphahara, Pittahara, Vātala, Grāhī, Stambhaka, Kṛmidoṣaghna

IMPORTANT FORMULATIONS - Uśīrasava.

THERAPEUTIC USES - Atisāra, Raktapitta.

DOSE - 10-20 g. of the drug for decoction.

JAYAPĀLA (Seed)

Jayapāla consists of dried seed of *Croton tiglium* Linn. (Fam. Euphorbiaceae); a small evergreen tree, 5-7 m high, found throughout tropical India.

SYNONYMS -

<i>Sansk.</i>	: Mukula, Tintidiphala
<i>Assam.</i>	: Kanibish
<i>Beng.</i>	: Jaipala
<i>Eng.</i>	: Croton
<i>Guj.</i>	: Nepalo, Jamalagota
<i>Hindi.</i>	: Jamalgota
<i>Kan.</i>	: Nepal, Japal beej, Japala, Nervalā
<i>Kash.</i>	: --
<i>Mal.</i>	: Nervalam, Neervalam
<i>Mar.</i>	: Jēpal, Japal
<i>Ori.</i>	: --
<i>Punj.</i>	: Japolota
<i>Tam.</i>	: Nervalam, Neervalam, Valam
<i>Tel.</i>	: Nepalamu
<i>Urdu.</i>	: Jamalgota

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Seed - Shows a hard testa, consisting of an epidermal layer, covered externally with a thick cuticle and composed of oval and tangentially elongated cells, filled with brownish content; epidermis followed by a layer of radially elongated cells, slightly bent at middle, upper half portion filled with reddish-brown and lower half filled with yellow contents; inner most zone consists of tangentially elongated, thin-walled cells; endosperm consists of polygonal parenchymatous cells filled with oil globules, a few cells having rosette

crystals of calcium oxalate; central region of endosperm shows a dicotyledonous embryo consisting of thin-walled parenchymatous cells.

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

IDENTITY, PURITY AND STRENGTH -

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

T.L.C. –

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

CONSTITUENTS – Fixed oil, Resins & Phorbol esters.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guna	: Guru, Snigdha
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Pittahara, Kaphahara, Recana

IMPORTANT FORMULATIONS – Icchābhedi Rasa, Aśvakañcuki Rasa.

THERAPEUTIC USES - Udararoga, Vibandha, Jvara.

DOSE - 6-12 mg. of the drug in powder form.

JAYANTI (Leaf)

Jayanti consists of **fresh and dried leaf** of *Sesbania sesban* (Linn.) Merr., Syn. *S. aegyptiaca* Pers. (Fam. Fabaceae); a quick growing, short lived shrub, 1.8-6 m high, found cultivated throughout plains of the country upto an altitude of 1200 m.

SYNONYMS -

<i>Sansk.</i>	: Jayanti, Jayā, Śūksma patra,
<i>Assam.</i>	: --
<i>Beng.</i>	: Jayanti
<i>Eng.</i>	: --
<i>Guj.</i>	: Rajashinganee, Jayanti
<i>Hindi.</i>	: Jaita, Jayata
<i>Kan.</i>	: Arinintajinangi, Karijimangai, Arishimajingai,
<i>Kash.</i>	: --
<i>Mal.</i>	: Semp, Atti, Itthikkanni
<i>Mar.</i>	: Jait
<i>Ori.</i>	: Jayantipatra
<i>Punj.</i>	: Jainta
<i>Tam.</i>	: Karum-sempai
<i>Tel.</i>	: Sominta, Jalugu, Nelichettu
<i>Urdu.</i>	: --

DESCRIPTION -

a) Macroscopic :

Leaves pinnately compound, 7.5-15.5 cm long, rachis shortly produced above last pair of leaflet; paripinnate, leaflets 6-16 pairs, opposite, linear, oblong, glabrous, entire, mucronate to acuminate, very shortly stalked, 1.0-3.3 cm long, 0.3-0.8 cm wide.

b) Microscopic:

Leaflet -

Rachis - shows single layered epidermis, followed by 2-3 layered collenchymatous and 4-7 layered round, thin-walled parenchymatous cells; vascular bundles arranged in a ring, having secretory cavities in phloem, each bundle covered externally with sclerenchymatous sheath, one smaller vascular bundle present in both the wings; pith small, consisting of thin-walled, polygonal, parenchymatous cells.

Lamina - shows single layered epidermis on both surfaces, stomata anisocytic, present on both surfaces, palisade single layered, spongy parenchyma consisting of round cells, small veins situated between palisade and spongy parenchyma cells, stomatal index on

upper surface 11-20 and on lower surface 11-25, palisade ratio 3.25-4.50 and vein islet number 27-36 per square mm.

Powder - Dull green; shows spongy parenchyma, palisade cells; xylem vessels with scalariform thickening and stomata.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 2 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 25 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (90 : 10) shows under U.V. (366 nm) six fluorescent zones at Rf. 0.05, 0.11, 0.19, 0.29, 0.56 (all pink) and 0.97 (yellow). On exposure to Iodine vapour ten spots appear at Rf. 0.05, 0.11, 0.19, 0.29, 0.37, 0.48, 0.56, 0.69, 0.91 and 0.97 (all yellow). On spraying with 5 % Methanolic-Phosphomolybdic acid reagent and heating the plate at 105°C for ten minutes nine spots appear at Rf. 0.05, 0.11, 0.19, 0.29, 0.37, 0.48, 0.56, 0.91 and 0.97 (all grey).

CONSTITUENTS - Protein, Calcium and Phosphorus.

PROPERTIES AND ACTION -

Rasa : Kaṭu, Tikta

Gūṇa : Laghu

Vīrya : Uṣṇa

Vipāka : Kaṭu

Karma : Vātahara, Pittahara, Kaphahara, Kaṅthasodhana, Rasāyana

IMPORTANT FORMULATIONS - Ratnagiri Rasa, Vajrapāṭa Rasa.

THERAPEUTIC USES - Galagaṇḍa, Mūtrakṛcchra, Viṣaroga.

DOSE - 3-6 g. in powder form.

JYOTISHMATĪ (Seed)

Jyotishmatī consists of **dried, brownish-orange, ripe seeds, devoid of capsule wall** of *Celastrus paniculatus* Willd. (Fam. Celastraceae); a large climbing shrub, mostly found all over the hilly parts of the country upto an altitude of 1200 m.

SYNONYMS -

<i>Sansk.</i>	: --
<i>Assam.</i>	: Kapalphotla
<i>Beng.</i>	: --
<i>Eng.</i>	: Staff tree
<i>Guj.</i>	: Malkangani
<i>Hindi.</i>	: Malkangani
<i>Kan.</i>	: Doddaganugae, Gangunge beeja, Gangunge humpu, Kangondiballi
<i>Kash.</i>	: --
<i>Mal.</i>	: Ceruppunnari, Uzhinja
<i>Mar.</i>	: Malkangoni
<i>Ori.</i>	: Malkanguni, Jyotishmati
<i>Punj.</i>	: Malkangoni
<i>Tam.</i>	: Valuluvai
<i>Tel.</i>	: Malkangani, Peddamaveru
<i>Urdu.</i>	: Malkangani

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter - Not more than 2 per cent, Appendix 2.2.2.
Total ash - Not more than 6 per cent, Appendix 2.2.3.
Acid-insoluble ash - Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive - Not less than 20 per cent, Appendix 2.2.6.
Water-soluble extractive - Not less than 9 per cent, Appendix 2.2.7.
Oil Contents - Not less than 45 per cent, Appendix 2.2.8.

T.L.C. -

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

CONSTITUENTS - Alkaloids, Oil and Tannins.

PROPERTIES AND ACTION -

Rasa : Kaṭu, Tikta
Guṇa : Sara, Uṣṇa, Tikṣṇa
Virya : Uṣṇa
Vipāka : Kaṭu
Karma : Vātahara, Kaphahara, Vāmaka, Virecaka, Śirovirecanopaga, Dīpana
Prabhāva : Meddhya

IMPORTANT FORMULATIONS - Smṛtisāgara Rasa, Jyotiṣmati Taila.

THERAPEUTIC USES - Vāṭavyādhi, Smṛtidaurbalya, Świtra.

DOSE - Seed : 1-2 g.
Oil : 5-15 drops.

KADAMBA (Stem Bark)

Kadamba consists of **dried stem bark** of *Anthocephalus cadamba* Miq., Syn. *A. indicus* A. Rich. (Fam. Rubiaceae), a deciduous, large tree, attaining a height of 18 m with a girth of about 2 m, found all over India on the slopes of evergreen forests upto 500 m and planted in parks and near temples etc.

SYNONYMS -

<i>Sansk.</i>	: Vṛtta puṣpa, Priyaka
<i>Assam.</i>	: Roghu, Kadam
<i>Beng.</i>	: Kadam
<i>Eng.</i>	: --
<i>Guj.</i>	: Kadamb, Kadam
<i>Hindi.</i>	: Kadam, Kadamba
<i>Kan.</i>	: Kadamba, Kadamba mara, Kadavala, Neirumavinamara
<i>Kash.</i>	: --
<i>Mal.</i>	: Attutekka, Katampu
<i>Mar.</i>	: Kadamb
<i>Ori.</i>	: Holiptiya, Kadamba Nipo, Kadambal
<i>Punj.</i>	: Kadamb
<i>Tam.</i>	: Arattam, Indulam, Kadappai, Vellai Kadambam, Vellaikhadambu, Kadambu Needam, Vellai Kadambu
<i>Tel.</i>	: Kadambamu, Kadimi Chettu
<i>Urdu.</i>	: --

DESCRIPTION -

a) Macroscopic :

Bark externally greyish-green with shallow fissures, exfoliating in small irregular woody scales, internally light reddish to reddish-brown, easily separates from inner bark into tangential strips; taste, bitter.

b) Microscopic :

Stem Bark -Outer most zone of the bark shows rhytidoma with cork 4-6 layers wide, composed of thin-walled, rectangular cells; phloem fibres same in structure as found in inner bark; middle bark composed of rectangular or tangentially elongated cells without intercellular spaces, some cells contain chlorophyll, most cells thick-walled but a few thin-walled containing prismatic crystals of calcium oxalate, a few cells with brown contents; inner bark consists of groups of fibres alternating with phloem, traversed by uni to triseriate, elongated cells of phloem rays; phloem composed of sieve tubes, phloem fibres, companion cells and phloem parenchyma; cells of phloem parenchyma thin-walled and polygonal; phloem fibres lignified with narrow lumen and pointed ends; outer region of inner bark and phloem tissues thin-walled, comparatively large and consisting

of rounded to polygonal cells a few phloem cells in this region compressed; phloem rays uni-to triseriate and arranged close to one another, cells distinct and slightly elongated, some cells at the periphery of inner bark filled with chlorophyll contents.

Powder – Brown; shows fragments of cork cells, phloem cells, fibres, and a few prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2	per cent, Appendix 2.2.2.
Total ash	-	Not more than 9	per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1.5	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 5	per cent, Appendix 2.2.7.

T.L.C. –

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Ethylacetate : Methanol : Water (100: 13.5:10) shows under U.V. (366 nm) nine fluorescent zones at Rf. 0.03, 0.13, 0.21, 0.31, 0.57, 0.64, 0.79, 0.83 and 0.90 (all yellow). On spraying with 5% Methanolic Sulphuric acid reagent on heating the plate at 110°C for ten minutes four spots appear at Rf. 0.63 (yellowish grey), 0.70 (orange yellow), 0.79 (grey) and 0.90 (grey).

CONSTITUENTS – Alkaloids, Steroids, Fats and Reducing Sugars.

PROPERTIES AND ACTION -

Rasa	: Kaṣāya, Madhura, Lavaṇa
Guna	: Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Vātahara, Pittahara, Vraṇaropana, Vedanāsthāpana

IMPORTANT FORMULATIONS - Nygrodhādi Kvātha Cūrṇa, Grahaṇīmihira Taila.

THERAPEUTIC USES - Dāha, Yonidoṣa, Vraṇa, Raktapitta, Viṣavraṇa (Daṇṣaja Vraṇa).

DOSE - 0.5 – 1.5 g. of the drug in powder form.

KĀKAMĀCĪ (Whole Plant)

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

SYNONYMS -

<i>Sansk.</i>	: Dhvankṣamācī
<i>Assam.</i>	: Kakamachi, Pitkachia, Datkachu
<i>Beng.</i>	: Gudakamai
<i>Eng.</i>	: Garden Night Shade
<i>Guj.</i>	: Piludi
<i>Hindi.</i>	: Makoya
<i>Kan.</i>	: Ganikayeagida, Ganikegida, ganike, Ganikesopu, Kage hanninagids
<i>Kash.</i>	: --
<i>Mal.</i>	: Karinthakkali, Manatakkali, Manjathakkali
<i>Mar.</i>	: Kamoni
<i>Ori.</i>	: Lunlunia, Lunilunika
<i>Punj.</i>	: Mako
<i>Tam.</i>	: Manarthakkali, Manaththakkali, Manitakkali, Maniththakkali
<i>Tel.</i>	: Kamanchi
<i>Urdu.</i>	: Makoh

DESCRIPTION :

a) Macroscopic –

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

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

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

Flower - Small, extra-axillary, sub-umbellate, 3-8 flowered cymes, peduncles 6-20 mm long, slender; pedicels 6-10 mm long, very slender; calyx 2-3 mm long, glabrous, five lobed, oblong, obtuse, 1.25 mm long; corolla 4-8 mm long, divided more than half way down into 5 oblong sub-acute lobes, white or pale violet; filaments short, flattened, hairy at base; anther 1.2-2.5 mm long, yellowish, oblong, obtuse notched at apex; ovary globose, glabrous; style cylindrical, hairy in lower part.

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

Seed - Discoid, 1.5 mm in dia., smooth, minutely pitted, yellow.

b) Microscopic :

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

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

Leaf -

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

Midrib - shows upper and lower epidermis of round to oval cells, covered with striated cuticle, trichomes similar to those found on petiole; collenchyma 2-3 layered on both surfaces; parenchyma 4-6 layered, thin-walled with small intercellular spaces; arc-shaped bicollateral vascular bundle placed centrally.

Lamina - dorsiventral, both upper and lower epidermis single layered, composed of oval to tangentially elongated cells covered with thick cuticle; palisade single layered; spongy parenchyma 4-6 layered containing chloroplasts with intercellular spaces; a few vessels with spiral thickenings, present beneath palisade parenchyma; in surface preparation a

large number of multicellular, warty hairs with pointed tips and glandular hairs are present; epidermis with irregular outline, stomata anisocytic, scattered on both surfaces but more abundant in lower surface; palisade ratio 2-4; vein islet number 7-10; stomatal index 15-17 on upper epidermis and 22-23 on lower epidermis.

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

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

IDENTITY, PURITY AND STRENGTH -

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

T.L.C. -

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

CONSTITUENTS – Alkaloids and Saponins.

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṭu
Guṇa	: Sara, Snigdha, Laghu
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Pittahara, Kaphahara, Bhedana, Rasāyana, Vṛṣya, Svarya, Hṛdya

IMPORTANT FORMULATIONS - Hṛdayārṇava Rasa, Mahā viṣagarbha Taila, Rasarāja Rasa.

THERAPEUTIC USES – Kuṣṭha, Kaṇḍu, Arśa, Prameha, Śoṭha, Hṛdroga, Jvara, Hikkā, Chardi, Netraroga.

DOSE - 5 – 10 ml. of the drug in juice form.

KAMALA (Flower)

Kamala consists of dried flowers (devoid of stalk) of *Nelumbo nucifera* Gaertn. Syn. *Nelumbium speciosum* Willd. (Fam. Nymphaeaceae); a large, aquatic herb with creeping stem, occurring throughout warmer parts of the country upto an altitude of 1000 m.

SYNONYMS -

Sansk. : Abja, Aravinda, Padma, Kalhāra, Sitotpala, Pankaja

Assam. : Podum

Beng. : Padma Phool, Salaphool

Eng. : Lotus

Guj. : Kamal

Hindi. : Kamal, Kanwal

Kan. : Kamal, Tavare, Naidile, Tavaregedd

Kash. : --

Mal. : Tamara, Venthamara, Chenthamara, Senthamara

Mar. : Komala

Ori. : Padma

Punj. : Kanwal, Pamposh

Tam. : Tamarai, Thamaraipoo, Aravindan, Paduman, Kamalam, Sarojam

Tel. : Kaluva, Tamarapuvow

Urdu. : Kamal

DESCRIPTION -

a) Macroscopic :

Drug occurs as entire or pieces of flowers, comprising of calyx, corolla, androecium, gynoecium and thalamus; entire flower 10-15 cm in dia., yellowish-brown; sepals leaf-like, crimped, 3-5 cm long, 1.3-2 cm wide, dark brown, broken pieces also occur; petals numerous, crimped, elliptic, obtuse, membranous, finely veined, 2-4 cm long, 1.2-2 cm wide yellowish-brown; anther, erect, linear 1.4-2 cm long, extended into clavate appendages; gynoecium apocarpous; carpels many, free, embedded in a creamy, top-shaped fleshy thalamus (torus) 3-5 cm long and 2.5-3 cm wide; fruit an etaerio of achenes, becoming loose in their sockets when ripe; seed hard, black, starchy and large.

b) Microscopic :

Flower -

Petal - shows single layered epidermis on both surfaces, consisting of rectangular cells covered with striated cuticle; ground tissue consisting of polygonal, parenchymatous cells with wide air-sacs.

Stamen –

Filament - filament appears circular in outline, consisting of single layered epidermis covered with striated cuticle; followed by ground tissue of oval, angular, parenchymatous cell; vascular bundle single, present in centre consisting of usual elements of xylem and phloem tissues.

Anther - shows four chambered anther, two on either sides, connected by parenchymatous cells containing vascular bundle; anther consists of a single layer of epidermis, composed of thin-walled, rectangular, parenchymatous cells followed by single layer of endothecium consisting of thin-walled, columnar, parenchymatous cells; spore sac contains yellow, spherical pollen grains with smooth exine and intine walls, measuring 50-61 μ in diameter.

Powder – Dusty brown; shows fragments of vessels with spiral thickening, spherical, yellow pollen grains, measuring 50-61 μ in dia. having smooth exine and intine.

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 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 14 per cent, Appendix 2.2.7.

CONSTITUENTS – Alkaloid (Nelumbine).

PROPERTIES AND ACTION -

Rasa	: Madhura, Tikta, Kaṣāya
Guṇa	: Śīta, Laghua
Virya	: Śīta
Vipāka	: Madhura
Karma	: Kaphahara, Pittahara, Santāpahara, Varṇya, Mūtra Virajaniya

IMPORTANT FORMULATIONS - Aravindāsava, Catura Kaval Ghṛta.

THERAPEUTIC USES – Tr̥ṣṇā Dāha, Raktapitta, Visarpa, Viṣavikāra.

DOSE - 12 –24 g. of the drug for decoction.

KAPITTHA (Fruit Pulp)

Kapittha consists of **dried pulp of mature fruit of *Feronia limonia* (Linn.) Swingle** Syn. *F. elephantum* Correa (Fam. Rutaceae); a deciduous, glabrous tree with strong, sharp, straight, axillary thorns, found throughout the plains of India, Siwalik range and forests, at base of Himalayas upto an elevation of 450 m; often cultivated in many parts of India; fruit rind is removed and the pulp is bruised and dried.

SYNONYMS -

Sansk. : Danta Satha, Kapipriya

Assam. : --

Beng. : Kayet Bael, Kavataleal, Kavita

Eng. : Wood Apple

Guj. : Kotha, Kondhu

Hindi. : Kaitha

Kan. : Bekalu, Belada hannu, Bilvara, Belalu, Balada, Haminamara,

Kash. : --

Mal. : Villanga Kaaya, Vilar maram,

Mar. : Kavatha

Ori. : --

Punj. : Kainth

Tam. : Vilamaram, Vilangai

Tel. : Velaga

Urdu. : Kaith

DESCRIPTION -

a) Macroscopic :

Fruit pulp occurs mostly in broken pieces and sometimes entire, measuring about 4-5 cm in dia; semicircular, rough, hard, having longitudinal ridges and furrows; reddish-brown; odour, aromatic; taste, sour.

b) Microscopic :

Fruit Pulp - shows irregular, thin-walled, parenchymatous cells; numerous idioblast cells filled with reddish-brown content; stone cells, slightly triangular and oval, with concentric striations and narrow lumen, found in groups; a few fibro-vascular bundles distributed in the pulp; xylem vessels having spiral thickenings.

Powder - Reddish-brown; shows fragments of fibro-vascular bundles, stone cells, triangular to oval with concentric striations and narrow lumen, vessels and idioblast filled with cell content.

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 12 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 25 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform : Ethylacetate : Formic acid (5:4:1) shows one spot at Rf. 0.91 (grey) in visible light. Under U.V. (366 nm) three fluorescent zones appear at Rf 0.14 (sky blue), 0.91 (blue) and 0.95 (blue). On exposure to Iodine vapour six spots appear at Rf 0.06, 0.12, 0.37, 0.50, 0.91 and 0.95 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate at 110°C for ten minutes five spots appear at Rf 0.12 (brown), 0.37 (brown), 0.50 (violet), 0.91 (violet) and 0.95 (violet).

CONSTITUENTS - Citric acid and Mucilage.

PROPERTIES AND ACTION -

	Ripe Pulp	Unripe Pulp
Rasa	: Madhura, Amla, Kaṣāya	Amla, Kaṣāya
Guṇa	: Laghu	Guru
Virya	: Śīta	Uṣṇa
Vipāka	: Madhura	Amla
Karma	: Vṛṣya, Pittavāhara, Sangrāhī, Vraṇanāśaka	Kaphaghna, Grāhī Vātala, lekhana

IMPORTANT FORMULATIONS - Kapithāṣṭaka Cūrṇa, Yavānyādi Cūrṇa.

THERAPEUTIC USES - Ripe - Tṛṣṇā, Hikka, Svāsa, Vāmi, Unripe - Grahani Roga, Agnimāndya.

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

KARAMARDA (Stem Bark)

Karamarda consists of **dried stem bark** of *Carissa carandas* Linn. (Fam. Apocynaceae); a dichotomously branched large shrub or small tree, met throughout India in wild state, sometimes cultivated.

SYNONYMS -

Sansk. : Krsnapakphala

Assam. : --

Beng. : Karamach

Eng. : --

Guj. : Karamadan

Hindi. : Karijige

Kan. : Karimkar

Kash. : --

Mal. : Karimkar

Mar. : Karamanda

Ori. : --

Punj. : Garna

Tam. : Kalakke

Tel. : --

Urdu. : Karaunda

DESCRIPTION -

a) Macroscopic :

Bark occurs in small and thin, flat or slightly curved pieces, rough due to longitudinal striations; external surface brownish-grey, internal surface grey and smooth, light in weight; fracture, short.

b) Microscopic :

Stem Bark - Mature bark shows a wide zone of stratified cork having lenticels at a few places; secondary cortex composed of thin-walled, tubular, parenchymatous cells having groups of stone cells; cortical fibres in single or groups of 2-3, a few stone cells attached with cortical fibres; secondary phloem consisting of usual elements; prismatic crystals of calcium oxalate found scattered in cortical cells and phloem parenchyma; starch grains simple, measuring 3-7 μ in dia. and compound having 2-3 components, found scattered in cortical and phloem parenchyma cells.

Powder - Greyish-brown; shows single and groups of stone cells, prismatic crystals of calcium oxalate, simple and compound starch grains, measuring 3-7 μ in dia.

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 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 8 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica Gel 'G' plate using Toluene : Ethylacetate (9 : 1) shows under U.V. (366 nm) one fluorescent zone at Rf. 0.52 (light sky blue). On spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate for about fifteen minutes at 105°C four spots appear at Rf. 0.35, 0.58 (both light grey), 0.90 (pink) and 0.97 (violet).

CONSTITUENTS - Glycosides and β -Sitosterol.

PROPERTIES AND ACTION -

Rasa : Amla
Guṇa : Guru, Sara
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Vātahara, Pittakara, Kaphahara

IMPORTANT FORMULATIONS - Marma Guṭīkā.

THERAPEUTIC USES - Kuṣṭhahara.

DOSE - 48 g. of the drug for decoction.

KARAÑJA (Root Bark)

Karañja consists of dried root bark of *Pongamia pinnata* (Linn.) Merr., Syn. *P. glabra* Vent. (Fam. Fabaceae), a glabrous tree, upto 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

SYNONYMS -

Sansk. : Karañjaka, Naktamāla, Naktāhvā, Ghṛtakarañja

Assam. : Korach

Beng. : Natakaranja, Dahara Karanja

Eng. : --

Guj. : Kanaji

Hindi. : Karanj

Kan. : Honge Beru

Kash. : --

Mal. : Pongu, Ungu

Mar. : Karanja

Ori. : Karanja

Punj. : Karanj

Tam. : Pungai

Tel. : Ganuga, Kanuga

Urdu. : Karanj

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

elongated cells towards inner region and tangentially elongated towards periphery; most of ray cells contain starch grain, similar to those present in secondary cortex.

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 1 per cent, Appendix 2.2.2.
Total ash	-	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 3.5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 17 per cent, Appendix 2.2.7.

TLC. -

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

CONSTITUENTS – Flavones Kanugin, Demethoxy-kanugin

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta, Kaṣāya
Guṇa	: Tikṣṇa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphahara, Vātahara, Pittahara, Kaṇḍūghna, Viśaghna, Vraṇasodhana

IMPORTANT FORMULATIONS - Prabhañjana Vimardana Taila.

THERAPEUTIC USES – Kuṣṭha, Kaṇḍu, Dustavrana, Prameha, Yoniroga, Kṛmiroga, Antravidradhi.

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

KARAÑJA (Root)

Karañja consists of dried root of *Pongamia pinnata* (Linn.) Merr., Syn. *P. glabra* Vent. (Fam. Fabaceae); a glabrous tree, upto 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

SYNONYMS –

Sansk. : Karañjaka, Naktamāla, Naktāhvā, Ghṛtakarañja

Assam. : Korach

Beng. : Natakaranja, Dahara Karanja

Eng. : --

Guj. : Kanaji

Hindi. : Karanj

Kan. : Honge Beru

Kash. : --

Mal. : Pongu, Ungu

Mar. : Karanja

Ori. : Karanja

Punj. : Karanj

Tam. : Pungai

Tel. : Ganuga, Kanuga

Urdu. : Karanj

DESCRIPTION –

a) Macroscopic :

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

b) Microscopic :

Root –Shows cork consisting of 5-15 or more rows of rectangular, tangentially elongated, thin-walled, cells; secondary cortex wide composed of polygonal, tangentially elongated cells, most of the cells containing both simple and compound starch grains consisting of 2-3 components, rounded to oval in shape, 3-11 μ in dia., some cells containing yellowish-brown contents and prismatic crystals of calcium oxalate; stone cells found in single as well as in groups of varying shapes and size; secondary phloem a very wide zone, consisting of tangentially arranged fibres, alternating with sieve elements and phloem parenchyma traversed by phloem rays mostly straight, 1-2 seriate, consisting of radially elongated, thin-walled cells towards inner region, tangentially elongated towards outer region; starch grains, and crystals similar to those of cortical cells, also

present in phloem parenchyma and phloem rays; secondary xylem consisting of vessels, tracheids, fibres and parenchyma; vessels found scattered throughout secondary xylem region in singles or groups of 2-4 or rarely, more; fibres thick-walled arranged in tangential bands traversed by xylem rays; xylem parenchyma cells thin-walled, rounded to oval in shape; xylem rays uni to triseriate consisting of radially elongated cells; starch grains and calcium oxalate crystals are similar to those present in cortical cells and also found scattered in xylem parenchyma and xylem ray cells.

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

IDENTITY, PURITY AND STRENGTH -

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

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

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta, Kaṣāya
Guṇa	: Tikṣṇa
Vīrya	: Uṣṇa
Vipākā	: Kaṭu
Karma	: Kaphahara, Vātahara, Pittahara, Kaṇḍūghna, Viṣaghna, Vraṇasodhana

IMPORTANT FORMULATIONS - Dhānvantara Ghṛta.

THERAPEUTIC USES – Kuṣṭha, Kaṇḍū, Duṣṭavraṇa, Prameha, Yoniroga, Kṛmiroga, Āntravidradhī, Vidradhī.

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

KARAÑJA (Stem Bark)

Karañja consists of **dried stem bark** of *Pongamia pinnata* (Linn.) Merr., Syn. *P. glabra* Vent. (Fam. Fabaceae); a glabrous tree, upto 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

SYNONYMS -

Sansk. : Karañjaka, Naktamāla, Naktāhvā, Ghrtakarañja

Assam. : Korach

Beng. : Natakaranja, Dahara Karanja

Eng. : --

Guj. : Kanaji

Hindi. : Karanj

Kan. : Honge Beru

Kash. : --

Mal. : Pongu, Ungu

Mar. : Karanja

Ori. : Karanja

Punj. : Karanj

Tam. : Pungai

Tel. : Ganuga, Kanuga

Urdu. : Karanj

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Bark - Shows 5-20 or more layers of cork, composed of rectangular, thick-walled cells, filled with reddish-brown content, at some places lenticels also appear; secondary cortex 10-15 layered having oval to polygonal, tangentially elongated, thin-walled, parenchymatous cells; beneath secondary cortex a large group of oval to elongated stone cells, arranged in a tangential manner, forming a continuous or discontinuous band; secondary phloem composed of sieve elements, phloem parenchyma, phloem fibre and stone cells, traversed by medullary rays; sieve elements and parenchyma composed of rectangular to polygonal thin-walled cells, alternating with stone cells; fibre small, polygonal, thin-walled and aseptate, a few associated with stone cells and arranged radially; medullary rays wavy, usually 2-4 cells wide, radially elongated and rounded to oval in shape, a few stone cells scattered in secondary cortex as in secondary phloem;

rhomboidal crystals of calcium oxalate found in secondary cortex; starch grains simple, rounded to oval and compound having 2-4 components, present in secondary cortex, phloem parenchyma and rays cells; oil globules found in secondary phloem only.

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 1 per cent, Appendix 2.2.2.
Total ash	-	Not more than 13 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 18 per cent, Appendix 2.2.7.

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

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta, Kaṣāya
Guṇa	: Tikṣṇa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Kaphahara, Vātahara, Pittahara, Kaṇḍūghna, Viṣaghna, Vraṇasōdhana

IMPORTANT FORMULATIONS - Bṛhanmañjiṣṭhādi Kvātha Cūrṇa, Mustākarañjādi Kvātha Cūrṇa.

THERAPEUTIC USES – Kuṣṭha, Kaṇḍu, Duṣṭavraṇa, Prameha, Yoniroga, Kṛmiroga, Āntravidradhī, Vidradhī.

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

KARAÑJA (Leaf)

Karañja consists of dried leaf of *Pongamia pinnata* (Linn.) Merr., Syn. *P. glabra* Vent. (Fam. Fabaceae); a glabrous tree, upto 18 m or sometimes more in height, found almost throughout the country upto an altitude of 1200 m.

SYNONYMS -

Sansk. : Karañjaka, Naktāmāla, Naktāhvā, Ghrtakarañja
Assam. : Korach
Beng. : Natakaranja, Dahara Karanja
Eng. : Smooth leaved pongamia
Guj. : Kanaji, Kanajo
Hindi. : Dithouri, Karuaini
Kan. : Honge, Hulagilu
Kash. : --
Mal. : Avittal, Ungu, Unu, Pungu
Mar. : Karanja
Ori. : Karanja
Punj. : Karanj
Tam. : Pungai, Pongana
Tel. : Ganuga, Kanuga
Urdu. : Karanj

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Leaf -

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

Midrib - shows single layered epidermis, consisting of tabular cells, covered with thick cuticle, followed by 3-4 layered collenchymatous hypodermis; cortex consists of round to oval, thin-walled parenchymatous cells; pericycle present in the form of sclerenchymatous sheath; vascular bundle, collateral, conjoint and arranged in discontinuous ring; cen-

tral portion occupied by oval to polygonal thin-walled parenchymatous pith; prismatic crystals of calcium oxalate present in cortex, phloem and pith.

Lamina –shows single layered epidermis covered with thick cuticle; palisade two layered; spongy parenchyma 3-5 layered, a few containing prismatic crystals similar to midrib, occasionally a few spongy parenchyma cells get elongated and look like palisade cells, palisade ratio 3.5-5.0; vein islet number 18-25 per mm square; stomata anisocytic, present in lower surface; stomatal index 12.5-20.

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

IDENTITY, PURITY AND STRENGTH -

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

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

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta, Kaṣāya
Guna	: Tikṣṇa
Virya	: Uṣṇa
Vipaka	: Kaṭu
Karma	: Vātahara, Kaphahara, Pittavardhaka, Bhedana, Kaṇḍughna, Kṛimihara, Sothahara

IMPORTANT FORMULATIONS - Jātyādi Taila.

THERAPEUTIC USES – Kuṣṭha, Kṛmiroga, Vraṇa, Kaṇḍu.

DOSE - For external use only.

KĀRAVALLAKA (Fresh Fruit)

Kāravallaka consists of **fresh fruit** of *Momordica charantia* Linn. (Fam. Cucurbitaceae); a monoecious climber found throughout the country often under cultivation, upto an altitude of 1500 m.

SYNONYMS -

Sansk. : Kāravella, Kathilla, Varivalli, Kāravalli.

Assam. : Kakiral, Kakral

Beng. : Karolla

Eng. : Bitter gourd

Guj. : Karela

Hindi. : Karela

Kan. : Hagalakai

Kash. : --

Mal. : Kaippa, Pavackkai

Mar. : Karla

Ori. : Kalara, Salara

Punj. : Karela

Tam. : Paharkai

Tel. : Kaakara Kaaya

Urdu. : Karela

DESCRIPTION -

a) Macroscopic :

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

IDENTITY, PURITY AND STRENGTH -

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

T.L.C. -

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

CONSTITUENTS – Alkaloid (Momoridine) and Glycosides.

PROPERTIES AND ACTION -

Rasa : Tikta, Kaṭu

Guṇa : Laghu

Vīrya : Uṣṇa

Vipāka : Kaṭu

Karma : Vātahara, Kaphahara, Raktadoṣahara, Dīpana, Hṛdya, Bhedi

IMPORTANT FORMULATIONS - Mahāviṣaḡarba Taila.

THERAPEUTIC USES - Kuṣṭha, Prameha, Kāmalā, Pāṇḍu, Kṛmiroga, Raktavikāra, Jvara, Svāsa, Kāsa, Aruci.

DOSE - 10 - 15 ml. juice of fresh drug.

KATUKĀ (Rhizome)

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

SYNONYMS -

Sansk. : Tiktā, Tiktārohini, Kaṭurohini, Katvī, Sutiktaka, Katuka, Rohini

Assam. : Katki, Kutki

Beng. : --

Eng. : Hellebore

Guj. : Kadu, Katu

Hindi. : Kutki

Kan. : Katuka rohini, Katuka rohini

Kash. : --

Mal. : Kaduk rohini, Katuka rohini

Mar. : Kutki, Kalikutki

Ori. : Katuki

Punj. : Karru, Kaur

Tam. : Katuka rohini, Katuku rohini, Kadugurohini

Tel. : Katukārohini

Urdu. : Kutki

DESCRIPTION -

a) Macroscopic :

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

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

b) Microscopic :

Rhizome – Shows 20-25 layers of cork consisting of tangentially elongated, suberised cells; cork cambium 1-2 layered; cortex single layered or absent, primary cortex persists in some cases, one or two small vascular bundles present in cortex; vascular bundles surrounded by single layered endodermis of thick-walled cells; secondary phloem

composed of phloem parenchyma and a few scattered fibres; cambium 2-4 layered; secondary xylem consists of vessels, tracheids, xylem fibres and xylem parenchyma, vessels vary in shape and size having transverse oblique articulation; tracheids long, thick-walled, lignified, more or less cylindrical with blunt tapering ends; xylem parenchyma thin-walled and polygonal in shape; centre occupied by a small pith consisting of thin-walled cells; simple round to oval, starch grains, measuring 25-104 μ in dia., abundantly found in all cells.

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

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

IDENTITY, PURITY AND STRENGTH

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

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform : Methanol (95 : 5) shows under U.V. light (366 nm) three fluorescent zones at Rf. 0.05 (blue), 0.30 (blue) and 0.35 (green). On exposure to Iodine vapour nine spots appear at Rf. 0.10, 0.17, 0.21, 0.30, 0.37, 0.41, 0.62, 0.72 and 0.84 (all yellow). On spraying with 5% methanolic sulphuric acid reagent and heating the plate for about ten minutes at 105°C seven spots appear at Rf. 0.05, 0.10, 0.17, 0.21, 0.30, 0.41 and 0.84 (all brownish grey).

CONSTITUENTS – Glucoside (Picrorrhizin).

PROPERTIES AND ACTION -

Rasa : Tikta, Kaṭu
Guṇa : Laghu
Vīrya : Usṇa
Vipāka : Kaṭu
Karma : Pittahara, Dīpanī, Bhedinī, Hṛdya, Jvarahara

IMPORTANT FORMULATIONS - Ārogyavardhini Guṭīkā, Tiktaka Ghr̥ta,
Sarvajvarahara Lauha, Mahātikataka Ghr̥ta.

THERAPEUTIC USES – Kāmalā, Śvāsa, Dāha, Jvara, Kuṣṭha, Viṣamajvara, Arocaka.

DOSE - 1 – 3 g. of the drug in powder form.

KOKILĀKṢĀ (Whole Plant)

Kokilākṣā consists of **dried whole plant** of *Asteracantha longifolia* Nees. Syn. *Hygrophila spinosa* T. Anders (Fam. Acanthaceae); a spiny, stout, annual herb, common in water logged places throughout the country.

SYNONYMS -

<i>Sansk.</i>	: Ikṣura, Ikṣuraka, Kokilākṣī
<i>Assam</i>	--
<i>Beng.</i>	: Kuliakhara, Kulekhade
<i>Eng.</i>	: --
<i>Guj.</i>	: Ekharo
<i>Hindi.</i>	: Talmakhana
<i>Kan.</i>	: Kolavali, Kolarind, Kolavankal
<i>Kash.</i>	: --
<i>Mal.</i>	: Vayalculli, Culli, Nirmuli
<i>Mar.</i>	: Talikhana, Kalsunda
<i>Ori.</i>	: --
<i>Punj.</i>	: --
<i>Tam.</i>	: Golmidi, Kettu, Nirguvireru, Nerugobbi
<i>Tel.</i>	: --
<i>Urdu.</i>	: Talmakhana

DESCRIPTION -

a) Macroscopic :

Root - Mostly adventitious, whitish to brown; no characteristic odour and taste.

Stem - Usually unbranched, fasciculate, sub-quadrangular, swollen at nodes, covered with long hairs which are numerous at the nodes, externally greyish-brown, creamish-brown in cut surfaces; no characteristic odour and taste.

Leaf - Greenish-brown, 1-7 cm long, 0.5-1 cm wide, sessile, lanceolate, acute, entire and hairy.

Flower - Yellowish-brown, usually occurring in apparent whorls of eight (in 4 pairs) at each node; bracts about 2.5 cm long, with long white hairs; calyx 4-partite, upper sepal 1.6-2 cm long, broader than the other three, which are 1.3 cm long, all linear-lanceolate, coarsely hairy on the back and with hyaline ciliate margins; corolla 3.2 cm long, widely 2 lipped, tube 1.6 cm long, abruptly swollen at top; stamens 4, didynamous, second pair larger; filament quite glabrous; anthers two celled, subequal, glabrous; ovary two celled with 4 ovules in each cell; style filiform, pubescent; stigma simple, involute with a fissure on upper side.

Fruit - Two celled, linear-oblong, compressed, capsule about 0.8 cm long, pointed, 4-8 seeded.

Seed - Ovate, flat or compressed, truncate at the base, 0.2-0.25 cm long and 0.1 - 0.15 cm wide, hairy but appearing smooth; when soaked in water immediately get coated with mucilage, light brown; taste slightly bitter and odour not distinct.

b) Microscopic :

Root - Root shows a single layered epidermis of thin-walled, rectangular to cubical, parenchymatous cells having unicellular hairs; secondary cortex composed of round to oval or oblong, thin-walled cells having large intercellular spaces; most of these cells divided longitudinally and transversely with walls forming 4-6 or more chambers; size of these cells and intercellular spaces gradually reduce towards the inner region, where these cells are mostly radially elongated, arranged in radial rows, a few thick-walled cells found scattered singly throughout secondary cortex; secondary phloem narrow consisting of small, thin-walled, polygonal cells; phloem fibres thick-walled, occur in groups of 2-6 or singles, scattered throughout the phloem region; secondary xylem forms continuous ring; vessels angular, broader towards centre, arranged radially having spiral thickenings, surrounded by thick-walled parenchyma and xylem fibres; fibre walls uniformly thickened; multi and uniseriate medullary rays occur from primary xylem region upto secondary cortex; ray cells thinwalled, radially elongated in xylem region, circular to transversely elongated in phloem region.

Stem - Shows somewhat sub-quadrangular outline; cork consists of 5-10 rows of rectangular, radially arranged, moderately thick-walled, brownish cells; collenchyma 4-8 layered consisting of isodiametric cells; a few thick-walled, isolated cells found scattered in this zone; cortical cells thin-walled, round, oblong, variable in size, with a number of large air cavities; a special feature of these cells is the formation of tangential and radial walls within the cell dividing it into 4-5 or more parts; most of cells contain numerous acicular crystals of calcium oxalate; endodermis single layered, composed of transversely elongate, thin-walled cells; phloem narrow, consisting of round to polygonal cells, peripheral ones larger, inner cells smaller; fibres thick-walled, single or in groups of 2-3, some cells contain calcium oxalate crystals similar to those found in cortical cells; xylem present in a ring; vessels with spiral thickenings, arranged radially; fibres elongated with wide lumen and pointed tips, medullary rays uni to multiseriate extend upto secondary cortex; ray cells thin-walled, radially elongated in secondary xylem, transversely elongated in secondary phloem; pith large, composed of polygonal, thin-walled parenchymatous cells, having small intercellular spaces; a few cells contain calcium oxalate crystals similar to those found in secondary cortex.

Leaf -

Midrib - Shows concavo-convex outline; epidermis on either surface covered with thick cuticle; collenchyma 2-5 layered; stele composed of small strands of xylem and phloem having some groups of fibre; rest of tissues composed of thin-walled, parenchymatous

cells, a few of them containing acicular crystals of calcium oxalate ; cystolith present beneath upper and above the lower epidermal cells.

Lamina - Shows epidermis single layered on either surface, composed of thin-walled, parenchymatous, tangentially elongated cells, covered with thick cuticle; stomata diacytic, 1-5 celled hairs present on both surfaces; palisade 1-2 layered; spongy parenchyma composed of 3-5 layered, loosely arranged cells traversed by a number of veins; palisade ratio 6.25-15.75; stomatal index 17.24-30.78; vein islet number 17-42.

Fruit - Shows single layered epidermis covered with striated cuticle followed by 5-10 layered, thick-walled, oval to hexagonal, lignified, sclerenchymatous cells .

Seed - Shows hairy testa composed of thin-walled, tangentially elongated cells covered with pigmented cuticle; embryo composed of oval to polygonal, thin-walled, parenchymatous cells containing oil globules.

Powder - Light brown; shows aseptate, elongated fibres; vessels with simple pits and spiral thickening; palisade, acicular crystals of calcium oxalate, unicellular hairs and oil globules.

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 4 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 20 per cent, Appendix 2.2.7.

CONSTITUENTS – Alkaloids.

PROPERTIES AND ACTION -

Rasa	: Madhura, Amla, Tikta
Guṇa	: Picchīla, Snigdha
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Balya, Vṛṣya, Mūtrala, Vājikara, Santarpana, Rucya

IMPORTANT FORMULATIONS – Pānaviralādi Bhasma (Kṣāra).

THERAPEUTIC USES – Āmavāta Śoṭha, Tṛṣṇā, Vātarakta.

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

KOKILĀKṢĀ (Root)

Kokilākṣā consists of **dried root** of *Asteracantha longifolia* Nees. Syn. *Hygrophila spinosa* T. Anders (Fam. Acanthaceae); a spiny, stout, annual herb, common in water logged places throughout the country.

SYNONYMS -

Sansk. : Ikṣura, Ikṣuraka, Kokilākṣī, Culli

Assam. : Kulekhara

Beng. : --

Eng. : --

Guj. : Ekhro

Hindi. : Talmakhana

Kan. : Nirmulli, Kolavulike, Kolavankae

Kash. : --

Mal. : Vayalculli, Nirchulli

Mar. : Talimakhana

Ori. : Koillekha, Koilrekha

Punj. : --

Tam. : Nirmulle

Tel. : Nirugobbi, Golimidi

Urdu. : Talmakhana

DESCRIPTION -

a) Macroscopic :

Roots mostly adventitious, branches on nodes, whitish to brownish; no characteristic odour and taste.

b) Microscopic :

Root—Appears circular in outline, epidermis consists of rectangular to cubical, thin-walled cells; a few epidermal cells elongated to form unicellular hairs, below epidermis 3-4 compactly arranged rows of thin-walled polygonal cells of secondary cortex; secondary cortex composed of rounded to oval or oblong, thin-walled cells having conspicuously large intercellular spaces, most of these cells divided longitudinally and transversely with walls forming 4-6 or more chambers, the size of these cells, and the intercellular spaces gradually reduce towards inner region of secondary cortex; a few thick-walled cells found scattered singly throughout secondary cortex, inner most row of thin-walled cells of secondary cortex comparatively smaller in size, slightly transversely elongated; second-

dary phloem narrow, consisting of small, thin-walled, polygonal cells, phloem fibres thick-walled occur in groups or as single cells, scattered throughout the phloem region, each group composed of 2-6 cells; secondary xylem forms continuous ring; xylem vessels usually arranged in radial rows, angular, broader towards centre, having spiral thickening, surrounded by thick-walled xylem parenchyma and xylem fibres; fibre walls uniformly thickened; multiseriate medullary rays occur from primary xylem region upto secondary cortex; uniseriate rays also present in xylem and extend upto the secondary cortex; ray cells thin-walled, radially elongated in the xylem region, rounded to transversely elongated in phloem region.

Powder – Light brown to ash coloured; shows fragments of pitted, lignified fibres; vessels with spiral thickening, unicellular hairs and a few groups of parenchymatous cells.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 12 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1 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	: Madhura, Amla, Tikta
Guṇa	: Picchila, Snigdha
Virya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Kaphahara, Mūtrala, Vṛṣya

IMPORTANT FORMULATIONS – Rāsnairañḍādi Kvātha Cūrṇa, Vastyamayāntaka Ghṛta.

THERAPEUTIC USES – Āmavāta Śoṭha, Aśmarī, Vātarakta, Pittatisāra.

DOSE - 3 –6 g. of the drug for decoction.

KOKILĀKṢĀ (Seed)

Kokilākṣā consists of dried seed of *Asteracantha longifolia* Nees. Syn. *Hygrophila spinosa* T. Anders. (Fam. Acanthaceae); a spiny, stout, annual herb, common in water logged places throughout the country.

SYNONYMS -

<i>Sansk.</i>	: Ikṣura, Ikṣuraka, Kokilākṣī, Culli
<i>Assam.</i>	: Kulekhara
<i>Beng.</i>	: --
<i>Eng.</i>	: --
<i>Guj.</i>	: Talimkhana
<i>Hindi.</i>	: Talmakhana
<i>Kan.</i>	: Kolavankae, Nirmulli, Kolavali
<i>Kash.</i>	: --
<i>Mal.</i>	: Nirchulli, Vayalchulli
<i>Mar.</i>	: Talimakhana
<i>Ori.</i>	: Koillekha, Koilrekha
<i>Punj.</i>	: --
<i>Tam.</i>	: Nirmulle
<i>Tel.</i>	: Nirugobbi, Nite, Gobbi
<i>Urdu.</i>	: Talmakhana

DESCRIPTION -

a) Macroscopic :

Ovate, flat or compressed, truncate at the base, 2-3 mm long and 1-2 mm wide, white, hairy but appearing smooth, when soaked in water immediately get coated with mucilage, light yellowish-brown; taste, slightly bitter and odour not distinct.

b) Microscopic :

Seed - Shows hairy testa composed of thin-walled, tangentially elongated cells covered externally with pigmented cuticle layer; embryo composed of oval to polygonal, thin-walled, parenchymatous cells; oil globules present in this region.

Powder - Greyish-brown; shows hairs and oil globules.

Swelling Index - 8-10.

Introduce the accurately weighed seeds into a 25 ml glass-stoppered measuring cylinder. The length of the graduated portion of the cylinder should be 125 mm; the internal diameter 16 mm subdivided in 0.2 ml and marked from 0 to 25 ml in upwards di-

rection. Add 25 ml of water, and shake the mixture thoroughly at intervals of every 10 minutes for 1 hour. Allow to stand for 3 hours at room temperature. Measure the volume in ml occupied by the seeds, including any sticky mucilage. Carry out simultaneously not less than 3 determination and calculate the mean value of the individual determinations, related to 1 g of seeds.

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 8 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6.

T.L.C. -

TLC of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (95 : 5) shows under U.V. (366 nm) five fluorescent zones at Rf. 0.24 (red), 0.41 (light blue), 0.55 (light blue), 0.76 (sky blue) and 0.93 (sky blue). On exposure to Iodine vapour seven spots appear at Rf. 0.03, 0.17, 0.24, 0.31, 0.38, 0.52 and 0.72 (all yellow). On spraying with 5% Ethanolic-Sulphuric acid reagent and on heating the plate for fifteen minutes at 105° C eight spots appear at Rf. 0.03 (light brown), 0.10 (light brown), 0.17 (light brown), 0.24 (dark brown), 0.31 (dark brown), 0.38 (light brown), 0.52 (dark brown) and 0.72 (dark brown).

CONSTITUENTS – An yellow semi-drying oil, enzymes like Diastase, Lipase, Protease and an Alkaloid.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guṇa	: Snigdha, Picchila
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Kaphahara, Vṛṣya, Balya, Ruchya, Santarpana

IMPORTANT FORMULATIONS – Yakṛt Sulavināśini Vatikā, Vastyamayāntaka Ghrta.

THERAPEUTIC USES – Vātarakta, Sotha, Pittāśmari.

DOSE - 3 –6 g. of the drug in powder form.

KOZUPPĀ (Whole Plant)

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

SYNONYMS -

<i>Sansk.</i>	: Lonikā, Loni, Ghotikā
<i>Assam.</i>	: --
<i>Beng.</i>	: Baraloniya, Badanuni, Baranunia
<i>Eng.</i>	: Garden Purslane, Common Indian Purslane
<i>Guj.</i>	: Luni, Loni, Moti Luni
<i>Hindi.</i>	: Khursa, Kulfa, Badi Lona
<i>Kan.</i>	: Dudagorai, Doddagoni Soppu, Lonika, Loni
<i>Kash.</i>	: --
<i>Mal.</i>	: Koricchira, Kozhuppa, Kozuppa, Kozuppaccira
<i>Mar.</i>	: Kurfah, Ghola
<i>Ori.</i>	: --
<i>Punj.</i>	: Lonak, Chhotalunia, Khurfa, Kwfa
<i>Tam.</i>	: Pasalai, Pulikkirai, Paruppukkeerai, Kozhuppu
<i>Tel.</i>	: Pappukura, Peddapavila Kura, Payilikura, Pavilikura
<i>Urdu.</i>	: Khurfa

DESCRIPTION -

a) Macroscopic :

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

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

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

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

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

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

b) Microscopic :

Root – Shows 5-15 layers of cork, inner half filled with reddish-brown contents; secondary cortex composed of thin-walled, oval cells, having intercellular spaces; pericycle fibre present in patches; secondary phloem consists of sieve tubes and parenchymatous cells; secondary xylem composed of vessels, tracheids and parenchyma; vessels, solitary or in groups of 2-5, arranged in radial rows, having simple pits and spiral thickening; tracheids, thick-walled with wide lumen; parenchyma abundant; simple as well as compound starch grains measuring 6-14 μ in dia., having 2-3 components present in secondary cortex, phloem, xylem parenchyma and ray cells.

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

Leaf –

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

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

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

IDENTITY, PURITY AND STRENGTH -

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

T.L.C. -

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

CONSTITUENTS - Protein, Carbohydrates, Vitamin C and Mucilage.

PROPERTIES AND ACTION -

Rasa : Amla
Guṇa : Sara, Guru, Rūkṣa
Vīrya : Uṣṇa
Vipāka : Amla
Karma : Vātahara, Pittakara, Kaphahara, Cakṣuṣya, Vāñidoṣahara

IMPORTANT FORMULATIONS - Marma Guṭīkā.

THERAPEUTIC USES - Vraṇa, Gulma, Prameha, Śoṭha, Arśa, Agnimāndya.

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

LAJJĀLU (Whole Plant)

Lajjālu consists of **dried whole plant** of *Mimosa pudica* Linn. (Fam. Fabaceae); a diffused undershrub, sensitive to touch, 25-50 cm high, found nearly throughout hotter and moist regions of the country.

SYNONYMS -

- Sansk.* : Saṁgā, Varākrāntā, Namaskārī
Assam. : Lajubilata, Adamalati
Beng. : Lajaka, Lajjavanti
Eng. : Touch-me-not
Guj. : Risamani, Lajavanti, Lajamani
Hindi. : Chhuimui, Lajauni
Kan. : Muttidasenui, Machikegida, Lajjavati
Kash. : --
Mal. : Thotta Vati
Mar. : Lajalu
Ori. : Lajakuri
Punj. : Lajan
Tam. : Thottavadi, Tottalchurungi
Tel. : Mudugudamara
Urdu. : Chhuimui

DESCRIPTION -

a) Macroscopic :

Root – Cylindrical, tapering, rependant, with secondary and tertiary branches, varying in length, upto 2 cm thick, surface more or less rough or longitudinally wrinkled; greyish-brown to brown, cut surface of pieces pale yellow; fracture hard, woody, bark fibrous; odour, distinct; taste, slightly astringent.

Stem – Cylindrical, upto 2.5 cm in dia; sparsely prickly, covered with long, weak bristles longitudinally grooved, external surface light brown, internal cut surface grey, bark fibrous; easily separable from wood.

Leaf – Digitately compound with one or two pairs of sessile, hairy pinnae, alternate, petiolate, stipulate, linear lanceolate; leaflets 10-20 pairs, 0.6-1.2 cm long, 0.3-0.4 cm broad, sessile, obliquely narrow or linear oblong; obliquely rounded at base, acute, nearly glabrous; yellowish-green.

Flower – Pink, in globose head, peduncles prickly; calyx very small; corolla pink, lobes 4, ovate oblong; stamens 4, much exerted; ovary sessile; ovules numerous.

Fruit – Lomentum, simple, dry, 1-1.6 cm long, 0.4-0.5 cm broad with indehiscent segments and persistent sutures having 2-5 seeds with yellowish, spreading bristle at sutures, 0.3 cm long, glabrous, straw coloured.

Seed – Compressed, oval-elliptic, brown to grey, 0.3 long, 2.5 mm broad having a central ring on each face.

b) Microscopic :

Root – Mature root shows cork 5-12 layered, tangentially elongated cells, a few outer layers crushed or exfoliated; secondary cortex consisting of 6-10 layered, tangentially elongated thin-walled cells; secondary phloem composed of sieve elements, fibres, crystal fibres and phloem parenchyma traversed by phloem rays, phloem fibres single or in groups, arranged in tangential bands; crystal fibres thick-walled, 3-25 chambered, each with single or 2-4 prismatic crystals of calcium oxalate; phloem rays uni to multiseriate, 2-3 seriate more common; secondary xylem consists of usual elements traversed by xylem rays; vessels scattered throughout secondary xylem having bordered pits and reticulate thickenings; crystal fibres containing one or rarely 2-4 prismatic crystals of calcium oxalate in each chamber; parenchyma, thick-walled, scattered throughout secondary xylem; xylem rays uni to bi-seriate, rarely multiseriate, wider towards secondary phloem and narrower towards centre; starch grains, prismatic crystals of calcium oxalate and tannin present in secondary cortex, phloem and xylem rays and parenchyma; starch grains both simple and compound having 2-3 components, rounded to oval measuring 6-20 μ and 16-28 μ in dia. respectively.

Stem – Mature stem shows 4-8 layered, exfoliated cork of tangentially elongated cells filled with reddish-brown contents; secondary cortex wide, consisting of large, moderately thick-walled, tangentially elongated to oval, parenchymatous cells, filled with reddish-brown contents, a few cells containing prismatic crystals of calcium oxalate, a number of lignified, fibres single or in groups, scattered throughout; secondary phloem consisting of usual elements, 2-5 transversely arranged strips of fibres occur alternating with narrow strips of sieve elements and parenchyma, crystal fibres elongated, thick-walled, containing single crystal of calcium oxalate in each chamber; phloem rays thick-walled, radially elongated; secondary xylem composed of usual elements traversed by xylem rays; vessels drum-shaped with spiral thickenings, tracheids pitted with pointed ends, fibres of two types, shorter with wide lumen and longer with narrow lumen; xylem rays radially elongated, thick-walled, 1-6 cells wide and 3-30 cells high; pith consisting of polygonal, parenchymatous cells with intercellular spaces.

Leaf –

Petiole - shows single layered epidermis with thick cuticle; cortex 4-7 layered of thin-walled, parenchymatous cells; pericycle arranged in a ring; 4 central vascular bundles present with two smaller vascular bundles arranged laterally, one in each wing.

Midrib - shows single layered epidermis, covered with thin-cuticle; upper epidermis followed by a single layered palisade, spongy parenchyma single layered, pericycle same as in petiole; vascular bundle single.

Lamina - shows epidermis on both surfaces, palisade single layered; spongy parenchyma, 3-5 layers consisting of circular cells; rosette crystals and a few veins present in spongy parenchyma.

Fruit - Shows single layered epidermis with a few non-glandular, branched, shaggy hairs; mesocarp of 5-6 layers of thin-walled, parenchymatous cells; some amphicribal vascular bundles found scattered in this region; endocarp of thick-walled, lignified cells followed by single layered, thin-walled, parenchymatous cells.

Seed - Shows single layered radially elongated cells; followed by 5-6 layered angular cells filled with dark brown contents; endosperm consists of angular or elongated cells, a few containing prismatic crystals of calcium oxalate; cotyledons consists of thin-walled cells, a few cells containing rosette crystals of calcium oxalate; embryo straight with short and thick radicle.

Powder - Reddish-brown; shows, reticulate, pitted vessels, prismatic and rosette crystals of calcium oxalate, fibres, crystal fibres, yellow or brown parenchymatous cells, palisade cells non glandular, branched, shaggy hairs, single and compound starch grains, measuring 6-25 μ in dia. with 2 - 3 components.

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 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 9 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica Gel 'G' plate using n-Butanol : Acetic acid : Water : (4:1:5). Under UV (366 nm) four fluorescent zones appear at Rf 0.35, 0.62, 0.69 (all blue) and 0.81 (bluish-pink). On exposure to Iodine vapour two spots appear at Rf. 0.35 and 0.94 (both yellow). On spraying with Dragendorff reagent followed by 5% Methanolic Sulphuric acid reagent one spot appears at Rf. 0.35 (orange).

CONSTITUENTS - Alkaloid

PROPERTIES AND ACTION -

Rasa : Kaṣāya, Tikta
Guṇa : Laghu, Rūkṣa
Vīrya : Śīta
Vipāka : Kaṭu
Karma : Kaphahara, Pittahara, Grāhī

IMPORTANT FORMULATIONS – Samaṅgādi Cūrṇa, Kuṭajāvāleha, Puṣyānuga Cūrṇa, Bṛhat Gangādhara Cūrṇa.

THERAPEUTIC USES – Raktapita, Atisāra, Yoniroga, Śopha, Dāha, Śvāsa, Vraṇa, Kuṣṭha.

DOSE - 10-20 g. of the drug for decoction.

MADHUKA (Flower)

Madhuka consists of flower usually without stalk or calyx of *Madhuca indica* J.F.Gmel. Syn. *M. latifolia* (Roxb.) Macbride, *Bassia latifolia* Roxb. (Fam. Sapotaceae); a medium sized deciduous tree occurs in mixed deciduous forests throughout India, and also cultivated.

SYNONYMS -

<i>Sansk.</i>	: Guḍapuṣpā
<i>Assam.</i>	: Mahua, Mahuwa
<i>Beng.</i>	: Mahuwa
<i>Eng.</i>	: The Indian Butter tree, Mahawash tree
<i>Guj.</i>	: Mahudo, Mahuwa
<i>Hindi.</i>	: Mahuwa
<i>Kan.</i>	: Hippegida, Halippe, Hippe, Hippenara, Madhuka, Ippa, Eppimara
<i>Kash.</i>	: --
<i>Mal.</i>	: Irippa, Ilippa, Iluppa, Eluppa
<i>Mar.</i>	: Mohda
<i>Ori.</i>	: Mahula
<i>Punj.</i>	: Maua, Mahua
<i>Tam.</i>	: Katiluppai, Kattu Iluppai, Iluppi
<i>Tel.</i>	: Ippa Puvvu
<i>Urdu.</i>	: Mahuva

DESCRIPTION -

a) Macroscopic :

Drug consists of mostly corolla and androecium; corolla fleshy, reddish-brown, tubular, lobes 7-14 (usually 8-9), ovate lanceolate, short, erect 0.5-2 cm long; stamen 20-30 (usually 24-26), epipetalous and arranged in two series; anther sub-sessile, epipetalous, basifixed, lanceolate, pointed at tip and hairy at the back with prominent dark brown connective strand; taste, sweet.

b) Microscopic :

Corolla -- Petal shows a single layered epidermis, followed by thin-walled, irregularly shaped parenchymatous cells; vascular bundles found scattered in parenchymatous tissues.

Androecium -- Anther shows 4 pollen chambers and prominent cells of connective tissue in the centre of the chambers; epidermis single layered covered with thin cuticle; a few unicellular hairs present on one side; endothecium composed of radially elongated, oval-shaped, lignified cells; tapetum not distinct; pollen grains single or in groups, spherical,

with clear exine and intine walls scattered in the pollen sac; a few cells of the vascular bundles are seen embedded in the connective tissues.

Powder – Dark brown; shows fragments of epidermal cells, unicellular hairs; round, brown pollen grains with clear exine and intine walls.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 25 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 70 per cent, Appendix 2.2.7.
Moisture content	-	Not more than 10 per cent, Appendix 2.2.9.

CONSTITUENTS – Sugars.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guṇa	: Guru
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittakara, Śukrala, Śramahara, Balya, Ahr̥dya

IMPORTANT FORMULATIONS - Madhūkāsava, Drākṣādi Kvātha Cūrṇa, Elādi Modaka.

THERAPEUTIC USES – Tr̥ṣṇā, Dāha, Śrama, Śvāsa, Kṣata, Kṣaya.

DOSE – 10 – 15 g. of the drug.

MATSYĀKṢĪ (Whole Plant)

Matsyāḳṣī consists of **dried whole plant** of *Alternanthera sessilis* (Linn.) R. Br., Syn. *A. triandra* Lam., *A. denticulata* R. Br., *A. nodiflora* R. Br., *A. repens* Gmel., non Link. (Fam. Amaranthaceae); a small prostrate or ascending herb with several spreading branches growing throughout the warmer parts of the country and frequently found in wet places especially around tanks and ponds.

SYNONYMS -

- Sansk.* : Matsyagandhā, Bahli, Matsyāduni, Gandalī, Gartkalambukā
Assam. : --
Beng. : Sanchesak, Salincha Sak
Eng. : --
Guj. : Jalajambo
Hindi. : Gudari Sag
Kan. : Honagonne soppu
Kash. : --
Mal. : Ponnankanni, Kozuppa
Mar. : Kanchari
Ori. : Matsagandha, Salincha Saaga
Punj. : --
Tam. : Ponnangkanni
Tel. : Ponnaganti Koora
Urdu. : --

DESCRIPTION -

a) Macroscopic :

Root - Cylindrical, 0.1-0.6 cm diameter, cream to grey, numerous roots arising from the main tap root as lateral rootlets; fracture, short; no characteristic odour and taste.

Stem - Herbaceous, weak, mostly cylindrical occasionally sub-quadrangular at the apical region, with spreading branches from the base; yellowish-brown to light-brown; nodes and internodes distinct, internodes 0.5-5 cm long, often rooting at lower nodes; fracture, short; no characteristic odour and taste.

Leaf - 1.3-7.5 cm long, 0.3-2 cm wide, sometimes reaching 10 cm long, 2.5 cm wide, sessile, linear-oblong, or elliptic, obtuse or subacute; no characteristic odour and taste.

Flower – Flower in small axillary sessile heads, white often tinged with pink, bracteoles 1.2 cm long, ovate, scarious; perianth 2.5-3 mm long, sepals ovate, acute, thin, ovary obcordate, compressed, style very short, capitate; no characteristic odour and taste.

Fruit – Utricle, 1.5 mm long, orbicular, compressed with thickened margins; no characteristic odour and taste.

b) Microscopic :

Root – Shows circular outline consisting of 5-7 layered, thin-walled tangentially elongated and squarish, radially arranged cork cells; secondary cortex narrow, consistig of thin-walled, round or oval, parenchymatous cells; vascular bundles radially arranged, numerous, consisting of thin-walled cells; xylem tissues lignified; conjunctive tissue between bundles consisting of oval, thin-walled, parenchymatous cells; anomalous secondary growth occurs in the form of succession of rings of vascular bundles which are bicollateral, open and exarch; in the pith there are two larger vascular bundles composed of xylem and phloem; pith consisting of thin-walled, round to oval, isodiametric, parenchymatous cells.

Stem – Shows single layered epidermis consisting of round or oval, thin-walled cells covered with striated cuticle; cortex 6-10 layered consisting of thin-walled oval to round, parenchymatous cells and rosette crystals of calcium oxalate measuring 55-77 μ in diameter; vascular bundles arranged in a ring, with anomalous secondary growth; with are conjoint, bicollateral, open and endarch phloem narrow consisting of thin-walled cells traversed by phloem rays; xylem consisting of usual elements traversed by xylem rays; there are two vascular bundles situated in the peripheral region of pith, each bundle consistig of xylem and phloem; pith distinct, composed of thin-walled, round to oval parenchymatous cells with intercellular spaces, a few parenchymatous cells contain rosette crystals of calcium oxalate.

Leaf –

Midrib – shows single layered epidermis on both surfaces, covered with striated cuticle; collenchymatous cells, 2-4 layered towards ventral side forming 1-2 small patches, 1-2 layered towards dorsal side; parenchymatous cells, thin-walled round or oval, isodiametric cells, a few of them containing rosette crystals of calcium oxalate; vascular bundles three, each consisting of xylem and phloem, present in the centre.

Lamina – dorsiventral; shows wavy or undulate, irregular, single layered, tabular epidermis cells present on both surfaces; stomata paracytic, more on ventral side and less on dorsal side; palisade 2-3 layers; spongy parenchyma 3-4 layered of oval or irregular loosely arranged cells; a few of them containing rosette crystals of calcium oxalate; stomatal index 22-26 in lower surface and 12-20 upper surface; palisade ratio 3-5; vein-islet number 6-12 and veinlet termination number 8-10.

Powder – Olive green; shows fragments of parenchymatous cells, wavy or undulate irregular epidermal cells in surface view, paracytic stomata, palisade cells and xylem vessels with pitted and reticulate thickening and rosette crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 10 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 4.5 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 19 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica Gel 'G' plate using Toluene : Ethylacetate (9:1) shows in visible light three spots at Rf. 0.16, 0.33 and 0.44 (all green). Under U.V. (366 nm) five fluorescent zones visible at Rf. 0.16, 0.33, 0.44, 0.54 and 0.68 (all red). On exposure to Iodine vapour eight spots appear at Rf. 0.18, 0.25, 0.35, 0.44, 0.59, 0.81, 0.94 and 0.96 (all yellow).

CONSTITUENTS – Sugar, Saponins & Sterols.

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṣāya, Madhura
Guṇa	: Laghu
Vīrya	: Śītu
Vipāka	: Kaṭu
Karma	: Vātahara, Pitthara, Kaphahara, Grāhī

IMPORTANT FORMULATIONS – Traikantaka Ghṛta.

THERAPEUTIC USES – Kuṣṭha, Raktavikāra, Pittavikāra.

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

METHĪ (Seed)

Methī consists of seeds of *Trigonella foenum-graecum* Linn. (Fam. Fabaceae); an aromatic, 30-60 cm tall, annual herb, cultivated throughout the country.

SYNONYMS -

<i>Sansk.</i>	: Methini
<i>Assam.</i>	: --
<i>Beng.</i>	: --
<i>Eng.</i>	: Fenugreek
<i>Guj.</i>	: Methi
<i>Hindi.</i>	: Methi
<i>Kan.</i>	: Menthe, Mente
<i>Kash.</i>	: --
<i>Mal.</i>	: Uluva
<i>Mar.</i>	: Methi
<i>Ori.</i>	: --
<i>Punj.</i>	: Methi
<i>Tam.</i>	: Mendium, Ventaiyam
<i>Tel.</i>	: Mentulu
<i>Urdu.</i>	: Methi

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Alkaloid, Sapogenins and Mucilage.

PROPERTIES AND ACTION -

Rasa	: Tikta
Guṇa	: Snigdha
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Dipana, Rucya

IMPORTANT FORMULATIONS - Mustakāriṣṭa, Mṛtasañjivani Surā.

THERAPEUTIC USES - Aruci, Jvara, Grahaṇī, Prameha.

DOSE – 3-6 g. of the drug in powder form.

MULAKA (Whole Plant)

Mulaka consists of fresh whole plant of *Raphanus sativus* Linn. (Fam. Brassicaceae); an annual or biennial bristly herb, cultivated throughout the country upto an altitude of 3,000 m in the Himalayas and other hilly regions.

SYNONYMS -

Sansk. : --
Assam. : --
Beng. : Mula
Eng. : Radish
Guj. : Mulo
Hindi. : Muli
Kan. : Moolangi
Kash. : --
Mal. : Mullanki
Mar. : Mula
Ori. : Mula, Rakhyasmula
Punj. : Mulaka, Muli, Mula
Tam. : Mullangi
Tel. : Mullangi
Urdu. : Muli

DESCRIPTION -

a) Macroscopic :

Root - Root cylindrical, variable size and thickness, having a few longitudinal striations; light greyish-brown externally and faint yellowish internally; odour, not distinct; taste, slightly pungent.

Stem - Slender, hollow, cylindrical, compressed, smooth with branches arising at node and show longitudinal striations on drying; 0.1-1.0 cm in dia., yellowish-green.

Leaf - Lower leaves hairy, petiole 5-5.3 cm long, lyrate, coarsely toothed; upper most leaves simple, sub-linear but narrowed at the base; bright green.

Flower - Flower in long terminal raceme, bisexual, regular, complete 1-2 cm long, pedicel with scattered hairs; sepal 6.5-10 cm long, oblong, sometimes brown red; petals 1.7-2.2 cm long, blade obovate, sub-marginate at the apex, white or lilac with yellow or purple vein; stamen 6 in two whorls, two outer smaller and four inner longer; ovary superior, green or brown-purple, 10-12 ovuled; style about 4 mm long, 1-2 chambered.

Fruit - Siliqua, erect, cylindrical, 3-9 cm long and 0.8-1.4 cm thick, continuous or more or less constricted, longitudinally sulcatus, greenish-yellow, occasionally pale purple.

Seed - Reddish-brown; irregularly globose, sometimes flattened, 2-4 mm long, 2 mm wide; surface generally smooth and sometimes wrinkled and grooved at micropylar end; taste, oily.

b) Microscopic :

Root - shows 3-10 layered tangentially elongated, radially arranged, cork cells; secondary cortex composed of wide zone of oval to polygonal, elliptical, thin-walled, parenchymatous cells; secondary phloem mostly composed of sieve elements and parenchyma, traversed by phloem rays; secondary xylem mostly consisting of vessels and parenchyma, traversed by xylem rays; vessels mostly solitary or 2-3 in group; medullary rays four to many cells wide; **starch grains simple and compound having 2-4 components, solitary or in groups, round to oval, measuring 6-14 μ in dia. present in cortex, phloem, xylem parenchyma and ray cells.**

Stem - Shows single layered epidermis with thick cuticle; cortex consists of 5-12 layers with intercellular spaces; endodermis at some places, single layered; pericycle occurs as crescent shaped groups of pericyclic fibres; vessels solitary or 2-4 in groups, in macerated preparation show bordered pits and spiral thickening; tracheids and fibres aseptate with pointed ends; medullary rays 1-3 cells wide; pith a wide zone of polygonal, parenchymatous cells; **starch grains simple, round to oval, measuring 3-6 μ in dia. present in cortex and phloem.**

Leaf -

Petiole - appears nearly circular in outline with two lateral wings; epidermis single layered, covered with thick cuticle; hairs unicellular, present only on upper side; cortex 6-12 layers of oval to polygonal, thin-walled, parenchymatous cells; collateral vascular bundles arranged in a ring.

Midrib - appears biconvex in outline; epidermis on both side covered with thin cuticle; epidermis followed by 6-12 layers of parenchymatous cortex on both sides; vascular bundle three in number, one central and two lateral.

Lamina - dorsiventral; epidermis on either surface with thin-cuticle; palisade 2-3 layers; spongy parenchyma 4-5 layers; anisocytic stomata present on both surfaces.

Fruit - Shows a single layered epidermis, covered with a thin-cuticle; epidermis followed by a wide zone of oval to polygonal, tangentially elongated, parenchymatous cells in which a few vascular bundles are embedded.

Seed - Seed coat consists of single layered epidermis of nearly rectangular cells, covered with thin, straight cuticle; epidermis followed by integument of radially elongated, red-

dish-brown, of columnar cells; beneath integument 2-3 layers of compressed, thin-walled, parenchymatous cells present; endosperm and embryo consists of oval to polygonal, thin-walled, parenchymatous cells, containing aleurone grains and oil globules.

Powder - Yellowish-green; shows aseptate fibres, spiral vessels, oil globules and round to oval starch grains, measuring 3-14 μ in diameter.

IDENTITY, PURITY AND STRENGTH

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 18 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1 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 22 per cent, Appendix 2.2.7.

CONSTITUENTS – Glucoside, Volatile oil (containing butyl crotonyl isothiocyanate sulphide) with a typical radish odour.

PROPERTIES AND ACTION-

Rasa	: Kaṭu, Tikta
Guṇa	: Laghu, Tikṣṇa
Vīrya	: Uṣṇa
Vipāka	: Katu
Karma	: Vātahara, Pittahara, Kaphahara, Dīpana, Pācana, Rucya, Svarya, Hrdya

IMPORTANT FORMULATIONS - Mūlakakṣāra, Gandhaka Vaṭī,
Hajarulayahūda Bhasma.

THERAPEUTIC USES - Gulma, Arśa, Agnimāndya, Pīnasa, Udāvarta.

DOSE - 20 – 40 ml. of the drug in juice form.

MULAKA (Root)

Mulaka consists of fresh root of *Raphanus sativus* Linn. (Fam. Brassicaceae); an annual or biennial bristly herb, cultivated throughout the country upto an altitude of 3,000 m in the Himalayas and other hilly regions.

SYNONYMS -

<i>Sansk.</i>	: Salamarkataka, Visra, Saleya, Marusambhava,
<i>Assam.</i>	: Mula
<i>Beng.</i>	: Mula
<i>Eng.</i>	: Radish
<i>Guj.</i>	: Mula, Mulo
<i>Hindi.</i>	: Muli
<i>Kan.</i>	: Moolangi, Moclengi gadde, Mullangi, Mugunigadde
<i>Kash.</i>	: --
<i>Mal.</i>	: Mullanki
<i>Mar.</i>	: Mula
<i>Ori.</i>	: Mula, Rakhyasamula
<i>Punj.</i>	: Mulaka, Muli, Mulaa
<i>Tam.</i>	: Mullangi, Mulakam, Mullangu
<i>Tel.</i>	: Mullangi
<i>Urdu.</i>	: Muli

DESCRIPTION -

Macroscopic :

Root fleshy, fusiform, cylindrical, having a few lateral fibrous roots, variable in size, usually 25-40 cm in length, sometime cultivated species 75-90 cm in length and 50-60 cm in girth; white in colour; taste, slightly or strongly pungent, rarely sweet.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 24 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 36 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 33 per cent, Appendix 2.2.7.

T.L.C. –

T.L.C. of alcoholic extract of drug on Silica gel 'G' plate using Benzene : Ethylacetate (9:1). Under UV (366 nm) two fluorescent zones appear at Rf. 0.04 & 0.09 (both blue). On exposure to Iodine vapour five spots appear at Rf. 0.04, 0.09, 0.34, 0.49 & 0.69 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110°C three spots appear at Rf. 0.04, 0.09 & 0.47 (all violet).

CONSTITUENTS – Glucoside, Methylmercaptan and Volatile Oil.

PROPERTIES AND ACTION -

Rasa : Kaṭu, Tikta
Guna : Laghu, Tīkṣṇa
Vīrya : Uṣṇa
Vipāka : Kaṭu
Karma : Vātahara, Pittahara, Kaphahara, Dīpana, Pācana, Rucya, Svarya, Hṛdya

IMPORTANT FORMULATIONS – Candanabalālākṣādi Taila, Mūlaka kṣāra.

THERAPEUTIC USES – Jvara, Śvāsa, Kāsa, Pīnasa, Galaroga, Vraṇa, Dadru, Netraroga, Gulma, Arśa, Agnimāndya, Udāvarta.

DOSE – 15-30 ml. of the drug in the juice form.

MURĀ (Root)

Murā consists of dried root of *Selinum candollei* DC. Syn. *S. tenuifolium* Wall. ex DC. (Fam. *Apiaceae*); a perennial herb, 0.6 - 2.4 m tall, found commonly in the Himalayas from Kashmir to Nepal at an altitude of 1800 - 42000 m.

SYNONYMS -

Sansk. : Surabhi, Daitya, Gandhakuti, Gandhavati

Assam. : --

Beng. : Musamansi

Eng. : --

Guj. : --

Hindi. : Mura

Kan. : Halukoratige, Haggoratige

Kash. : --

Mal. : Muramanchi

Mar. : Mura

Ori. : Muramansi

Punj. : --

Tam. : Mural

Tel. : Mura

Urdu. : --

DESCRIPTION -

a) Macroscopic :

Roots occur in broken and cylindrical pieces, 6-12 cm long and 0.3 - 1.5 cm thick with stem portions attached and covered with leaf sheaths, roots rough due to longitudinal striations and root scars; colour, dull brown; odour, aromatic; taste, slightly bitter.

b) Microscopic :

Root - Shows 10 - 25 layers of cork cells consisting of radially elongated, rectangular cells, outer cork cells filled with dark brown contents, inner cells thin-walled, tangentially elongated; cork cambium consisting of 1-2 layered tangentially elongated, thin-walled cells; secondary cortex composed of rounded, parenchymatous cells with intercellular spaces; secondary phloem shows wide zone, consisting of sieve elements and parenchyma, traversed by phloem rays; cambium 2-4 layered, consisting of tangentially elongated, thin-walled cells; secondary xylem consisting of vessels, fibres and parenchyma, traversed by xylem rays; vessels solitary or in groups of 2-6 or more having spiral thickenings; fibres aseptate, short with blunt ends; xylem rays 2-5 cells wide, composed of radially arranged, somewhat oval cells; starch grains simple, round to oval, measuring 7-55 μ in dia., present in secondary cortex, secondary phloem, xylem parenchyma, xylem and

phloem rays; secretory canals numerous, distributed throughout secondary cortex, secondary phloem, secondary xylem and medullary rays; secretory canals lined by varying number of epithelial cells and filled with yellowish contents.

Powder - Brown; shows groups of cork cells, parenchymatous cells, secretory canals, oil globules and simple starch grains, round to oval measuring 7-55 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 9 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 3.5 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 17 per cent, Appendix 2.2.7.

CONSTITUENTS - Dihydropyrano-coumarines (identified as Isopteryxin and Anomalin), Sucrose and Mannitol.

PROPERTIES AND ACTION -

Rasa	: Katu, Tikta, Kaṣāya, Madhura
Guna	: Laghu
Virya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittahara

IMPORTANT FORMULATIONS - Arvindāsava, Karpūradyarīṣṭa.

THERAPEUTIC USES - Jvara, Dāha, Bhrama, Murchha, Śvāsa, Trṣā.

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

MURVĀ (Root)

Murvā consists of dried root of *Marsdenia tenacissima* Wight. & Arn. (Fam. Asclepiadaceae); a large stout, twining shrub, growing throughout the country.

SYNONYMS -

<i>Sansk.</i>	: Madhusrava, Madhurasā
<i>Assam.</i>	: Murha
<i>Beng.</i>	: --
<i>Eng.</i>	: --
<i>Guj.</i>	: Moravel
<i>Hindi.</i>	: Murva, Jartor
<i>Kan.</i>	: Koratige Hambu, Kallu Shambu, Koratige, Halukaratige, Kadaluhaleballi
<i>Kash.</i>	: --
<i>Mal.</i>	: Perumkurumba
<i>Mar.</i>	: Morvel
<i>Ori.</i>	: Murva, Murga,
<i>Punj.</i>	: --
<i>Tam.</i>	: Perunkurinjan
<i>Tel.</i>	: Chagaveru
<i>Urdu.</i>	: Turbud Safed

DESCRIPTION -

a) Macroscopic :

Root cylindrical, available in cut pieces of varying length and 0.5-3 cm thick, externally yellow to buff coloured with dark brown patches on the cork; prominent longitudinal ridges and furrows and transverse cracks present; bark easily separable from wood; fracture, short and granular in bark region and fibrous in wood; taste, slightly bitter; odour, indistinct.

b) Microscopic :

Root - Shows a cork, composed of 15-25 layers of thin-walled, tangentially elongated, rectangular cells, some filled with reddish-brown contents; secondary cortex composed of an outer region of broken ring of stone cells of varying thickness, followed by wide zone of oval to polygonal parenchymatous cells; stone cells yellow in colour of variable shapes and size; secondary phloem composed of mostly parenchyma with small patches of sieve elements and small strands of stone cells, similar to those present in secondary cortex; resin cells present irregularly in this region; phloem fibres absent; phloem rays 1-3 cells wide; secondary xylem segmented and shows a wedge-shaped structure, consisting of small tangential, concentric bands of unlignified masses of parenchymatous tissue, separated by similar concentric band of lignified tissue, composed of vessels, tracheids,

fibres, fibre tracheids and xylem parenchyma; in isolated preparation xylem vessels cylindrical with transverse articulations, vary in shape and size with bordered pits; fibres much elongated with mostly tapering ends and pitted walls; thick-walled and lignified parenchyma possess simple and bordered pits and scalariform thickening; xylem rays not distinctly marked where adjoining parenchyma is delignified; rosette and a few prismatic crystals of calcium oxalate and abundant starch grains, present in parenchymatous tissues; starch grains simple, elliptical to spherical with central hilum, 5.5-22 μ dia., compound starch grains having 2-3 or rarely upto 6 components.

Powder – Light brown; shows a number of stone cells, fibres, tracheids, fibre-tracheids, vessels with pitted walls, fragments of cork, rosette and prismatic crystals of calcium oxalate, simple and compound starch grains, measuring 5.5 - 22 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 5 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 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 14 per cent, Appendix 2.2.7.

CONSTITUENTS – Resin.

PROPERTIES AND ACTION -

Rasa	: Madhura, Tikta,
Guṇa	: Guru, Sara
Vīrya	: Uṣṇa
Vipāka	: Madhura
Karma	: Vātahara, Pittahara, Kaphahara, Viṣaghna

IMPORTANT FORMULATIONS – Āragvadhādi Kvātha Cūrṇa,
Patoladi Kvātha Cūrṇa, Prameha Mihira Taila,
Sudarsana Cūrṇa.

THERAPEUTIC USES – Jvara, Medoroga, Meha, Mukha Śoṣa, Kṛmiroga, Hṛdroga,
Kaṇṭhī, Arśa, Raktapitta, Trṣṇā.

DOSE – 2-6 g. of the drug in powder form.
10-20 g. of the drug for decoction.

NĀGAKĒŚARA (Stamen)

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

SYNONYMS -

- Sansk.* : Keśara, Nāgapuṣpa, Nāga, Hemā, Gajakeśara
Assam. : Negeshvar, Nahar
Beng. : Nagesvara, Nagesar
Eng. : Cobras Saffron
Guj. : Nagkesara, Sachunagkeshara, Nagchampa, Pilunagkesar, Tamranagkesar
Hindi. : Nagkesara, Pila Nagkesara
Kan. : Nagsampige, Nagakesari
Kash. : --
Mal. : Nangaa, Nauga, Peri, Veluthapala, Nagppu, Nagappovu
Mar. : Nagkesara
Ori. : Nageswar
Punj. : Nageswar
Tam. : Naugu, Naugaliral, Nagachampakam, Sirunagappu
Tel. : Nagachampakamu
Urdu. : Narmushk, Nagkesar

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Essential oil and Oleo-resin.

PROPERTIES AND ACTION -

Rasa	:	Tikta, Kaṭu, kaṣāya
Guṇa	:	Laghu, Rūkṣa
Vīrya	:	Uṣṇa
Vipāka	:	Kaṭu
Karma	:	Kaphahara, Varṇya, Vastivātāmayaghna, Ūrdhajatrugatarogahara

IMPORTANT FORMULATIONS - Candanabalālākṣādi Taila, Kumāryāsava, Nāgakesarādi Cūrṇa.

THERAPEUTIC USES - Vātarakta, Śopharoga, Vastiroga, Raktapitta.

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

NĪLĪ (Leaf)

Nīlī (leaf) consists of **dried leaf** of *Indigofera tinctoria* Linn. (Fam. Fabaceae); a shrub, 1.2-1.8 m high, found throughout and widely cultivated in many parts of the country.

SYNONYMS –

Sansk. : Nīlikā, Nīlīnī, Rangapatrī

Assam. : Nilbam

Beng. : Nil

Eng. : Indigo

Guj. : Gali, Galiparna

Hindi. : Nili

Kan. : Karunili

Kash. : —

Mal. : Neelamar

Mar. : Neel

Ori. : Nili, Nila

Punj. : Neel

Tam. : Avuri

Tel. : Nili Chettu, Nili

Urdu. : Neel

DESCRIPTION –

a) Macroscopic :

Drug occurs mostly in the form of leaflets and broken pieces of rachis; leaflet 1-2.5 cm long and 0.3-1.2 cm wide, oblong or oblanceolate with very short mucronate tip; pale green to greenish-black; no characteristic odour and taste.

b) Microscopic :

Leaf –

Petiole - appears nearly circular in outline having two lateral wings; epidermis single layered covered externally with thin cuticle and followed internally by single layered collenchymatous cells; pericycle present in the form of continuous or discontinuous ring, vascular bundles collateral and three in number, large one present in central and two smaller in lateral wings; pith composed of round to oval, thin-walled parenchymatous cells, a few prismatic crystals of calcium oxalate present in phloem and pith region.

Midrib - shows epidermis, cuticle and hair, similar as in petiole; beneath epidermis on lower side single or 2-3 layers of collenchyma on upper side present, both followed by 2-

3 layers of thin-walled parenchyma; vascular bundle single, collateral and crescent-shaped.

Lamina - shows dorsiventral structure; epidermis, cuticle and hair, similar as in petiole and midrib; palisade 2-3 layers; spongy parenchyma 2-4 layered, a few patches of veins scattered between palisade and spongy parenchyma, prismatic crystals of calcium oxalate rarely present in mesophyll cells; paracytic stomata and hair present on both surfaces but abundant in lower surface.

Powder - Greenish-grey; shows groups of mesophyll cells, aseptate fibres, pitted vessels, unicellular hairs and rarely 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 10 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 7.5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 25 per cent, Appendix 2.2.7.

CONSTITUENTS – Glycoside (Indican).

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṭu
Guna	: Sara
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Recanī, Keśya

IMPORTANT FORMULATIONS - Nīlibhṛṅgādi Taila (for external use only)
Mahāpañcagavya Ghṛta.

THERAPEUTIC USES - Āmavāta, Vātarakta, Udararoga, Udāvarta, Plīhāroga, Gulma, Jvara, Kāsa, Viṣavikāra, Kṛmiroga.

DOSE - 50-100 g. of decoction.

NĪLĪ (Root)

Nīlī (Root) consists of **dried root** of *Indigofera tinctoria* Linn. (Fam. Fabaceae); a shrub, 1.2-1.8 m high, found throughout and widely cultivated in many parts of the country.

SYNONYMS -

<i>Sansk.</i>	: Nīlikā, Nīlinī, Rangapatrī
<i>Assam.</i>	: Nilbam
<i>Beng.</i>	: Nil
<i>Eng.</i>	: Indigo, Indian Indigo
<i>Guj.</i>	: Nil, Gali, Gari
<i>Hindi.</i>	: Nili
<i>Kan.</i>	: Kadunili, Karunili, Nili, Neeligida, Olleneeli
<i>Kash.</i>	: --
<i>Mal.</i>	: Amari, Nilam
<i>Mar.</i>	: Nili, Nila
<i>Ori.</i>	: —
<i>Punj.</i>	: Neel
<i>Tam.</i>	: Avuri, Neeli
<i>Tel.</i>	: Nili Chettu, Nili, Aviri
<i>Urdu.</i>	: Neel

DESCRIPTION -

a) Macroscopic :

Root mostly available in pieces, hard, woody, cylindrical, 0.1-1.5 cm thick, surface nearly smooth except for a few scattered lenticels; pale-yellow to light yellowish-brown; odour not distinct; taste, slightly bitter.

b) Microscopic :

Root -Shows a narrow zone of cork consisting of 4-10 layers of tangentially elongated, rectangular, thin-walled cells, with lenticels; secondary cortex a narrow zone, consisting of rectangular to polygonal, thin-walled cells, group of fibres, measuring 11-17 μ in dia., thick-walled and lignified with wide lumen; secondary phloem composed of usual elements; wood occupies bulk parts of the root, consisting of usual elements; vessels solitary or 2-4 in groups having simple pits; fibres present in the form of alternating bands of parenchyma; parenchyma cells rectangular to polygonal in shape and attached on both the opposite sides of vessels; medullary rays 1-4 cells wide; prismatic crystals of calcium oxalate present in secondary cortex, phloem and xylem parenchyma and rays; oil globules present in cortex and phloem parenchyma; starch grains simple, round to oval, measuring 3-11 μ in dia., present in cortex, phloem, xylem parenchyma and rays.

Powder – Creamish-brown; shows aseptate fibres, pitted vessels, simple and compound starch grains, measuring 3-11 μ in dia., rarely oil globules and 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 6 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 0.7 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 4 per cent, Appendix 2.2.7.

T.L.C -

T.L.C. of alcoholic extract of the drug on Silica gel 'GF 254 + Silica gel 'G' (1:3 w/w) plate using Chloroform : Ethylacetate (6:4) show under U.V. (366 nm) ten fluorescent zones at Rf. 0.14 (blue), 0.30 (bluish green), 0.40 (blue), 0.47 (blue), 0.58 (blue), 0.63 (bluish green), 0.75 (blue), 0.81 (blue), 0.86 (green) and 0.91 (blue). On exposure to Iodine vapour thirteen spots appear at Rf. 0.06, 0.10, 0.14, 0.27, 0.33, 0.40, 0.50, 0.58, 0.63, 0.75, 0.80, 0.86 and 0.91 (all yellow). On spraying with 5% Methanolic Sulphuric acid reagent and heating the plate at 110°C for ten minutes fourteen spots appear at Rf. 0.06, 0.10, 0.14, 0.21, 0.27, 0.33, 0.40, 0.50, 0.58, 0.63,, 0.75, 0.81, 0.86, and 0.91 (all grey).

CONSTITUENTS – Glycoside (Indican).

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṭu
Guna	: Sara
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Recanī, Keśya, Bhrama Mohahara

IMPORTANT FORMULATIONS - Arvindāsava, Triphalādi Taila.

THERAPEUTIC USES - Vātarakta, Āmavāta, Udāvarta, Udararoga, Plīhāroga, Viṣavikāra, Kāsa, Gulma, Kṛimiroga.

DOSE - 48 g. of drug for decoction.

NIMBA (Leaf)

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

SYNONYMS -

Sansk. : Arista, Picumarda
Assam. : Mahanim
Beng. : Nim, Nimgach
Eng. : Margosa Tree
Guj. : Kohumba, Limba, Limbado, Limado
Hindi. : Nim, Nimba
Kan. : Nimba, Bevu, Oilevevu, Kahibevu, Bevinama
Kash. : --
Mal. : Veppu, Aryaveppu, Nimbam, Veppa
Mar. : Balantanimba, Limba, Bakayan, Nim, Kadunimb
Ori. : Nimba
Punj. : Nimba, Bakan, Nim
Tam. : Vemmu, Veppu, Arulundi, Veppan
Tel. : Vemu, Vepa
Urdu. : Neem

DESCRIPTION -

a) Macroscopic :

Leaves - Compound, alternate, rachis 15-25 cm long, 0.1 cm thick; leaflets with oblique base, opposite, exstipulate, lanceolate, acute, serrate, 7-8.5 cm long and 1.0-1.7 cm wide, slightly yellowish-green; odour, indistinct; taste, bitter,

b) Microscopic -

Leaf -

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

Lamina - shows dorsiventral structure; epidermis on either surface, composed of thin-walled, tangentially elongated cells, covered externally with thick cuticle; anomocytic stomata present on lower surface only; palisade single layered; spongy parenchyma composed of 5-6 layered, thin-walled cells, traversed by a number of veins; rosette crystals of calcium oxalate present in a few cells; palisade ratio 3.0-4.5; stomatal index 13.0-14.5 on lower surface and 8.0-11.5 on upper surface.

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Triterpenoids and Sterols.

PROPERTIES AND ACTION -

Rasa	: Tikta, Rūkṣa
Guna	: Laghu
Virya	: Śīta
Vipāka	: Kaṭu
Karma	: Vātalā, Pittanāśaka, Grāhī

IMPORTANT FORMULATIONS - Kāśīsādi Ghrta, Jātyādi Ghrta, Ārogyavardhini Gutikā, Nimbapatrādiupanāha, Pancaguna Taila.

THERAPEUTIC USES - Jvara, Āmasōtha, Vrana, Kuṣṭha, Prameha, Netraroga, Krmiroga, Viśaroga.

DOSE - 1-3 g. of the drug in powder form.
10-20 g. of the drug for decoction.

NIMBA (Stem Bark)

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

SYNONYMS -

<i>Sansk.</i>	: Arista, Picumarda
<i>Assam.</i>	: Mahanim
<i>Beng.</i>	: Nim, Nimgacha
<i>Eng.</i>	: Margosa Tree
<i>Guj.</i>	: Kadvo Limbdo
<i>Hindi.</i>	: Nim, Nimb
<i>Kan.</i>	: Nimba, Bevu, Oilevevu, Kahibevu
<i>Kash.</i>	: --
<i>Mal.</i>	: Veppu, Aruveppu
<i>Mar.</i>	: Balantanimba, Limba, Kadunimb
<i>Ori.</i>	: Nimba
<i>Punj.</i>	: Nimba, Bakam, Nim
<i>Tam.</i>	: Veppai, Vembu
<i>Tel.</i>	: Vemu, Vepa
<i>Urdu.</i>	: Neem

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Stem Bark -Shows outer exfoliating pieces hard, woody, considerably thick in older barks; almost entirely dead elements of secondary phloem, alternating with discontinuous tangential bands of compressed cork tissue, former composed of several layers of stone cells occurring in regularly arranged groups together with collapsed phloem elements filled with brown contents; in between the successive zones of cork tissue 3-5 layers of fibre groups with intervening thin-walled and often collapsed phloem elements present; each zone of cork tissue consists of several layers of regular, thin-walled cells occasionally with a few compressed rows of thick-walled cells towards outer surface; within exfoliating portion a number of layers of newly formed cork composed of thin-walled, rectangular cells and one or two layers of cork cambium, below which a wide zone of secondary phloem present; secondary cortex absent in most cases; secondary phloem commonly composed of well-developed fibre bundles traversed by 2-4 seriate phloem rays and transversely separated by bands of parenchymatous tissue of phloem;

phloem elements of outer bark mostly collapsed; a few fairly large secretory cavities also occur in phloem; most of phloem parenchyma contain starch grains and prismatic crystals of calcium oxalate; starch grains, simple, round with central hilum, measuring 2.75-5 μ ; structure of bark varies considerably according to gradual formation of secondary cork bands.

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

IDENTITY, PURITY AND STRENGTH -

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

T.L.C. -

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

CONSTITUENTS - Bitter principles Nimbin and Nimbiol.

PROPERTIES AND ACTION -

Rasa	: Tikta
Guṇa	: Laghu, Rūkṣa
Vīrya	: Śīta
Vipāka	: Katu
Karma	: Kaphahara, Pittahara, Viṣaghna, Kaṇḍughna, Vraṇasōdhanakara, Hṛdayavidāhasāntikara

IMPORTANT FORMULATIONS - Nimbādi Kwātha Cūrṇa, Nimbādi Cūrṇa, Pancanimba Cūrṇa, Pañcatikta Guggulu Ghrta, Pathyādi Kwātha (Ṣaḍanga) Cūrṇa, Sudersana Cūrṇa.

THERAPEUTIC USES - Vraṇa, Kuṣṭha, Prameha, Kandu, Krmiroga, Jvara, Dāha, Rakta pitta.

DOSE - 2-4 g. of the drug in powder form, Decoction should be used externally.

PALĀSA (Stem Bark)

Palasa consists of **dried stem bark** of *Butea monosperma* (Lam.) Kuntze (Fam. Fabaceae); a medium sized tree with somewhat crooked trunk, 12 - 15 m high with irregular branches, commonly found throughout the greater part of the country upto about 915 m, except in very arid parts.

SYNONYMS -

<i>Sansk.</i>	: Kimsuka, Raktapuspa
<i>Beng.</i>	: Palash, palas, Palash Gachha
<i>Eng.</i>	: Bastard peak
<i>Guj.</i>	: Kesudo, Khakharo, Khakhapado
<i>Hindi.</i>	: Dhak, Tesu
<i>Kan.</i>	: Muttug, Muttuga, Muttala
<i>Kash.</i>	: --
<i>Mal.</i>	: Plasu, Camata, Plas, Chama Tha
<i>Mar.</i>	: Palas
<i>Ori.</i>	: --
<i>Punj.</i>	: Palash, Dhak, Tesu
<i>Tam.</i>	: Purasu, Paras
<i>Tel.</i>	: Moduga, Modugu, Chettu
<i>Urdu.</i>	: Dhak, Palaspapda

DESCRIPTION -

a) Macroscopic :

Mature stem bark, 0.5 - 1 cm thick, greyish to pale brown, curved, rough due to presence of rhytidoma, and scattered dark brown spots of exudate; rhytidoma 0.2 cm thick usually peels off, exposing light brown surface, exfoliation of cork and presence of shallow longitudinal and transverse fissures; fracture, laminated in outer part and fibrous in inner part; internal surface rough, pale brown; taste, slightly astringent.

b) Microscopic -

Stem Bark - Mature bark shows rhytidoma consisting of alternating layers of cork, secondary cortex and phloem tissue; cork cells, thin-walled, 5-10 or more layered, rectangular, dark-brown; secondary cortical cells round and irregular in outline, dark brown, moderately thick-walled; tanniferous cells, often in groups, having brown colour, sometimes containing mucilage and other materials found scattered in this zone; beneath this zone regular cork consisting of 4-12 rows of radially arranged, rectangular cells followed by a zone of 2 - 4 layers of sclereids; secondary phloem consisting of sieve tubes, companion cells, phloem parenchyma, phloem fibres, crystal fibres, traversed by

phloem rays; in outer and middle phloem regions phloem tissues get crushed and form tangential bands of ceratenchyma; phloem fibres arranged in tangential bands alternating with sieve tubes and phloem parenchyma; most of fibre groups contain prismatic crystals of calcium oxalate forming crystal sheath; in macerated preparation phloem fibres appear thick-walled, lignified, elongated with tapering or bifurcated ends; crystal fibres divided into a number of chambers containing a prismatic crystal of calcium oxalate in each chamber; phloem rays multiseriate 4 - 12 cells wide, 7 - 50 cells in height, straight; prismatic crystals of calcium oxalate found scattered in the secondary phloem tissues and phloem rays; starch grains simple or compound having 2 - 3 components, measuring 2.75 - 13.75 μ in dia., found scattered in phloem parenchyma and phloem ray cells abundantly; tanniferous cells and secretory cavities also occur in secondary phloem.

Powder - Reddish-brown; shows numerous prismatic crystals of calcium oxalate, starch grains simple and compound with 2 - 3 components measuring 3-14 μ in dia., dark brown coloured cells, sclereids mostly in groups, thin-walled cork cells, numerous crystal fibres in group or singles.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 12 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 14 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (90:10) under U.V. (366 nm) shows four fluorescent zones at Rf. 0.10, 0.18, 0.48, 0.65 (all blue). On exposure to Iodine vapour three spots appear at Rf. 0.10, 0.48 and 0.67 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for about ten minutes at 105°C three spots appear at Rf. 0.10, 0.48 and 0.67 (all violet).

CONSTITUENTS - Kinotannic acid and Gallic acid.

PROPERTIES AND ACTION -

Rasa	: Kaṣāya, Kaṭu, Tikta
Guna	: Sara, Snigdha
Vīrya	: Uṣṇa
Vipāka	: Katu
Karma	: Kaphavātasāmaka, Agnidipaka. Sāraka, Vṛsya

IMPORTANT FORMULATIONS - Palāsa Ksāra, Nyagrodhādi Kwātha Cūrma,
Mahānārāyaṇa Taila

THERAPEUTIC USES - Grahaṇī, Gulma, Arsa, Vraṇa, Krmiroga.

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

PĀRIBHADRA (Stem Bark)

Pāribhadra consists of the dried stem bark of *Erythrina indica* Lam. (Fam. Fabaceae); medium sized, quick growing tree, distributed widely in deciduous forests throughout India, also grown in gardens as an ornamental plant and as a support for black pepper vine.

SYNONYMS -

Sansk. : Pāribhadra, Kantakimsuka

Assam. : --

Beng. : Pattemadar

Eng. : Coral tree

Guj. : Panderavo

Hindi. : Pharahada, Pangara

Kan. : Hongar, Halivanadamar

Kash. : --

Mal. : Murrikku

Mar. : Pangara

Ori. : --

Punj. : --

Tam. : Kalyanamurongai, Mulmurungai

Tel. : Badisa, Varifamu

Urdu. : --

DESCRIPTION -

a) Macroscopic :

Mature dried stem bark about 0.5-2.0 cm thick, smooth, exfoliating in narrow strips; outer surface yellowish to yellowish-grey, lenticels found at short intervals longitudinal lines on the outer surface, yellowish to cream coloured; whole bark differentiated into outer non-fibrous and inner fibrous zones, outer bark breaks readily with a short fracture, inner bark fibrous.

b) Microscopic :

Stem Bark - Mature bark shows stratified and lignified cork of about 2-9 or more alternating bands of narrow tangentially elongated compressed, yellowish coloured cells and of wider cells in 3-25 or more layers, tangentially elongated to squarish, radially arranged and thin-walled; a few cells contain prismatic crystals of calcium oxalate; secondary cortex consists of large, somewhat tangentially elongated to polygonal, parenchymatous cells, a few cells contain prismatic crystals of calcium oxalate, stone cells occur in singles or in groups which are circular, elongated or rectangular in shape, parenchymatous cells surrounding stone cells groups, contain large crystals of calcium oxalate; secondary

phloem consisting of sieve tubes with their companion cells, phloem fibres and phloem parenchyma traversed by phloem rays; phloem fibres, mostly arranged in tangential strips alternating with the regular thin-walled phloem elements, sieve elements in outer and middle regions of phloem mostly get collapsed and crushed and form many tangential strips of sclerenchyma between the tangential groups of phloem fibres; fibres large, thick-walled with narrow lumen; crystal fibres numerous, septate and each chamber contains a single prismatic crystals of calcium oxalate; phloem parenchyma thin-walled, a few of them contains crystals of calcium oxalate similar to those found in the secondary cortex and crystal fibres; phloem rays numerous and mostly multiseriate running almost straight in the inner phloem region but bent towards left or right in the outer phloem region; ray cells thin-walled, radially elongated in the inner region and slightly tangentially elongated towards outer region in transverse section.

Powder – Creamish-yellow; shows striated cork, pieces of phloem fibres, stone cells and 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 13 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 2.5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 7 per cent, Appendix 2.2.7.

CONSTITUENTS – Alkaloids and Resins.

PROPERTIES AND ACTION –

Rasa	: Tikta, Kaṭu
Guṇa	: Sara
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Medohara, Krmighna

IMPORTANT FORMULATIONS - Nyagrodhādi Cūrṇa, Abhayā Lavāṇa, Nārāyaṇa Taila.

THERAPEUTIC USES - Krmiroga, Sotha, Karṇaroga.

DOSE - 6-12 g. of the drug in powder form.
12 - 24 g. of the drug for decoction.

PIPPALĪMŪLA (Stem)

Pippalīmūla consists of **dried, cut, stem pieces** of *Piper longum* Linn. (Fam. Piperaceae); a slender, aromatic, creeping and perennial herb; native of the hotter parts of the country and found wild as well as cultivated extensively in Bengal and southern states.

SYNONYMS -

Sansk. : Māgadhī, Granthikā, Pippalikā

Assam. : --

Beng. : Pipulmul

Eng. : Piper root

Guj. : Gantoda, Ganthoda

Hindi. : Piparamula

Kan. : Modikaddi, Hippali, Tippali, Modi

Kash. : --

Mal. : Kattuthippaliver, Tippaliveru

Mar. : Pimplimula

Ori. : Pippalimula, Bana Pippalimula

Punj. : Pippalimula, Magha

Tam. : Kanda Tippili, Ambinadi Desavaram

Tel. : Modi, Madikatta

Urdu. : Filfil Daraz

DESCRIPTION -

a) Macroscopic :

Drug available in cut pieces, having distinct internodes and swollen nodes with a number of small rootlets and root scars; stout, cylindrical, 0.2-0.6 cm thick, reddish-brown to grey; odour, aromatic; taste, pungent.

b) Microscopic :

Stem - Shows a single layered epidermis followed by a continuous ring of collenchymatous and round to oval thin-walled, parenchymatous cells; vascular bundles show peripheral and medullary arrangement, separated from each other by a wavy strip of sclerenchyma forming a ring, enclosing pith; bundles collateral and arranged in rings, having sclerenchymatous sheath of pericyclic cap over phloem; xylem wedge-shaped; starch grains simple and compound having 2-7 components, round to oval, measuring 3-14 μ in dia., present abundantly throughout the section.

Powder - Reddish-brown to creamish-grey; under microscope shows scalariform vessels, aseptate fibres, simple and compound starch grains measuring 3-14 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 5.5 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 4.0 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 12 per cent, Appendix 2.2.7

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (9:1) shows under U.V. light eight spots at Rf. 0.04 (yellow), 0.12 (light green), 0.25 (green), 0.31 (light green), 0.36 (light green), 0.53 (light green), 0.65 (green) and 0.97 (blue). On exposure to Iodine vapour five spots appear at Rf. 0.13, 0.25, 0.40, 0.89, 0.93 (all yellow). On spraying with Dragendorff reagent two orange coloured spots appear at Rf. 0.13 & 0.25.

CONSTITUENTS - Alkaloids (Piperine, Piperlongumine, Piperlonguminine etc.),
Essential oils.

PROPERTIES AND ACTION -

Rasa : Kaṭu
Guṇa : Laghu, Rūkṣa
Virya : Uṣṇa
Vipāka : Kaṭu
Karma : Vātahara, Kaphahara, Dīpana, Pācana, Vātānulomana, Vulaprasamana, Rucya

IMPORTANT FORMULATIONS - Pañcakola Cūrṇa, Daśamūla Taila,
Daśamūlapañcakolādi Kvātha Cūrṇa,
Daśamūlaṣaṭpalaka Ghṛta.

THERAPEUTIC USES - Udararoga, Ānāha, Gulma, Kṛmiroga, Vātaroga.

DOSE - 0.5 - 1 g. of the drug in powder form.

PLAKṢA (Stem Bark)

Plakṣa consists of dried stem bark of *Ficus lacor* Buch. - Ham. = *F. lucescens* Blume., Syn. *F. infectoria* Roxb. (Fam. Moraceae); a large spreading tree, with occasional aerial roots, found nearly throughout the country and commonly planted as an avenue and ornamental tree.

SYNONYMS -

Sansk. : -- Parkari, Parkati, Jaṭi

Assam. : --

Beng. : Pakur

Eng. : --

Guj. : Paras pipalo, Pepli

Hindi. : Pakad

Kan. : Karibasari, Kadubasari, Jeevibasari, Basari, Juvvebasari

Mal. : Itti, Ittiyadi, Itthy

Mar. : --

Ori. : Pakali, Pakal

Punj. : --

Tam. : Icchi, Itthi, Kallalnaram

Tel. : --

Urdu. : Pakhad

DESCRIPTION -

- a) **Macroscopic** - Bark rough, occurring in flat to curved, quilled pieces, measuring 0.4-0.7 cm in thickness; external surface ash or whitish-grey; numerous transversely arranged lenticels; ranging from 0.1 cm - 1.3 cm in length, lip-shaped and exfoliating; internal surface rough, fibrous, longitudinally striated, reddish-brown; fracture, fibrous.
- b) **Microscopic** - Shows 5-8 layered cork consisting of thin-walled, rectangular cells, a few external layers exfoliating; secondary cortex very wide consisting of compactly arranged, rectangular, thick-walled, pitted cells, patches of circular to elongated, lignified, elliptical stone cells with radiating canals, a few with concentric striations; a few prismatic crystals of calcium oxalate and reddish-brown contents found scattered throughout the secondary cortex; secondary phloem very wide consisting of mostly stratified layers of collapsed cells forming ceratenchyma, groups of fibres, phloem parenchyma, laticiferous cells, traversed by 2-5 seriate phloem rays; phloem fibres lignified with wide lumen and pointed tips; thin-walled, rectangular, a few phloem parenchyma containing prismatic crystals of calcium oxalate.

Powder - Reddish-brown; shows thick-walled parenchyma with simple pits; stone cells in groups and singles, prismatic crystals of calcium oxalate, elongated phloem fibres with wide lumen and pointed tips.

IDENTITY, PURITY AND STRENGTH –

Foreign matter	-	Not more than 1 per cent, Appendix 2.2.2.
Total ash	-	Not more than 10 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1.5 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 6 per cent, Appendix 2.2.7.

CONSTITUENTS – Sterols, Sugar, Tannin, Alkaloid and Saponin.

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Kaṣāya
Guṇa	: Rūkṣa
Virya	: Śīta
Vipāka	: Śīta
Karma	: Pittahara, Kaphahara, Medohara, Stambhana, Dahahara, Śramahara, Saṁgrāhī, Bhagnasādhaka, Yonidosahara

IMPORTANT FORMULATIONS - Nyagrodhādi Kvātha Cūrṇa, Nālpāmarādi Taila, Marma Guṭikā.

THERAPEUTIC USES - Raktapitta, Murchā, Vraṇa, Yoniroga, Sotha, Visarpa, Atisāra.

DOSE - 50 g. of the drug in powder form for decoction.

PRASĀRINĪ (Whole Plant)

Prasāriṅī consists of dried **whole plant** of *Paederia foetida* Linn. (Fam. Rubiaceae); an extensive foetid smelling perennial climber, found in most of the parts of country.

SYNONYMS -

Sansk. : Sāraṅī, Prasāraṅī, Gandhapatra

Assam. : Bhedilata

Beng. : --

Eng. : --

Guj. : Prasarini

Hindi. : Gandha Prasarini

Kan. : Hesarani, Prasarini bail

Kash. : --

Mal. : Tala nili

Mar. : Hiranvel, Haranvel

Ori. : --

Punj. : Prasarini

Tam. : Mudiya Kundal

Tel. : Gontima goru-Teega

Urdu. : --

DESCRIPTION -

a) Macroscopic :

Root - Tap root 2-4 cm long, 0.5-2 cm thick, cylindrical or subcylindrical, tortuous, having a number of branches and rootlets; dark brown; surface rough due to longitudinal wrinkles, ridges and fissures; remnants of rootlet, thin scars and numerous horizontal lenticels also present; fracture, short in bark region and somewhat fibrous in wood; odour, disagreeable and foetid more marked in fresh samples; taste, indistinct.

Stem - Slender, sub-erect with diffuse branching, upto 4 cm thick; subcylindrical showing a dumb-bell shaped appearance in transverse view due to presence of two prominent furrows running opposite each other on both surfaces, externally dark brown, longitudinal anastomosing wrinkles, ridges and a few transverse cracks and circular lenticels, fracture, fibrous; odour, foetid more marked in fresh samples; taste, indistinct.

Leaf - Simple, petiolate, stipulate; 10-15 cm long, 5-6 cm broad; somewhat glabrous; ovate, entire, base narrow or broad, apex acute or cuspidate; stipule ovate, lanceolate, bifid, entire, acute, base broad with hairy surface, texture, thin; odour, foetid more distinct in fresh samples; taste, indistinct.

Flower - Violet to pink; bracteate, pedicellate, bisexual, calyx campanulate, acutely, toothed; corolla funnel-shaped, usually pubescent, somewhat gibbous and wooly inside, limb narrow, divided into five cordate crenulate segments, lobes short; filament short, inserted irregularly about the middle of the tube, anther erect within the tube; ovary turbinate, two celled containing one ovule, each attached to the bottom of the cell; style, simple; stigma two cleft with lobes bent amongst the anther.

Fruit - Berry, orbicular, ellipsoid, compressed, smooth with five lines on each side, one celled, two seeded, 1.1 cm across, red or black.

Seed - Compressed, smooth, enlarged with somewhat membranous ring all round.

b) Microscopic :

Root - Mature root shows 6-13 layers of cork, composed of tangentially elongated cells, in outer few layers somewhat collapsed, lignified and filled with brown content; cork cambium 1-2 layers; secondary cortex 5-16 layers of thin-walled; somewhat radially arranged parenchymatous cells; secondary phloem appears as wedge-shaped conical masses consisting of sieve elements and parenchyma traversed by phloem rays; major portion of phloem element thick-walled, sieve elements form collapsed masses of ceratenchyma in outer region and intact in inner most region; uni to biseriate phloem rays composed of usually thick-walled cells in outer and middle phloem region; multiseriate phloem rays composed of thin-walled parenchymatous cells showing funnel-shaped dilatation in outer phloem region; in tangential section through inner phloem region sieve cells shows beaded thickening; cambium 1-3 layered; secondary xylem consists of wide zone of lignified and non-lignified tissue traversed by xylem rays; lignified tissue consists of vessels, tracheids and fibres; non-lignified tissue consists of thin-walled parenchymatous cells; xylem vessels distributed singly or in groups of two to three having variable shape and bordered pits; tracheids long and narrow having bordered pits; fibres long, narrow having simple pits; xylem parenchyma have simple pits or reticulate thickening; xylem ray cells thin-walled, circular to somewhat radially elongated in non-lignified zone and thick-walled, lignified and radially elongated in lignified zone having simple pits; starch grains as granular masses, oil globules as small circular bodies and raphides of calcium oxalate present in a few cells of secondary cortex, phloem, xylem and medullary rays.

Stem - Mature stem shows 7-11 layers of cork composed of rectangular cells, a few outer layers lignified; secondary cortex 6-9 layers consisting of thin-walled parenchymatous cells; pericyclic fibres present in singles or in groups of two to three, much elongated and septate with very narrow lumen; secondary phloem much similar to that of root having thick-walled phloem elements, arranged in wedged-shaped conical masses, with ceratenchyma, two types of phloem rays, sieve cells with beaded thickening; cambium 1-2 layers; secondary xylem represented by lignified and non-lignified tissues; inner most xylem composed of thin compact band of 8-9 layers of lignified tissue with primary xylem attached towards pits, xylem vessels associated with tracheids, fibres and lignified or non-lignified parenchyma; a few xylem vessels show tyloses; all elements have similar pit-

tings as described in case of root; uni and biseriata rays thin-walled but lignified; in lignified region, multiseriata rays usually thin-walled; centre of stem occupied by small pith and a few sclereids; a few cells of secondary cortex, phloem, xylem, medullary rays and pith contain starch grains, oil globules and raphides of calcium oxalate.

Leaf –

Petiole – shows similar structure as midrib but differs in possessing trichomes comparatively smaller, as well as two more somewhat spherical accessory bundles, one flanking on each side of median vascular bundle close to lateral extensions where they further split after reaching distal end of petiole; starch grains, oil globules and raphides of calcium oxalate similar to those of root and stem also present in parenchymatous cells of petiole, midrib and in mesophyll cells of leaf.

Midrib - composed of single layered epidermis covered with cuticle; ground tissue consisting of 2-5 layered of collenchyma towards upper and lower side and rest parenchyma; a larger median crescent-shaped vascular bundle consisting usual elements with xylem towards upper side and phloem towards lower side.

Lamina - shows a dorsiventral structure; epidermis single layered covered externally with striated cuticle; uniseriate covering trichomes and paracytic stomata present on both surfaces; mesophyll composed of single layered palisade cells and 3-4 layered spongy tissue; in margin of leaf mesophyll replaced by thick-walled cells; veins usually surrounded by bundle sheath, larger veins transcurrent and smaller ones embedded; vein islet number 5-10 per sq. mm., palisade ratio 6.75-14.2. .

Powder - Dark green; shows fragments of cork cells, palisade cells, raphides of calcium oxalate, oil globules and starch grains.

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 6 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 9 per cent, Appendix 2.2.7.

CONSTITUENTS - Alkaloids, Volatile Oil.

PROPERTIES AND ACTION -

Rasa	: Tikta
Guṇa	: Guru, Sara
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Vrsya, Balakṛt, Sandhāṅkṛt

IMPORTANT FORMULATIONS - Prasāriṇī Taila, Dasāmūlāriṣṭa.

THERAPEUTIC USES - Vātaroga, Vātarakta.

DOSE - 2-4 g. of drug in powder form.

PRIYĀLA (Seed)

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

SYNONYMS -

<i>Sansk.</i>	: Piyālaka, Bahulavalkala
<i>Assam.</i>	: --
<i>Beng.</i>	: Chirangi, Chowl, Satdhan
<i>Eng.</i>	: --
<i>Guj.</i>	: Charal, Shalichokha
<i>Hindi.</i>	: Piyal, Piyar, Chiraungi
<i>Kan.</i>	: Nurlaal
<i>Kash.</i>	: --
<i>Mal.</i>	: Mural, Priyalam, Mural maram
<i>Mar.</i>	: Charoli
<i>Ori.</i>	: --
<i>Punj.</i>	: --
<i>Tam.</i>	: Muolaima, Korka, Saraparuppu
<i>Tel.</i>	: Sara, Sarapappu
<i>Urdu.</i>	: Chironji

DESCRIPTION -

a) Macroscopic :

Seed laterally much compressed, creamish-brown, mottled with darker brown lines, 0.4-0.6 cm long, 0.3-0.5 cm wide, occasionally separate cotyledons also occur, funicle stout, micropyle superior, linear, hilum present at the apex of round edge; slight pressure separates oily cotyledons; odour, pleasant; taste, sweetish-oily.

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 4 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 0.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 7 per cent, Appendix 2.2.7.

T.L.C. -

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

CONSTITUENTS - Albuminoids, Oil and Starch.

PROPERTIES AND ACTION -

Rasa : Madhura
Guṇa : Guru, Snigdha, Sara
Vīrya : Śīta
Vipāka : Madhura
Karma : Vātahara, Pittahara, Kaphakara, Sukrakara, Bhagnasādhaka, Śramahara, Br̥mhaṇa, Vṛṣya, Balya, Hṛdya, Āmavardhaka

IMPORTANT FORMULATIONS - Pūgakhanda, Priyāla Taila.

THERAPEUTIC USES - Raktapitta, Dāha, Kṣata, Kṣaya.

DOSE - 10 - 20 g. of the drug in powder form.

PRIYANGU (Inflorescence)

Priyangu consists of **dried inflorescence** of *Callicarpa macrophylla* Vahl. (Fam. Verbenaceae); an erect, 1.2- 2.4 m high shrub, found throughout North and East India ascending to 1800 m in the West Himalayas from Kashmir to Assam, and abundant in Bengal plains.

SYNONYMS -

Sansk. : Phalini, Vanitā
Assam. : Priyangu
Beng. : Priyangu
Eng. : --
Guj. : Lata Priyangu
Hindi. : Priyangu
Kan. : Priyangu, Gandhapriyangu
Kash. : --
Mal. : Njazhal
Mar. : Priyangu, Gavhala
Ori. : Priyangu
Punj. : Priyangu
Tam. : Gnazhal, Gnazalpoo
Tel. : Prakhanam, Prenkanamu
Urdu. : --

DESCRIPTION -

a) Macroscopic :

Inflorescence - Cymose, densely clothed with wooly hairs; 2.5-7.5 cm across, peduncle cylindrical, 1.5 - 3 mm in dia; densely hairy.

Flower - 0.5 cm long; brown, calyx, bell-shaped, 4 toothed covered with wooly hairs; corolla, brown, tubular, 4 lobbed spreading; stamens 4, equal in size, epipetalous, anther ovate, basifixed; filament very long, hairy; ovary 2-4 celled; style, long; stigma minutely capitate.

b) Microscopic :

Peduncle - Shows more or less wavy outline, epidermis single layered with stellate hairs; cortex composed of 10-18 layers of elliptical, thin-walled, parenchymatous cells, a few upper layers filled with reddish-brown contents; pericycle appears in the form of interrupted ring of pericyclic fibres; phloem composed of usual elements except phloem fibres; xylem consists of usual elements; vessels mostly solitary with spiral thickening; fibres aseptate.

Powder - Brown; shows abundant numbers of stellate hairs, spiral vessels, aseptate fibres, groups of thin-walled, elliptical, oval and round pollen grains with clear exine and yellowish 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 2 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 14 per cent, Appendix 2.2.7.

CONSTITUENTS - Glycosides, Terpenes, Phenolic compound, Resin and Saponin.

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṣāya
Guṇa	: Rūkṣa
Vīrya	: Śīta
Vipāka	: Kaṭu
Karma	: Vātahara, Pittahara, Rakta Prasādana, Daurgandhyahara, Purīṣasamgrahāṇīya, Mūtravirajāṇīya, Sandhāṇīya, Vranaropaṇa.

IMPORTANT FORMULATIONS - Khadirādi Gutikā (Mukharoga), Elādi Cūrṇa, Kanaka Taila, Kumkumādi Taila, Nīlikādyā Taila.

THERAPEUTIC USES - Dāha, Jvara, Rakta-pitta, Pakvātisāra, Svedādhikya.

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

ŚĀLĪ (Root)

Śālī consists of **dried root** of *Oryza sativa* Linn. (Fam. Poaceae); an annual herb, cultivated throughout India.

SYNONYMS -

<i>Sansk.</i>	: Dhānya, Vrihi, Nivara
<i>Assam.</i>	: --
<i>Beng.</i>	: Chaval, Dhana, Cala, Chawl, Sali, Dhan
<i>Eng.</i>	: Rice, Paddy
<i>Guj.</i>	: Bhata, Corava, Damgara, Coke, Shalichokha
<i>Hindi.</i>	: Chaval, Dhana
<i>Kan.</i>	: Bhatto, Nellu, Bhatta, Akki
<i>Kash.</i>	: --
<i>Mal.</i>	: Ari, Nellu,
<i>Mar.</i>	: Tandulamul, Dhanarmul, Bhata Chamul
<i>Ori.</i>	: --
<i>Punj.</i>	: Dhan, Jhona
<i>Tam.</i>	: Arishi, Nelver
<i>Tel.</i>	: Dhanyamu, Odalu, Biyyamu
<i>Urdu.</i>	: Chaval, Biranj

DESCRIPTION -

a) Macroscopic :

Root fibrous, thin, cylindrical, 5-15 cm in length and 0.05-0.1 cm thick with a few rootlets, soft, smooth; creamish-brown to greyish-brown.

b) Microscopic :

Root - Shows single layered epidermis consisting of thin-walled, rectangular cells with a few unicellular root hairs; exodermis 1-2 layered, composed of thick-walled, sclerenchymatous cells; cortex differentiated into three zones; outer 5-8 and inner 2-3 layered, both consisting of round to oval, parenchymatous cells with intercellular spaces; middle zone consisting of radially elongated, parenchymatous cells having very large air-spaces; endodermis and pericycle both single layered; xylem and phloem form equal number of bundles arranged alternately with each other; centre occupied by a small pith composed of polygonal, thick-walled, sclerenchymatous cells.

Powder - Greyish-cream; shows groups of sclerenchymatous cells, pitted vessels and prismatic crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 5 per cent, Appendix 2.2.2.
Total ash	-	Not more than 21 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 16 per cent, Appendix 2.2.4.
Water-soluble extractive	-	Not less than 3 per cent, Appendix 2.2.7.

CONSTITUENTS – Sugars.

PROPERTIES AND ACTION -

Rasa	: Madhura, Kaṣāya
Guṇa	: Snigdha, Guru, Laghu
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittahara, Kaphahara, Śukrala, Baddhālpavarcasa, Br̥mhaṇa, Mūtrala, Balya, Varṇakṛt, Svarya, Rucya, Cakṣuṣya, Ḥṛdya, Stanyajanana

IMPORTANT FORMULATIONS - Brāhma Rasāyana, Stanyajanana Kaṣāya Cūrṇa.

THERAPEUTIC USES - Stanyakṣaya, Mūtrakṛcchra.

DOSE - 50 g. of the drug for decoction.

ŚĀŅKHAPUṢĪ (Whole Plant)

Śāᅇkhapuṣᅇ consists of whole plant of *Convolvulus pluricaulis* Choisy (Fam. Convolvulaceae); a prostrate, sub-erect, spreading, hairy, perennial herb with a woody root stock, found throughout the country.

SYNONYMS -

- Sansk.* : Śāᅇkhapuṣᅇ, Śāᅇkhāhvā
Assam. : --
Beng. : Sankhapuspi
Eng. : --
Guj. : Shankhaveli
Hindi. : Shankhapushpi
Kan. : Bilikantisoppu, Shankhapushpi, Shankhauhi
Kash. : --
Mal. : --
Mar. : Shankhavela, Sankhahuli, Sankhapuspi
Ori. : Sankhapuspi
Punj. : Sankhapuspi, Ksirapuspi, Sankhahuli
Tam. : Sanghupushpam, Kakattam, Kakkanangudi, Karakhuratt
Tel. : Shankhapushpi
Urdu. : --

DESCRIPTION -

a) Macroscopic :

Root - Usually branched, cylindrical, ribbed having some rough stem nodules and small secondary roots, 1-5 cm long, 0.1-0.4 cm thick, yellowish-brown to light brown.

Stem - Slender, cylindrical, about 0.1 cm or less in thickness with clear hairy nodes and internodes; light green.

Leaf - Shortly petiolate, linear-lanceolate, acute, hairy on both surfaces; 0.5-2 cm long and 0.1-0.5 cm broad; light green.

Flower - White or pinkish; solitary or in pairs sessile or sub-sessile in the leaf axis; sepals narrowly, linear-lanceolate, sparsely hairy; corolla shortly discoid; stamen 5, free, epipetalous, alternate with the petals, inserted deep in the corolla tube; ovary superior and bicarpellary.

Fruit - Capsule, oblong globose with coriaceous, pale brown pericarp.

Seed - Brown; minutely puberulous.

b) Microscopic :

Root - Appears nearly circular in outline; cork composed of 10-15 layers of tangentially elongated, thick-walled cells; cortex composed of 6-10 layers of oval to elongated, elliptical, parenchymatous cells and yellowish-brown, tanniniferous, secretory cells present in this region; phloem composed of sieve elements, phloem parenchyma and phloem rays; xylem consisting of usual elements; vessels solitary or in groups of two with simple pits; fibres and tracheids aseptate and pitted; medullary rays 1-3 cells wide and multicellular in length; starch grains solitary or in groups, simple and composed of 2-3 components, round to oval in shape, measuring 3-8 μ in dia., present in cortex, phloem, xylem rays and parenchyma.

Stem - Shows single layered epidermis, covered with thick cuticle; at places unicellular hairs present; cortex differentiated in two zones, 2-3 upper collenchymatous and 1-2 lower parenchymatous layers, both having round to oval, elongated, thin-walled cells; endodermis single layered; pericycle present in the form of single strand of fibres; phloem a narrow zone, mostly composed of sieve elements and parenchyma; xylem consists of vessels, fibres and parenchyma; medullary rays and tracheids not distinct, vessels mostly solitary with spiral thickening; fibres aseptate having pointed ends and narrow lumen; strand of internal phloem present around the slightly lignified pith.

Leaf -

Midrib - appears convex in lower and concave in upper side; epidermis single layered, covered with thick cuticle; lower epidermis followed by 2-3 layers of chlorenchymatous cells; vascular bundle bicollateral, composed of usual elements of phloem and xylem; rest of tissue between chlorenchyma and vascular bundles composed of 4-5 layers of parenchymatous cells.

Lamina - shows epidermis on both surfaces covered with thick cuticle; hairs unicellular, present on both surfaces, palisade two layered, spongy parenchyma 4-5 layered; a few bicollateral vascular bundles present in spongy parenchyma; palisade ratio 6-9; vein islet number 21-25 per sq. mm., stomatal index in lower surface 17-20 and in upper surface, 13.8-17.0; stomatal number in lower surface 184-248, and in upper surface 202-238 per sq. mm.

Powder - Light yellowish-green; shows groups of vessels with spiral thickening and simple pits, fibres and tracheids, simple and compound starch grains, measuring 3 - 8 μ in dia., unicellular hairs, mesophyll cells and gives positive test for tannin.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 17 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 8 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 – Alkaloid.

PROPERTIES AND ACTION -

Rasa	:	Tikta, Kaṭu, Kaṣāya
Guṇa	:	Ṣara
Vīrya	:	Ṣīta
Vipāka	:	Kaṭu
Karma	:	Pittahara, Kaphahara, Rasāyana, Medhya, Balya, Mohanāsaka, Āyuṣya

IMPORTANT FORMULATIONS - Agastyaharītakī, Rasāyana, Brāhma, Rasāyana, Brāhmī Ghr̥ta, Mānasmitra Vātaḥa, Gorocanādi Vāṭī, Brāhmī Vāṭī.

THERAPEUTIC USES - Mānasaroga, Apasmāra.

DOSE - 3-8 g. of the drug in powder form.

Note : In certain parts of India, *Clitoria ternatea* Linn. and *Evolvulus alsinoides* Linn. are used as 'Sankhapuṣpī'.

SAPTALĀ (Whole Plant)

Saptalā consists of **dried whole plant** of *Euphorbia dracunculoides* Lam. (Fam. Euphorbiaceae); a much branched, 20-40 cm high, annual herb, found throughout India in the plains and low hills.

SYNONYMS -

- Sansk.* : Sātalā, Carmasāhvā, Caramakaṣā
Assam. : --
Beng. : Chagalpupti
Eng. : --
Guj. : Satale
Hindi. : Titali, Joyachi, Chagulputputi
Kan. : Satala, Bilikalli, Kalli
Kash. : --
Mal. : Chasma Lantha, Pathiri
Mar. : Nivadung
Ori. : Naagapheni, Siju, Saptala
Punj. : Kangi
Tam. : Tillakada, Thusimullai
Tel. : Tillakada
Urdu. : Thuhar

DESCRIPTION -

a) Macroscopic :

Root - Small, 4-5 cm long, 0.5-2 mm thick, cylindrical, ribbed, gradually tapering, having a few secondary roots, pale brown; fracture, short; odour and taste indistinct.

Stem - Slender, glabrous, cylindrical, 1-3 mm thick, internode 1- 1.5 cm long, light yellow; fracture, short; odour and taste indistinct.

Leaf - 1.7-7 cm long, 0.2-0.8 cm wide, sessile, linear, lanceolate or linear oblong, sub-acute, base rarely rounded or sub-cordate; greenish-yellow; odour and taste not distinct.

Flower - Involucre broadly campanulate, sub-sessile, solitary, 2.5 mm across at the mouth, glabrous outside and pubescent inside, lobes short, ovate, ciliolate; gland semilunate, horned; filament pubescent; style, 1 mm long, free to the base, shortly 2-fid at the apex.

Fruit - Capsule, smooth; 3-4 mm in dia; trilocular, 3- celled with or without attached pedicel.

Seed - 3 mm long, ellipsoidal to oblong with a white, leprous tuberculate testa, rounded at the base, grooved at one side, with an arillode at the oblique depressed apex.

b) Microscopic :

Root - Young root shows exfoliated, single layered epidermis; mature root shows thin-walled cork, composed of 10-12 layers of rectangular cells; secondary cortex consists of 4- 6 layers of oval, elliptical, parenchymatous cells; oval to elongated elliptical thick-walled, lignified cells with wide lumen; groups of stone cells and a few fibres present in this region; endodermis and pericycle not distinct; secondary phloem composed of sieve elements and parenchyma; secondary xylem consists of vessels, fibres, tracheids and medullary rays; all elements thick-walled and lignified; fibres and vessels having simple pits; starch grains simple, rounded to oval, 2.75 μ in dia; found scattered in phloem region; rarely a few oil globules also present.

Stem - 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, rectangular, tangentially elongated and radially arranged cells; cortex composed of 4-5 layers of oval to rectangular, tangentially elongated, elliptical, thin-walled parenchymatous cells; stone cells oval to elongated, elliptical, thick-walled lignified, with wide lumen present in this region; endodermis not distinct; pericycle represented by groups of lignified fibres; secondary phloem narrow, composed of sieve elements, phloem parenchyma and a few elongated laticiferous sacs; secondary xylem composed of vessels, fibres and tracheids, traversed by numerous xylem rays; all elements, thick-walled and lignified, vessels having simple pits; fibres elongated and aseptate; centre occupied by a pith, consisting of thick-walled, circular to oval, parenchymatous cells; some rounded, small laticiferous sacs present in peripheral pith cells, filled with yellowish-brown content; starch grains more abundant in phloem and pith region, simple, solitary or in groups, rounded to oval, measuring 5.5-19.25 μ in diameter.

Leaf -

Midrib - shows slightly convex outline; epidermis single layered, covered externally with thick, striated cuticle; hypodermis consists of single layered collenchymatous cells towards lower side; vascular bundle collateral and surrounded by 4-6 layers of thin-walled, parenchymatous cells.

Lamina -shows slightly wavy outline; epidermis on either covered with thick cuticle; paracytic stomata present on both surfaces; mesophyll differentiated into palisade and spongy parenchyma; palisade single layered present on both sides; spongy parenchyma 4-5 layered consisting of irregularly arranged cells present between upper and lower palisade; a few small collateral vascular bundles embedded in spongy parenchyma.

Powder - Light yellow; shows vessels with simple pits, aseptate fibres; oval to elongated, elliptical, stone cells thick-walled, lignified with wide lumen; simple, rounded to oval starch grains, measuring 3-19 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 11 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 10 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform; Methanol (95:5) shows under U.V. (366 nm) two blue fluorescent zones at Rf. 0.04 and 0.67. On exposure to Iodine vapour three spots appear at Rf.0.04, 0.46, and 0.57 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 105°C two spots appear at Rf. 0.46 (brown) and 0.87 (violet).

CONSTITUENTS – Glyco-alkaloid (Euphorbine).

PROPERTIES AND ACTION -

Rasa	: Tikta, Kaṣāya
Guṇa	: Laghu, Rūkṣa, Tikṣṇa, Vikāṣī
Virya	: Śīta
Vipāka	: Katu
Karma	: Vātalā, Pittahara, Kaphahara, Raktadoṣahara, Viḍbhedinī

IMPORTANT FORMULATIONS - Brāhmī Ghṛta, Miśraka Sneha, Nārāyaṇa Cūrṇa.

THERAPEUTIC USES - Gulma, Udāvartta, Ānāha, Udararoga, Vibandha, Visarpa.

DOSE - 50 g. of the drug for decoction.

ŚATĀHVĀ (Fruit)

Śatāhvā consists of the **dried ripe fruits** of *Anethum sowa* Roxb. ex Flem. Syn. *A. graveolens* Linn. var. *sowa* Roxb.; *A. graveolens* DC.; *Peucedanum sowa* Roxb.; *P. graveolens* Benth. (Fam. Apiaceae); a tall, glabrous, aromatic herb found throughout tropical and sub-tropical regions of the country and cultivated.

SYNONYMS -

<i>Sansk.</i>	: Śatapuspā
<i>Assam.</i>	: --
<i>Beng.</i>	: Suva, Sulpha, Shulupa, Sowa
<i>Eng.</i>	: Indian Dil Fruit
<i>Guj.</i>	: Suva
<i>Hindi.</i>	: Soya, Sova
<i>Kan.</i>	: Sabasige
<i>Kash.</i>	: --
<i>Mal.</i>	: --
<i>Mar.</i>	: Badishep, Shepa, Shepu
<i>Ori.</i>	: --
<i>Punj.</i>	: Soya
<i>Tam.</i>	: Satakuppa
<i>Tel.</i>	: Sadapa
<i>Urdu.</i>	: Shibt, Soya

DESCRIPTION -

a) Macroscopic :

Fruits, dark brown, often stalk attached, broadly oval and compressed dorsally; mericarps usually separate and free, 4 mm long, 2-3 mm broad and 1 mm thick, glabrous, traversed from the base to apex by 5 lighter coloured primary ridges of which 3 dorsal, slightly raised, brown, filiform and inconspicuous, 2 lateral prolonged into thin, yellowish membranous wings; odour, faintly aromatic resembling that of caraway, and a warm, slightly sharp taste, akin to caraway.

b) Microscopic :

Fruit - Pericarp shows epidermis of polygonal tabular cells having thick outer wall and striated cuticle; mesocarp, parenchymatous, some cells lignified and show reticulate thickening; endocarp consists of tabular cells sometimes with sinuous anticlinal walls; vittae, 4 on the dorsal vallecule and 2 on the commissural surface, extending the length of each mericarp with an endothelium of brown cells and containing volatile oil; dorsal costae three, one larger and the two lateral broadly winged, each costae with vascular strands; endosperm much flattened and consists of thick-walled, cellulosic, parenchyma containing fixed oil and numerous

aleurone grains upto 5 μ in diameter containing micro-rosette crystals of calcium oxalate; carpophore split, passing at the apex into the raphe of each mericarp containing a vascular strand of sclerenchymatous fibres and spiral vessels.

Powder - Brown; shows spiral vessels, micro-rosette crystals of calcium oxalate and oil globules, aleurone grains upto 5 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	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 1.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 4 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 15 per cent, Appendix 2.2.7
Volatile Oil	-	Not less than 3 per cent, Appendix 2.2.10

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene shows on exposure to Iodine vapour two spots at Rf. 0.59 and 0.68 (all yellow). On spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate for about ten minutes at 110°C three spots appear at Rf. 0.37 (pink) 0.59 (blue) and 0.68 (violet).

CONSTITUTIONS – Essential Oil.

PROPERTIES AND ACTION –

Rasa	: Kaṭu, Tikta
Guṇa	: Snigdha
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Dīpana, Sūlaprasāmana

IMPORTANT FORMULATIONS - Br̥hat phala Ghr̥ta, Gorocanādi Vaṭi, Nārāyana Cūrṇa, Ṣaḍbindu Taila.

THERAPEUTIC USES - Jvara, Netra roga, Vraṇa, Sūla, Atisāra.

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

SIGRU (Leaf)

Sigru consists of **dried leaf** of *Moringa oleifera* Lam. Syn. *Moringa pterygosperma* Gaertn. (Fam. Moringaceae); a small or medium sized tree, found wild in sub-Himalayan tract, commonly cultivated throughout the country.

SYNONYMS -

- Sansk.* : Śobhāñjana, Bahala, Tīkṣṇagandhā, Akṣīva, Mocaka
Assam : --
Beng. : Sajina, Sajna, Sajne
Eng. : Horse Radish Tree, Drum Stick Tree
Guj. : Sargavo, Sekato, Saragavo Parna
Hindi. : Shajoma, Mungna
Kan. : Neegge, Nugge ele
Kash. : --
Mal. : Murinna, Tishnagandha, Muringa, Muringa Elai
Mar. : Sevaga, Segata, Segata pana, Shewgachi pane
Ori. : Sajana, Munga, Munika
Punj. : Sohanjana
Tam. : Murungai, Murungai Ilai
Tel. : Munaga Aku
Urdu. : Sehjan

DESCRIPTION -

a) Macroscopic :

Leaves tripinnate compound, available in the form of leaflets and some broken pieces of rachis, slender, thickened, and articulated at the base; leaflet 1.2-2 cm long and 0.5-1 cm wide, entire, elliptic, ovate or obovate, rounded or narrowed at base and obtuse at apex; smooth and greenish-grey to pale green; odour and taste not distinct.

b) Microscopic :

Rachis – Rachis shows single layered epidermis, followed by single layer of pigmented collenchymatous hypodermis; cortex consistig of 5-10 layered, oval to elliptical, thin-walled, parenchymatous cells; pericycle forming a broken ring, consisting of pericyclic fibres; vascular bundle collateral; pith composed of wide zone of thin-walled, parenchymatous cells; rosette crystals of calcium oxalate present in cortex, pith and phloem parenchyma.

Leaflet – Leaflet shows dorsiventral structure; epidermis and unicellular hairs present on both the surfaces; palisade single layered; spongy parenchyma 2-3 layers; central region occupied by a crescent-shaped, collateral vascular bundle surrounded by 2-4 layers of collenchymatous cells; rosette crystals of calcium oxalate present in mesophyll and collenchymatous cells; stomata anomocytic, present on both surface but more on lower sur-

face; palisade ratio 6-11; stomatal index 10-13-15 stomatal number 100-137 upper surface and 290-350 lower surface per mm square; vein islets number 50-65.

Powder –Greyish-green; shows groups of spongy parenchyma, palisade cells; spiral vessels, unicellular hairs with blunt tip; pieces of polyhedral epidermal cells in surface view, stomata and rosette crystals of calcium oxalate.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 16 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 8 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 22 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (9:1) shows six spots at Rf. 0.05, 0.18, 0.26 (all green), 0.36 (yellowish green), 0.46 (dark green) & 0.94 (yellow) in visible light. Under U.V. (366 nm) six fluorescent zones are visible at Rf. 0.05, 0.18, 0.26, 0.36, 0.46 (all red) & 0.94 (blue). On spraying with 5% Methanolic Phosphomolybdic acid reagent six spots appear on heating the plate for ten minutes at 105° C at Rf. 0.38, 0.46 (both blue), 0.52 (green), 0.59 (blue), 0.69 (blue) and 0.87 (blue). On spraying with Anisaldehyde-Sulphuric acid reagent ten spots appear on heating the plate for ten minutes at 105°C at Rf. 0.05, 0.20, 0.26, (all green), 0.30 (pink), 0.36 (green), 0.46 (green), 0.53 (yellow), 0.69 (yellow), 0.82 (yellow) and 0.94 (violet).

CONSTITUENTS – Carbohydrate, Protein, Carotene and Ascorbic acid.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guṇa	: Guru, Rūkṣa, Tikṣṇa
Vīrya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittahara, Medohara, Śukra nāśaka, Kṛmihara, Br̥nhana, Cakṣuṣya, Sirovirecaka

IMPORTANT FORMULATIONS - Viṣatinduka Taila, Ekāṅgavīra Rasa, Ratnagiri Rasa.

THERAPEUTIC USES - Śopha, Kṛmiroga, Medoroga, Pliharoga, Vidradhi, Gulma, Galaganda.

DOSE - 10 - 20 ml of the fresh drug in juice form.

STHŪLAILĀ (Seed)

Sthūlailā consists of **dried seed** of *Amomum subulatum* Roxb. (Fam. Zingibera-
ceae); a herb with leafy stem and perennial root stock; cultivated in swampy places along
the sides of mountain streams in Bengal and Assam.

SYNONYMS -

<i>Sansk.</i>	: Bhadrā, Bhadrailā
<i>Assam.</i>	: --
<i>Beng.</i>	: Baara aliach
<i>Eng.</i>	: Greater or Nepal cardamom
<i>Guj.</i>	: Elaicho, Mothi Elichi
<i>Hindi.</i>	: Bari elachi
<i>Kan.</i>	: Dodda Yalakki, Nepdi Elakki
<i>Kash.</i>	: --
<i>Mal.</i>	: Valiya Elam, Perelam
<i>Mar.</i>	: Mothi Elayachi
<i>Ori.</i>	: Bada aleicha, Aleicha
<i>Punj.</i>	: Budi Eleichi
<i>Tam.</i>	: Periya Elam, Beraelam, Kattu Elam
<i>Tel.</i>	: Pedda Elakulu
<i>Urdu.</i>	: Badi Elaichi, Heel Kalan

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Seed -Shows a very thin membraneous aril composed of several layers of collapsed cells
containing oil globules and prismatic crystals of calcium oxalate; testa consists of single
layered epidermis of rectangular cells followed by 1-2 layers of collapsed, thin-walled
parenchymatous cells, beneath this a single layered large rectangular cells containing oil
globules present, which is internally surrounded by several layers of flattened, thin-
walled, parenchymatous cells; perisperm consists of polygonal, thin-walled, paren-
chymatous cells containing round to oval starch grains measuring 2-5 μ in dia., and clus-
ter crystals of calcium oxalate; perisperm surrounded externally by thick-walled, scleren-
chymatous, radially elongated dark brown beaker cells; perisperm encloses the en-
dosperm and embryo, both composed of polygonal, thin-walled, parenchymatous cells,
rich in protein.

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

IDENTITY, PURITY AND STRENGTH -

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

CONSTITUENTS – Volatile Oil (rich in Cineole).

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta
Guṇa	: Laghu, Rūkṣa, Tikṣṇa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Rocaka, Dīpanī, Mukhaśodhaka, Angamardaprasāmana

IMPORTANT FORMULATIONS - Sārivadyāsava, Karpūrādyārka, Kalyāṇaka Ghṛta, Vastyamayāntaka Ghṛta, Mānasamitra Vāṭaka.

THERAPEUTIC USES - Svāsa, Kāsa, Trṣṇā, Chardi, Mukharoga, Hṛllāsa, Kaṇḍu.

DOSE - 0.5 –1 g. of the drug in powder form.

Note - Cluster crystals of calcium oxalate are present in Sthūlaelā (*Amomum subulatum* Roxb. (Seed), while absent in Sūkṣmailā (*Elettaria cardamomum* Maton. (Seed).

TEJOVATĪ (Stem Bark)

Tejovati consists of dried stem bark of *Zanthoxylum armatum* DC. Syn. *Z. alatum* Roxb. (Fam. Rutaceae); an evergreen or sub-deciduous shrub or occasionally a small tree upto 6 m high, stem and branches, armed with long, sharp prickles, found in the hot valleys of the Himalayas from Jammu to Khasia hills at 600-1800 m and eastern ghats in Orissa and Andhra Pradesh at 1200 m, also sometimes planted for hedges in Assam.

SYNONYMS -

<i>Sansk.</i>	: Tejohva
<i>Assam.</i>	: --
<i>Beng.</i>	: Tejovati
<i>Eng.</i>	: --
<i>Guj.</i>	: Tejabala, Tejbal
<i>Hindi.</i>	: Tejbal
<i>Kan.</i>	: Tejapatri, Jimmi, Tumbura, Tumburudra, Tejovanti
<i>Kash.</i>	: --
<i>Mal.</i>	: Thumboonal, Thumbooni, Valiyavaluzhavam
<i>Mar.</i>	: Tejabal
<i>Ori.</i>	: Tejabala
<i>Punj.</i>	: Tejovati, Tejabal
<i>Tam.</i>	: Thejovathi
<i>Tel.</i>	: Tejoyathi
<i>Urdu.</i>	: Kabab-e-Khandan

DESCRIPTION -

a) Macroscopic :

Bark corky, channelled and single quilled with large marks of tubercular prickles; 0.1-0.2 cm thick, external surface pale brown, rough with numerous scattered patches of lenticels, rather deeply furrowed; internal surface smooth, light yellow to pale brown; fracture, short; odour, aromatic; taste, aromatic pungent.

b) Microscopic :

Stem Bark - Shows exfoliated cork interrupted by lenticels at some places; cork 15-20 layers of tabular, brownish, thick-walled cells; secondary cortex 10-20 layers of tangentially elongated or oval, thin-walled, parenchymatous cells; small groups of stone cells and some fibres found scattered in this region; secondary phloem consisting of sieve elements, parenchyma and fibres traversed by phloem rays; phloem fibres thick-walled, lignified, aseptate and arranged in tangential rows; stone cells found in tangential bands alternating with phloem fibres; a number of secretory cells found scattered throughout secondary phloem; phloem rays 1-2 cells wide and 10-15 cells high; secretory cells contain-

ing oily or resinous substances; prismatic crystals of calcium oxalate and simple starch grains found scattered in secondary cortex, phloem parenchyma and phloem rays; starch grains round and oval, measuring 2.75 - 13.75 μ in diameter.

Powder - Yellowish-brown; shows fragments of cork cells; aseptate fibres, stone cells, prismatic crystals of calcium oxalate, oil globules and starch grains, round and oval measuring 2.75 - 13.75 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 12 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 8.5 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 13 per cent, Appendix 2.2.7.

CONSTITUENTS – A bitter crystalline principle identical with Berberine, a Volatile Oil and Resin.

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta
Guṇa	: Rūkṣa
Vīrya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Dīpana, Pācana, Rucya, Medhya

IMPORTANT FORMULATIONS - Pancatikta Guggulu Ghr̥ta, Kālaka Cūr̥ma (Lepa).

THERAPEUTIC USES - Śvāsa, Kāsa, Mukharoga, Āmavāta, Aruci, Hikkā.

DOSE - 10-20 g. of the drug for decoction.

TULASĪ (Whole plant)

TulasĪ consists of **dried whole plant** of *Ocimum sanctum* Linn. (Fam. Lamiaceae); an erect, 30 – 60 cm high, much branched, annual herb, found throughout the country.

SYNONYMS -

Sansk. : Surasā, Kṛṣṇatulasī, Bana Tulasī
Assam. : Tulasī
Beng. : Tulasī
Eng. : Holy Basil
Guj. : Tulasī, Tulsi
Hindi. : Tulasī
Kan. : Tulasī, Shree Tulasī, Vishnu Tulasī
Kash. : --
Mal. : Tulasī, Tulaṣa
Mar. : Tulasā
Ori. : --
Punj. : Tulasī
Tam. : Tulasī, Thulasi, Thiru Theezai
Tel. : Tulasī
Urdu. : Raihan, Tulsi

DESCRIPTION –

a) Macroscopic:

Root - Thin, wiry, branched, hairy, soft, blackish-brown externally and pale violet internally.

Stem - Erect, herbaceous, woody, branched, hairy, subquadrangular, externally purplish-brown to black, internally cream coloured; fracture, fibrous in bark and short in xylem; odour, faintly aromatic.

Leaf - 2.5-5 cm long 1.6 - 3.2 cm wide, elliptic oblong, obtuse or acute, entire or serrate, pubescent on both sides; petiole thin, about 1.5 - 3 cm long hairy; odour, aromatic; taste, characteristic.

Flower - Purplish or crimson coloured, small in close whorls; bracts about 3 mm long and broad, pedicels longer than calyx, slender, pubescent; calyx ovoid or campanulate, 3-4 mm bilipped, upper lip broadly obovate or suborbicular, shortly apiculate, lower lip longer than upper having four mucronate teeth, lateral two short and central two largest; corolla about 4 mm long, pubescent; odour, aromatic; taste, pungent.

Fruit - A group of 4 nutlets, each with one seed, enclosed in an enlarged, membranous, veined calyx, nutlets sub-globose or broadly elliptic, slightly compressed, nearly smooth;

pale brown or reddish with small black marking at the place of attachment to the thalamus; odour, aromatic; taste, pungent.

Seed - Rounded to oval; brown, mucilaginous when soaked in water, 0.1 cm long, slightly notched at the base; no odour; taste, pungent, slightly mucilaginous.

b) Microscopic :

Root - Shows a single layered epidermis followed by cortex, consisting of seven or more layers of rectangular, round to oval polygonal, thin-walled, parenchymatous cells, filled with brown content, inner layers of cortex devoid of contents; phloem consisting of sieve elements, thin-walled, rectangular parenchyma cells and scattered groups of fibres, found scattered in phloem; xylem consists of vessels, tracheids, fibres and parenchyma; vessels pitted; fibre tracheides, long, pitted with pointed ends; fibres thick walled and with pointed ends.

Stem - Shows a single layered epidermis with uniseriate, multicellular covering trichomes having 5-6 cells, occasionally a few cells collapsed; cortex consists of 10 or more layers of thin-walled, rectangular, parenchymatous cells; phloem consists of sieve elements, thin-walled, rectangular parenchyma cells and fibres; fibres found scattered mostly throughout phloem, in groups and rarely in singles; xylem occupies major portion of stem consisting of vessels, tracheids fibres and parenchyma; vessels pitted; fibres with pointed ends; centre occupied by narrow pith consisting of round to oval, thin-walled, parenchymatous cells.

Leaf -

Petiole - shows somewhat cordate outline, consisting of single layered epidermis composed of thin-walled, oval cells having a number of covering and glandular trichomes; covering trichomes multicellular 1-8 celled long, rarely slightly reflexed at tip; glandular trichomes short, sessile with 1-2 celled stalk and 2-8 celled balloon-shaped head, measuring 22-27 in dia; epidermis followed by 1 or 2 layers and 2 or 3 layers of thin-walled, elongated, parenchyma cells towards upper and lower surfaces respectively; three vascular bundles situated centrally, middle one larger than other two; xylem surrounded by phloem.

Midrib - epidermis, trichomes and vascular bundles similar to those of petiole except cortical layers reduced towards apical region.

Lamina - epidermis and trichomes similar to those of petiole; both anomocytic and diacytic type of stomata present on both surfaces, slightly raised above the level of epidermis; palisade single layered followed by 4-6 layers of closely packed spongy parenchyma with chloroplast and oleo-resin; stomatal index 10-12-15 on upper surface and 14 - 15 - 16 on lower surface; palisade ratio 3.8; vein islet number 31 - 35.

Powder - Greenish; shows thin-walled, parenchymatous cells, a few containing reddish-brown contents, unicellular and multicellular trichomes either entire or in pieces; thin-

walled fibres, xylem vessels with pitted thickenings, fragments of epidermal cells in surface view having irregular shape, oil globules, rounded to oval, simple as well as compound starch grains having 2-5 components, measuring 3-17 μ in diameter.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 10 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 4 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 8 per cent, Appendix 2.2.7.

T.L.C. of Tulasi oil obtained by stem distillation is carried out on Silica gel 'g' plate using Toluene: Ethylacetate (93:7) Tulasi oil is diluted in chloroform-toluene (1:10). Eugenol to be applied as standard also diluted in 1:30 ratio and 10 μ l of each to be applied in band form. After running distance of 10 cm the plate is air drying for 15 minutes and than kept in the over for 2 to 5 minutes. On cooling spray, in thoroughly vanillin - Sulphuric acid reagent and heat the plate at 110°C for 5 - 1- minutes. Under observation. Record Rf. values of eugenol and caryophyllence. Eugenol (orange brown) approx. Rf. value 0.7, caryophyllence (reddish violet) runs to solvent front..

CONSTITUENTS - Essential Oil.

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta, Kaṣāya
Guna	: Tikṣna, Rūkṣa, Laghu
Virya	: Uṣṇa
Vipaka	: Kaṭu
Karma	: Pittavardhini, Vātahara, Kaphahara, Hṛdya, Dīpana, Rucya, Durgandhihara

IMPORTANT FORMULATIONS - Tribhuvanakīrti Rasa, Mukṭāpañcāmṛta Rasa, Mukṭādi Mahāñjana, Mānasamitra Vāṭaka.

THERAPEUTIC USES - Śvāsa, Kāsa, Hikkā, Chardi, Kṛmiroga, Pārsva Śūla, Kuṣṭha, Aśmari, Netraroga.

DOSE - 1-3 ml. of the drug in juice form.
1-2 g. of the drug in powder form (seed).

TULASĪ (Leaf)

Tulasī consists of dried leaf of *Ocimum sanctum* Linn. (Fam. Lamiaceae), an erect, 30-60 cm high, much branched annual herb, found throughout the country.

SYNONYMS -

Sansk. : Surasā, Kṛṣṇatulasī, Bana Tulasī

Assam. : Tulasī

Beng. : Tulasī

Eng. : Holy Basil, Sacred Basil

Guj. : Tulasī, Tulsi

Hindi. : Tulasī

Kan. : Tulasī

Kash. : --

Mal. : Tulasī

Mar. : Tulas

Ori. : --

Punj. : Tulasī

Tam. : Tulasī, Thulasī

Tel. : Tulasī

Urdu. : Raihan, Tulsi

DESCRIPTION -

a) Macroscopic :

Leaves 2.5-5 cm long, 1.6-3.2 cm wide, elliptic-oblong, obtuse or acute, entire or serrate, pubescent on both surfaces, petiolate, thin, petiole 1.5-3 cm long, hairy; odour, aromatic; taste, characteristic.

b) Microscopic :

Petiole - shows cordate outline, consisting of single layered epidermis composed of thin-walled, oval cells having a number of covering and glandular trichomes; covering trichomes multicellular, uniseriate 1-8 celled long, rarely slightly reflexed at tip; glandular trichomes short, sessile or with 1-2 celled stalk, and 2-8 celled, balloon-shaped head, enclosed in a cuticular bladder, measuring 22-27 μ dia., upper epidermis, followed by 3-4 layers of collenchymatous and 1-2 layers of parenchymatous cells; lower epidermis followed by 1-3 layers of collenchymatous and 2-3 layers of parenchymatous cells; three vascular bundles situated centrally, middle one larger than the other two, consisting of xylem and phloem.

Midrib - epidermis, trichomes and vascular bundles similar to those of petiole, except reduced in cortical layers towards apical region of midrib.

Lamina - epidermis and trichomes similar to those of petiole on both surfaces; stomata anomocytic and diacytic present on both surfaces and slightly raised above the level of epidermis; palisade single layered followed by 4-6 layers of closely packed spongy parenchyma with chloroplasts and oleo-resin; stomatal index 10-13-15 on upper surface and 14-15-16 on lower surface; palisade ratio 3.8; vein islet number 31-33.

Powder - Light-green; shows fragments of polygonal, less wavy walled epidermal cells in surface view, covering and glandular trichomes as a whole or in pieces, palisade and spongy parenchyma, anomocytic and diacytic stomata.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 19 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 13 per cent, Appendix 2.2.7.

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene : Ethylacetate (9:1) shows in visible light nine spots at Rf. 0.03 (dark green), 0.04, 0.08 (both green), 0.12 (light green), 0.21, 0.33 (both green) 0.45 (yellowish green), 0.85 & 0.93 (both light green). Under UV (366 nm) eight fluorescent zones appear at Rf. 0.04, 0.30, 0.33, 0.45, 0.83 (all pink) 0.85 (blue), 0.93 (pink) & 0.98 (blue). On exposure to Iodine vapour eleven spots appear at Rf. 0.04, 0.08, 0.12, 0.21, 0.33, 0.45, 0.54, 0.75, 0.83, 0.88 and 0.93 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate at 110° for ten minutes ten spots appear at Rf. 0.08 (violet), 0.12 (light violet), 0.21 (brown), 0.33 (violet), 0.45 (violet), 0.54 (blue), 0.75 (violet), 0.83 (blue), 0.93 (violet) and 0.98 (blue).

CONSTITUENTS - Essential Oil (Carvacrol, Caryophyllene, Nerol and Camphene etc.).

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta, Kaṣāya
Guṇa	: Laghu, Rūkṣa, Tīkṣṇa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Pittahara, Dīpanī, Hr̥dya, Kṛmighna

IMPORTANT FORMULATIONS - Mānasamitra Vaṭaka, Tribhuvana Kīrti Rasa, Mukta Pañcāmṛt Rasa, Mahājvarāṅkusā Rasa.

THERAPEUTIC USES - Śvāsa, Kāsa, Pratisyāya, Pārsvaśūla, Aruci, Hikkā, Kṛmiroga, Kuṣṭha.

DOSE - 2-3 g. of the drug in powder form.

VACĀ (Rhizome)

Vacā consists of **dried rhizome** of *Acorus calamus* Linn. (Fam. Araceae); a semi-aquatic herb, wild or cultivated throughout the country ascending upto 1800 m in the Himalayas.

SYNONYMS -

<i>Sansk.</i>	: Ugragandhā, Ugrā, Ṣaḍgranthā
<i>Assam.</i>	: --
<i>Beng.</i>	: --
<i>Eng.</i>	: The Sweet Flag
<i>Guj.</i>	: Ghoduvaj, Ghodvach
<i>Hindi.</i>	: Bach, Gora-bach
<i>Kan.</i>	: Baje, Narru Berua
<i>Kash.</i>	: --
<i>Mal.</i>	: Vayambu
<i>Mar.</i>	: Vaca, Vekhanda
<i>Ori.</i>	: --
<i>Punj.</i>	: Varch, Ghodavaca
<i>Tam.</i>	: Vasambu, Pillai maruntho
<i>Tel.</i>	: Vasa
<i>Urdu.</i>	: Waja-e-Turki

DESCRIPTION -

a) Macroscopic :

Drug occurs in simple or rarely with thumb-like branches at nodes; sub-cylindrical to slightly flattened, somewhat tortuous or rarely straight, cut pieces of 1-5 cm long, and 0.5-1.5 cm thick; upper side marked with alternately arranged, large, broadly triangular, transverse leaf scars which almost encircle the rhizome; at nodes leaf sheath mostly having an appearance present; lower side shows elevated tubercular spots of root scars; light-brown with reddish-tinge to pinkish externally, buff coloured internally; fracture, short; odour, aromatic; taste, pungent and bitter.

b) Microscopic :

Rhizome - Shows single layered epidermis; cortex composed of spherical to oblong, thin-walled cells of various sizes, cells towards periphery, smaller, somewhat collenchymatous, more or less closely arranged cells towards inner side, rounded and form a network of chains of single row of cells, enclosing large air spaces, fibro-vascular bundles and secretory cells having light yellowish-brown contents, present in this region; endodermis distinct; stele composed of round, parenchymatous cells enclosing large air spaces similar to those of cortex and several concentric vascular bundles arranged in a

ring towards endodermis, a few vascular bundles scattered in ground tissues; starch grains simple, spherical, measuring 3-6 μ in dia., present in cortex and ground tissue.

Powder - Buff coloured; shows fibres, reticulate, annular vessels and simple spherical starch grains, measuring 3-6 μ in diameter.

Observation of powder and its extracts on exposure under UV light :-

a. Powder as such : - Yellowish-cream

b. Extracts in

- i. Petroleum ether : No change
- ii. Chloroform : Light green
- iii. Methanol : Yellowish-green
- iv. Benzene : No change

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 1 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 9 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 16 per cent, Appendix 2.2.7.
Volatile oil	-	Not less than 2 per cent, Appendix 2.2.10

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel G⁺ plate using Toluene : Ethylacetate (9:1) shows two spots at Rf. 0.14 (violet) and 0.73 (violet) on spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 105°C.

CONSTITUENTS - Volatile Oil (principal constituents of the Volatile oil are Asamyl alcohol, Eugenol and Asarone), also contains a bitter principle Acorin (Glucoside), Starch and Tannin.

PROPERTIES AND ACTION -

Rasa	: Kaṭu, Tikta
Guṇa	: Laghu, Tikṣṇa
Virya	: Uṣṇa
Vipāka	: Kaṭu
Karma	: Vātahara, Kaphahara, Mala Mūtravisodhani, Dipani, Kanṭhya, Kṛmihara, Vāmak, Medhya

IMPORTANT FORMULATIONS - Vacādi Taila, Vacā Laśunādi Taila,
Sāraswata, Cūrṇa, Sāraswatā riṣṭa,
Mānasmitra Vaṭaka, Candra prabhā Vaṭi,
Khadirādi Vaṭi, Hinguvacādi Cūrṇa.

THERAPEUTIC USES - Apasmāra, Unmāda, Vibandha, Ādhmāna, Śūla, Karṇa srāva,
Kāsa, Śvāsa, Smṛti daurbalya.

DOSE - 60 -120 mgs of the drug in powder form.
1- 2 g. of the drug in powder form for inducing vomiting.

Note : Śodhana of 'VACĀ' is to be done before internal use.

VATSANĀBHA (Root)

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

SYNONYMS -

Sansk. : Amṛta, Viṣa Vajranāga, Sthāvaraviṣa, Vatsanāgaka
Assam. : Bish, Mithavish
Beng. : Kathavish
Eng. : Aconite
Guj. : Vachhanaag, Basanaag
Hindi. : Bisa, Meethabisha, Bachhnaag, Teliya Bish
Kan. : Basanalli, Vatsanabha, Vatsanabhi, Vachanaga
Kas : --
Mal. : Vatsanabhi
Mar. : Bachnaga
Ori. : Tahara, Mahura, Mithviṣa
Punj. : Mitha Viṣa, Mithatelia
Tam. : Vasanaavi, Vatsanabhi, Nabhi, Vasanabhi
Tel. : Vatsanaabhi, Naabhi
Urdu. : Bachnak, Mithatelia, Beesh, Atees

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

Root - Shows epidermis 1-3 layered, suberised, papillose on outside, primary cortex consisting of 8-10 layers of oval to tangentially elongated, thin-walled, parenchymatous cells, without or with a few intercellular spaces, a few rectangular or triangular stone cells in singles found scattered in this zone; primary cortex separated by distinct endodermis; inner bark parenchymatous, consisting of round to oval cells, containing a few groups of phloem strands, occupying more than half the radius; cambium having 6 - 10 angles; xylem vessels arranged almost in a ring, some scattered, often forming 'V' shaped ring, en-

closing xylem parenchyma in older portions; bundles compact often wedge-shaped having acute apex; xylem exarch, metaxylem vessels met in centre; starch grains simple measuring 6-18 μ in dia. and compound grains consisting of 2-5 components with hilum in centre, present in cortical cells, phloem parenchyma and xylem parenchyma.

Powder - Light grey; shows vessels, a few aseptate fibres, and numerous simple and compound starch grains having hilum in the centre, single grain measuring 6-18 μ in dia.

IDENTITY, PURITY AND STRENGTH -

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

T.L.C. -

T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Chloroform : Methanol (90:10) shows six spots at Rf. 0.10, 0.20, 0.39, 0.56, 0.74 and 0.96 (all yellow) on exposure to Iodine vapour. On spraying with Dragendorff reagent two spots appear at Rf. 0.39 and 0.96 (both orange).

CONSTITUENTS - Alkaloids.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guṇa	: Uṣṇa, Rūkṣa, Tīkṣṇa, Laghu, Vikāṣī Vyavāyī, Yogavāhī,
Virya	: Uṣṇa
Vipāka	: Madhura
Karma	: Tridoṣahara, Rasāyana, Svedala, Pittasantāpakāraka

IMPORTANT FORMULATIONS - Tribhuwanakirti Rasa, Sūtasékharā Rasa, Ānandabhairava Rasa, Vātavidhwansana Rasa, Mahāviṣāgarbha Taila.

THERAPEUTIC USES - Sannipāta, Vātakaphajvara, Vātaroga, Jvarātisāra, Kantharoga.

DOSE - 15 - 30 mgs of the drug in powder form.

Note : It is dangerous to exceed the normal dose.

VIDĀRĪ (Tuberous Root)

Vidāri consists of **sliced and dried pieces of tuberous root** of *Pueraria tuberosa* DC. (Fam. Fabaceae); a perennial climber with very large tuberous root, distributed nearly throughout the country except in very humid or very arid regions and ascending upto 1200 m.

SYNONYMS -

<i>Sansk.</i>	: Vidāri, Vidārikā, Bhumikuṣmāṇḍa
<i>Assam.</i>	: Bhedeleton, Bhuikumra
<i>Beng.</i>	: Vidari, Bhumikusmanda, Bhuinkumra
<i>Eng.</i>	: --
<i>Guj.</i>	: Vidarikanta, Bhonykoru, Eagio, Bhoikolu, Sakharvel
<i>Hindi.</i>	: Vidarikanda
<i>Kan.</i>	: Nelagumbala Gudde, Nelagumbala, Gumadi belli, Nelagumbula, Gumadigida
<i>Kash.</i>	: --
<i>Mal.</i>	: Mudakku
<i>Mar.</i>	: Bhuikohala, Ghodvel
<i>Ori.</i>	: Bhuiankakharu
<i>Punj.</i>	: --
<i>Tam.</i>	: Nilapooṣani
<i>Tel.</i>	: Nelagummuda, Darigummadi
<i>Urdu.</i>	: --

DESCRIPTION -

a) Macroscopic :

Drug available in the form of longitudinally sliced pieces of variable size; outer surface reddish-brown, smooth except for protuberances at some places; cut surface creamish-brown, starchy and somewhat porous; usually does not break, but pliable; taste, sweetish.

b) Microscopic :

Tuberous Root – Mature tuber shows 20-30 layers of cork consisting of rectangular, thin-walled, tangentially elongated and radially arranged cells filled with dark reddish-brown content except in a few inner layers; secondary cortex consists of 6-15 layers of circular, oval to rectangular and tangentially elongated, thin-walled cells, yellow band of 2-6 layers of compactly arranged stone cells present towards inner side of cortex; stone cells moderately thick-walled, varying in shape and size and having well marked striations and pits; a number of prismatic crystals of calcium oxalate found in parenchymatous cells, and also rarely in stone cells; secondary phloem consists of sieve elements and phloem parenchyma having a number of strands of phloem fibres and a few stone cells;

sieve elements somewhat collapsed in outer region forming tangential bands; phloem fibres much elongated, highly thickened, lignified with narrow lumen; a number of tanniferous ducts filled with brown content, distributed throughout this region; xylem forms whole of inner white spongy zone, consisting of several concentric rings of one or a few xylem vessels associated with a few xylem elements; vessels mostly drum-shaped having reticulate thickening; xylem rays multiseriate and well marked consisting of thin-walled, radially elongated cells, a few latex duct also present; plenty of starch grains mostly simple, somewhat round, angular to oval, having central hilum and striations, measuring 5.5 - 13.75 μ in dia. present in all parenchymatous cells.

Powder - Buff coloured; shows plenty of starch grains with central hilum and striations measuring 5.5 - 13.75 μ in dia., fragments of cork, prismatic crystals of calcium oxalate, a few xylem vessels with reticulate thickening and phloem fibres.

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2.
Total ash	-	Not more than 17 per cent, Appendix 2.2.3.
Acid-insoluble ash	-	Not more than 4.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	-	Not less than 4 per cent, Appendix 2.2.6.
Water-soluble extractive	-	Not less than 24 per cent, Appendix 2.2.7.

CONSTITUENTS – Gluconic and Malic acids.

PROPERTIES AND ACTION -

Rasa	: Madhura
Guna	: Śnigdha, Guru
Virya	: Śīta
Vipāka	: Madhura
Karma	: Vātahara, Pittahara, Stanyada, Sukrala, Mūtrala, Jivaniya, Rasāyana, Br̥hmaniya, Svarya, Var̥ṇya, Balya.

IMPORTANT FORMULATIONS - Vidāryādīkvātha Cūrṇa, Vidāryādi Ghr̥ta, Marma Guṭīkā, Manmathābhra Rasa, Pūgakhaṇḍa (Aparaḥ).

THERAPEUTIC USES - Dāha, Raktapitta, Angmarda, Daurbalya, Śoṣa.

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

YAVA (Fruit)

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

SYNONYMS -

Sansk. : -- Dhānyarāja, Tikṣṇasūka, Hayeṣṭā
Assam. : --
Beng. : Jau, Jav
Eng. : Barley
Guj. : Cheno, Jau
Hindi. : Jav
Kan. : --
Kash. : --
Mal. : Javegambu
Mar. : Yava, Java
Ori. : --
Punj. : Javo
Tam. : Barley
Tel. : Barlibiyam, Yava Dhanya
Urdu. : Jau

DESCRIPTION -

a) Macroscopic :

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

b) Microscopic :

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2 per cent, Appendix 2.2.2
Total ash	-	Not more than 4 per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 1.5 per cent, Appendix 2.2.4
Water-soluble ash	-	Not more than 4 per cent, Appendix 2.2.5
Alcohol-soluble extractive	-	Not less than 2.5 per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 5.5 per cent, Appendix 2.2.7

T.L.C. -

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

CONSTITUENTS - Starch, Sugars, Fats, Proteins (Albumin, Globulin, Prolamin and Glutelin) also contains Flavone Glycosides viz, Orientoside, Orientin, Vitexin etc.

PROPERTIES AND ACTION -

Rasa	: Kaṣāya, Madhura
Guṇa	: Rūkṣa, Guru, Picchila, Mrdu
Virya	: Śita
Vipāka	: Kaṭu
Karma	: Vātakṛt, Pittahara, Kaphahara, Medahara, Balya, Vṛṣya, Svarya, Varnya, Sthairyakara, Puriṣakṛt, Mūtrahara, Lekhana

IMPORTANT FORMULATIONS - Agastyaharītakī Rasāyana, Elādyā Modaka, Dādihika Ghṛta, Dhānvantara Ghṛta, Gandharvahasta Taila, Dhānvantara Taila, Bṛhatmāṣa Taila, Sarsapādi Pralepa, Kāyasthādyā Vartti.

THERAPEUTIC USE - Medoroga, Prameha, Trṣṇā, Urustambha, Kantharoga, Svāsa, Kāsa, Pinasa, Tvagrogā.

DOSE - 100 - 200 g. of the drug.

YAVĀSAKA (Whole Plant)

Yavāsaka consists of **dried whole plant** of *Alhagi pseudalhagi* (Bieb). Desv. (Fam. Fabaceae); a small thorny shrub, mostly found in arid and dry regions of Gujarat, Punjab, Uttar Pradesh and Rajasthan.

SYNONYMS -

Sansk. : Yavāsa, Yāsa, Yavāsaka
Assam. : Bhatuashak
Beng. : --
Eng. : Persian Manna Plant
Guj. : Javaso
Hindi. : Javasa
Kan. : Turuchana gida, Javasa, Neladangara, ballidurabi, Duralabha
Kash. : --
Mal. : Venkatithura, Valiya Kotithuva
Mar. : Dhamasa
Ori. : --
Punj. : --
Tam. : Punaikanjuri, Kanchori
Tel. : Chinnadoolagondi, Dhanvayasamu
Urdu. : Turanjabeen

DESCRIPTION -

a) Macroscopic :

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

Stem – Cylindrical, glabrous, slightly rough at basal region with slender; hard, sharp axillary spines upto 3.8 cm long; branched, terete, striate, glabrous, nearly 0.1-1 cm thick; yellowish-green to yellowish-brown.

Leaf – Simple, alternate, oblong, mucronate obtuse, drooping, opposite, extipulate, 0.5-1 cm long, 0.5-0.7 cm broad, elliptical, smooth or puberulous with very short petiole, stipules green; no taste and odour.

b) Microscopic :

Root – Shows 6-10 layers of tangentially elongated, radially arranged cork cells; cork cambium single layered, filled with reddish-brown contents; secondary cortex almost absent; phloem composed of sieve elements, phloem parenchyma and phloem fibres; some phloem parenchyma cells filled with tannin; xylem consists of vessels, tracheids, fibres parenchyma and xylem rays; vessels mostly solitary with simple pits; tracheids and fibres thick-walled, aseptate with bluntly pointed ends; medullary rays 1-4 cells wide, 3-45 cells

long; pith composed of a few thin-walled, angular, parenchymatous cells; starch grains simple, rounded to oval, 5.5-14.75 μ in dia. present throughout the region.

Stem – Shows a single layered epidermis covered externally with thick cuticle; cortex composed of 8-15 layers of oval, tangentially elongated cells, numerous tanniferous cells found scattered in this region; pericycle present in form of fibre groups; phloem composed of sieve elements, parenchyma and fibres; some parenchyma cells filled with tannin; xylem consists of vessels, tracheids, xylem fibres, xylem parenchyma and xylem rays; vessels solitary or in groups of 2-3 with simple pits; tracheids and fibres, a few with thick wall and simple pits; medullary rays 2-3 cells wide pith composed of rounded, thin-walled, parenchymatous cells, some cells filled with tannin.

Leaf –

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

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

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

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

IDENTITY, PURITY AND STRENGTH -

Foreign matter	-	Not more than 2	per cent, Appendix 2.2.2
Total ash	-	Not more than 13.5	per cent, Appendix 2.2.3
Acid-insoluble ash	-	Not more than 2.5	per cent, Appendix 2.2.4
Alcohol-soluble extractive	-	Not less than 2	per cent, Appendix 2.2.6
Water-soluble extractive	-	Not less than 10	per cent, Appendix 2.2.7

CONSTITUENTS – Sugars (Melizitose, Sucrose, Invert Sugars).

PROPERTIES AND ACTION -

Rasa : Madhura, Tikta, Kaṣāya
Guna : Laghu, Sara
Vīrya : Śīta
Vipāka : Madhura
Karma : Kaphahara, Pittahara, Dīpana, Balakṛt

IMPORTANT FORMULATIONS – Chinnodbhavādi Kvātha Cūrṇa,
Gandharvahastādi Kvātha Cūrṇa,
Bhārangyādi Kvātha Cūrṇa, Arimedādi Taila.

THERAPEUTIC USE – Tr̥ṣṇā, Chardi, Kāsa, Jwara, Vātarakta, Raktapitta, Visarpa.

DOSE – 20 – 50 g. of the drug in powder form for decoction.

APPENDIX-I

1.1. APPARATUS FOR TESTS AND ASSAYS

1.1.1 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.

1.1.2 Sieves

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

Sieves conform to the following specifications –

Approximate sieve number*	Nominal mesh aperture size mm	Tolerance average aperture size ± mm
4	4.0	0.13
6	2.8	0.09
8	2.0	0.07
10	1.7	0.06
12	1.4	0.05
16	1.0	0.03
--	µm	±µm
22	710	25
25	600	21
30	500	18
36	425	15
44	355	13
60	250	13(9.9) **
85	180	11(7.6)
100	150	9.4(6.6)
120	125	8.1(5.8)
150	106	7.4(5.2)
170	90	6.6(4.6)
200	75	6.1(4.1)
240	63	5.3(3.7)
300	53	4.8(3.4)
350	45	4.8(3.1)

* Sieve number is the number of meshes in a length of 2.24 cm in each transverse direction parallel to the wires.

** Figures in brackets refer to close tolerances, those without brackets relate to full tolerances.

1.1.3 Thermometers

Unless otherwise specified, thermometers suitable for pharmacopoeial tests conform to Indian Standard 4825-1968 and are 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.

1.1.4 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°. The 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	100
Subdivision, ml	0.05	0.05	0.1	0.1
Tolerance, ± ml	0.01	0.03	0.05	0.1

1.1.5 Weights and Balances

Pharmacopoeial tests and assays require the use of analytical balances that vary in capacity, sensitivity and reproducibility. The accuracy needed for 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 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 (Pharmakon = 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, Microscopical 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 pharmacognosistical evaluation.

As mentioned above each crude drug derived from the vegetable kingdom consists of a definite part of plant e.g., leaf, stem, fruit, seed, wood, bark, root etc. Morphological or Macroscopical details of the respective part are given by observing it with a naked eye or with the aid of a magnifying lens. In this description general conditions of the drug, size, shape, outer surface, inner surface etc are referred to. Drugs can be identified with the aid of the above, only if they are available in entire condition. Sensory or Organoleptic characters describe colour, odour, taste, consistency etc. The microscopic examination of different parts of the drug provides several diagnostic characters. In case of leaves, surface preparation and transverse section, preferably through midrib, are made and nature of epidermis, trichomes, stomata, arrangement of 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 clues 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 drugs samples are cleared by clearing agents, mostly 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 scleroids 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 Chromatography 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.

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 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 chloral hydrate 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

For microscopical examination of fruit and seed take the specimens or 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 stem 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 de-fatted and clarified as follows :

Place 0.5 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 Ruthenium Red and examine it under a low power microscope or under dissecting microscope. Mucilage appears as pinkish-red or yellow coloured masses.

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 in a test tube for 1-3 minutes. Soft pieces are then straightened with a scalpel so as to have an 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 derivatives are detected by treating with alkali solution (blood-red colour shows the presence of anthraquinone derivatives).

B. Cut materials

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

C. Powder

Prepare specimen for examination by placing a little amount of powder on a slide, add 1-2 drops of *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

For anatomical examination of entire roots and rhizomes 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 softened roots are straightened with the 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 *safranin* 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. For this, prepare specimen with water to measure the granule of starch with an ocular 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 *safranin solution* as mentioned above for barks.

4. **Fixed oil** –For fixed oil detection use Sudan IV, as mentioned above for fruits and seeds.

If required for tannin, anthraquinone derivatives, test as mentioned above.

B. Cut material

Make small pieces or scraping 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 scrapings for various chemicals as mentioned above.

C. Powder

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

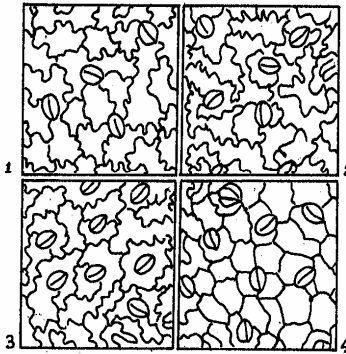


Fig. 1 Various types of stomata

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 *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 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 5 × 5 mm in size in a test-tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minutes or until the fragments become transparent. Transfer a fragment to a microscopical slide and prepare the mount of the upper epidermis 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 cell, dividing the count by 4; this is the "Palisade ratio" (See Fig. 2).

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

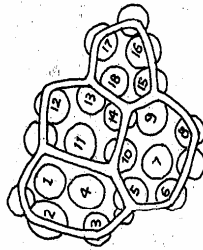


Fig. 2 Palisade ratio $\frac{18.4}{4} = 4.5$

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 millimeters from the central portion of the lamina and excluding the midrib and the margin of the leaf. Clear the pieces of lamina by heating in a test tube containing *chloral hydrate solution* on a boiling water-bath for 30 to 60 minutes or until clear and prepare a mount in *glycerol-solution* or, if desired, stain with *saffranin solution* and prepare the mount in *Canada Balsam*. Place the stage micrometer on the microscope stage and examine with 4x objective and a 6x eye piece. Draw a line representing 2 mm on a sheet of paper by means of a

microscopical drawing apparatus and construct a square on the line representing an area of 4 square millimeters. Move the paper so that the square is seen in the centre of the field of the eyepiece. Place the slide with the cleared leaf piece on the microscope stage and draw in the veins and 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 millimeters. For each sample of leaf make not fewer than three determinations and calculate the average number of vein-islets per square millimeter.

For Leaf Fragments having an area less than 4 square millimeters – Take fragments of leaf lamina each with an area of not less than 1 square millimeter, excluding the midrib and the margin of the leaf. Clear and prepare a mount as stated above. Use a 10x objective and a 6x eyepiece and draw a line representing 1 mm 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-islets in 1 square millimetre. For each sample of leaf make not less than 12 determinations and calculate the average number.

2.1.7 Determination of Stomatal Number

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 fragments 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 40 x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Mark on the drawing paper a cross (x) for each stomata and calculate the average number of stomata per square millimetre for each surface of the leaf.

2.2. DETERMINATION OF QUANTITATIVE DATA OF VEGETABLE DRUGS

2.2.1 – Sampling of Vegetable Drugs

Original Samples

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

When the total weight of the drug to be sampled is less than 100 Kg, at least 250 g 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 500 g 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 250 g; 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 125 g.

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.

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 constant weight. Calculate the percentage of acid-insoluble ash with reference to the air dried drug.

2.2.5. –Determination of Water Soluble Ash

Boil the ash for 5 minutes with 25 ml of water; collect insoluble matter in a Gooch crucible, or on an ashless filter paper, wash with hot water, and ignite for 15 minutes at a temperature not exceeding 450°.

Subtract the weight of the insoluble matter from the weight of the ash; the difference in weight represents the water-soluble ash. Calculate the percentage of water-soluble ash with reference to the air-dried drug.

2.2.6. –Determination of Alcohol Soluble Extractive

Macerate 5 g of the air dried drug, coarsely powdered, with 100 ml 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 25 ml of the filtrate to dryness in a tared flat bottomed shallow dish, and dry at 105°, to constant weight and weigh. Calculate the percentage of alcohol-soluble extractive with reference to the air-dried drug.

2.2.7. –Determination of Water Soluble Extractive

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

2.2.8. –Determination of Ether Soluble Extractive (Fixed Oil Content)

Transfer a 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. Calculate the percentage of ether-soluble extractive with reference to the air-dried drug.

2.2.9. –Determination of Moisture Content (Loss on Drying)

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

Place about 10 g of drug (without preliminary drying) after accurately weighing (accurately weighed to within 0.01 g) it in a tared evaporating dish. For example, for underground or unpowdered drug, prepare about 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° 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 weighings after drying for 30 minutes and cooling for 30 minutes in a desiccator, show not more than 0.01 g 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.

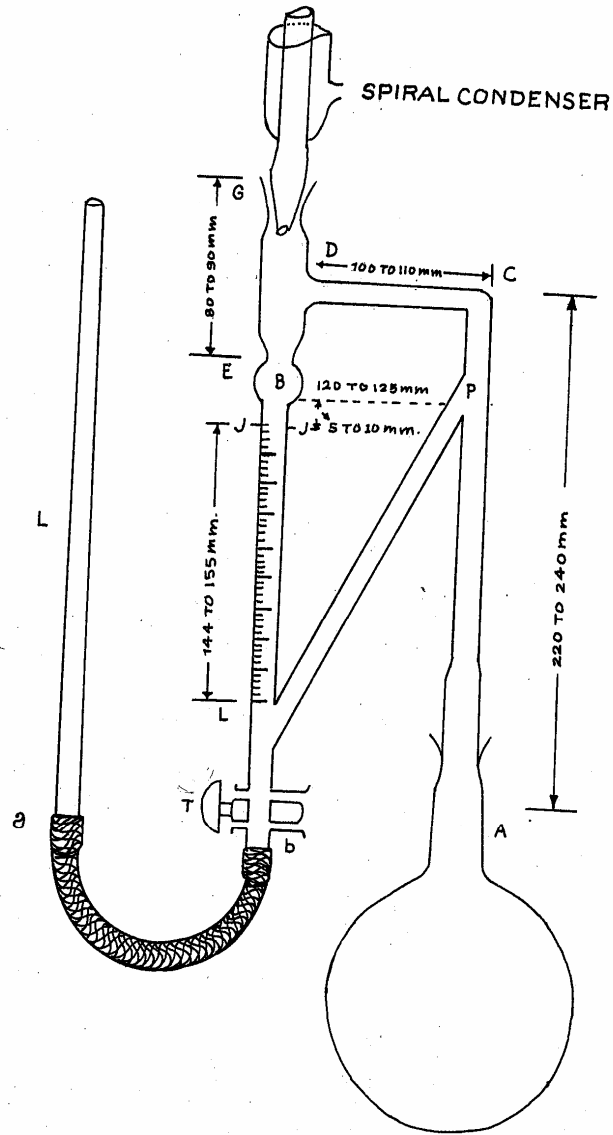


Fig. 3 Apparatus for volatile oil determination

- (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.

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

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

Tube EG, length –80 to 90 mm.

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 regulative tap.

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

The Whole of the apparatus is effectively screened from draught.

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

Method of determination

A suitable quantity of the coarsely powdered drug together with 75 ml of *glycerin* and 175 ml of *water* in the one litre distilling flask, and a few pieces of porous earthen ware and one filter paper 15 cm cut into small strips, 7 to 12 mm wide, are also put in the distilling flask, which is then connected to the still head. Before attaching the condenser, water is run into the graduated receiver, keeping the tap T open until the water overflows, at P. Any air bubbles in the rubber tubing a–b are carefully removed by pressing the tube. The tap is then closed and the condenser attached. The contents of the flask are now 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 (3 to 4 hours) heating is discontinued, the apparatus is allowed to cool for 10 minutes and the tap T is opened and the tube L₁ lowered slowly; as soon as the layer of the oil completely enters into the graduated part of the receiver the tap is closed and the volume is read.

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

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

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

2.2.11. –Special processes used in Alkaloidal Assays

2.2.11.a –CONTINUOUS EXTRACTION OF DRUG –

Where continuous extraction of a drug of 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 with a piece of calico or other suitable material. D is a glass coil, 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).

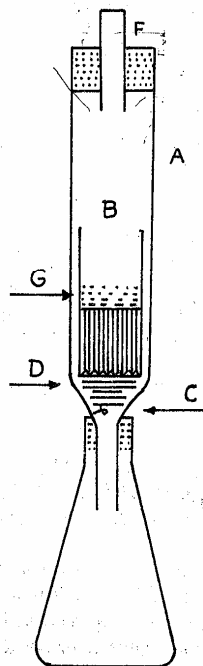


Fig. 4 Apparatus for the continuous extraction of Drugs

2.2.11.b –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* for solanaceous alkaloids 0.05 ml of *potassium iodobismuthate solution* or for emetine, 0.05 ml of *iodine solution*; not more than a very faint opalescence is produced.

2.2.12 Thin-Layer Chromatography (TLC)

Thin-layer chromatography is a technique in which a solute undergoes distribution between two phases, a stationary phase acting through adsorption and a mobile phase in the form of a liquid. The adsorbent is a relatively thin, uniform layer of dry finely powdered material applied to a glass, plastic or metal sheet or plate. Glass plates are most commonly used. Separation may also be achieved on the basis of partition or a combination of partition and adsorption, depending on the particular type of support, its preparation and its use with different solvent.

Identification can be effected by observation of spots of identical R_f value and about equal magnitude obtained, respectively, with an unknown and a reference sample chromatographed on the same plate. A visual comparison of the size and intensity of the spots usually serves for semi-quantitative estimation.

Apparatus

- (a) Flat glass plates of appropriate dimensions which allow the application at specified points of the necessary quantities of the solution being examined and appropriate reference solutions and which allow accommodation of the specified migration path-length. The plates are prepared as described below; alternatively, commercially prepared plates may be used.
- (b) An aligning tray or a flat surface on which the plates can be aligned and rested when the coating substance is applied.
- (c) The adsorbent or coating substance consisting of finely divided adsorbent materials, normally 5 μm to 40 μm in diameter, is suitable for chromatography. It can be applied directly to the plate or can be bonded to the plate by means of Plaster of Paris (Hydrated Calcium Sulphate) or with any other suitable binders. The adsorbent may contain fluorescing material to help in visualising spots that absorb ultra-violet light.
- (d) A spreader which, when moved over the glass plate, will apply a uniform layer of adsorbent of desired thickness over the entire surface of the plate.
- (e) A storage rack to support the plates during drying and transportation.
- (f) A developing chamber that can accommodate one or more plates and can be properly closed and sealed. The chamber is fitted with a plate support rack that supports the plates, back to back, with lid of the chamber in place.

- (g) Graduated micro-pipettes capable of delivering microlitre quantities say 10 μ l and less.
- (h) A reagent sprayer that will emit a fine spray and will not itself be attacked by the reagent.
- (i) An ultra-violet light, suitable for observation at short (254 nm) and long (365 nm) ultra-violet wavelengths.

Preparation of plates –Unless otherwise specified in the monograph, the plates are prepared in the following manner. Prepare a suspension of the coating substance in accordance with the instructions of the supplier and, using the spreading device designed for the purpose, spread a uniform layer of the suspension, 0.25 to 0.30 mm thick, on a flat glass plate 20 cm long. Allow the coated plates to dry in air, heat at 100° to 105° for at least 1 hour (except in the case of plates prepared with cellulose when heating for 10 minutes is normally sufficient) and allow to cool, protected from moisture. Store the plates protected from moisture and use within 3 days of preparation. At the time of use, dry the plates again, if necessary, as prescribed in the monographs.

Method

Unless unsaturated conditions are prescribed, prepare the tank by lining the walls with sheets of filter paper; pour into the tank, saturating the filter paper in the process, sufficient of the mobile phase to form a layer of solvent 5 to 10 mm deep, close the tank and allow to stand for 1 hour at room temperature. Remove a narrow strip of the coating substance, about 5 mm wide, from the vertical sides of the plate. Apply the solutions being examined in the form of circular spots about 2 to 6 mm in diameter, or in the form of bands (10 to 20 mm x 2 to 6 mm unless otherwise specified) on a line parallel with, and 20 mm from, one end of the plate, and not nearer than 20 mm to the sides; the spots should be 15 mm apart. If necessary, the solutions may be applied in portions, drying between applications. Mark the sides of the plate 15 cm, or the distance specified in the monograph, from the starting line. Allow the solvent to evaporate and place the plate in the tank, ensuring that it is as nearly vertical as possible and that the spots or bands are above the level of the mobile phase. Close the tank and allow to stand at room temperature, until the mobile phase has ascended to the marked line. Remove the plate and dry and visualise as directed in the monograph; where a spraying technique is prescribed it is essential that the reagent be evenly applied as a fine spray.

For two-dimensional chromatography dry the plate after the first development and carry out the second development in a direction perpendicular to the first.

When the method prescribed in the monograph specified 'protected from light' or 'in subdued light' it is intended that the entire procedure is carried out under these conditions.

Visualisation

The phrases *ultra-violet light (254 nm)* and *ultra-violet light (365 nm)* indicate that the plate should be examined under an ultra-violet light having a maximum output at about 254 or at about 365 nm, as the case may be.

The term *secondary spot* means any spot other than the principal spot. Similarly, a *secondary band* is any band other than the principal band.

Rf. Value

Measure and record the distance of each spot from the point of its application and calculate the Rf. value by dividing the distance travelled by the spots by the distance travelled by the front of the mobile phase.

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 narrow necked, round-bottomed flask until frothing ceases, cool, and apply the General Test; no visible stain is produced.

Arsenic solution, dilute, AsT :

<i>Strong Arsenic solution AsT</i>	1 ml
<i>Water</i> 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 :

<i>Arsenic trioxide</i>	0.132 g
<i>Hydrochloric acid</i>	50 ml
<i>Water</i> sufficient to produce	100 ml

Brominated hydrochloric acid AsT :

<i>Bromine solution AsT</i>	1 ml
<i>Hydrochloric acid AsT</i>	100 ml

Bromine solution AsT :

<i>Bromine</i>		30 g
<i>Potassium bromide</i>		30 g
<i>Water</i>	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.

Citric 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 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 2 ml of *water*, and again heat until white fumes are given off; cool, add 50 ml of *water* and 10 ml of *stannated hydrochloric acid AsT*, and apply the General Test; no visible stain is produced.

Potassium chlorate AsT : *Potassium chlorate* which complies with the following additional test :

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

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

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

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

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

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

Stannated hydrochloric acid AsT :

Stannous chloride solution AsT

1ml

Hydrochloric Acid AsT

100 ml

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

It complies with the following test :

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

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

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

Zinc AsT : *Granulated zinc* which complies with following additional test :

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

General Method of Testing – By a variable method of procedure suitable to the particular needs of each substance, a solution is prepared from the substance being examined which may or may not contain that substance, 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 10 mm when the tube has a rounded-off end, or so that the ground end of the tube is flush with the larger end of the bung. A piece of *mercuric chloride paper* is placed flat on the top of the bung and the other bung placed over it and secured by means of the rubber band or spring clip in such a manner that the borings of the two bungs (or the upper bung and the glass tube) meet to form a true tube 6.5 mm in diameter interrupted by a diaphragm of *mercuric chloride paper*.

Instead of this method of attaching the *mercuric chloride paper*, any other method may be used provided (1) that the whole of the evolved gas passes through the paper; (2) that the portion of the paper in contact with the gas is a circle 6.5 mm in diameter; and (3) that the paper is protected from sunlight during the test. The test solution prepared as specified, is placed in the wide-mouthed bottle, 1 g of *potassium iodide AsT* and 10 g of *zinc AsT* added, and the prepared glass tube is placed quickly in position. The action is allowed to proceed for 40 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 substance indicates that the proportion of arsenic is 1 part per million.

- NOTE – (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 evolution of the gas varies somewhat with different 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 50 ml of water, 10 ml of *stannated hydrochloric acid AsT* and quantities of *dilute arsenic solutions AsT* varying from 0.2 ml to 1 ml. The resulting solutions, when treated as described in the General Test, yield stains on the *mercuric chloride paper* referred to as the standard stains.

Preparation of the Test Solution

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

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

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

Ferrous sulphate – Dissolve 5 g in 10 ml of water and 15 ml of *stannated hydrochloric acid AsT* and distil 20 ml; to the distillate add a few drops of *bromine solution AsT*. Add 2 ml of *stannated hydrochloric acid AsT*, heat under a reflux condenser for one hour, cool, and add 10 ml of water and 10 ml of *hydrochloric acid AsT*.

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

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

Magnesium sulphate – Dissolve 5 g in 50 ml of water and add 10 ml of *stannated hydrochloric acid AsT*.

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

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

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

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

2.3.2 –Limit Test for Chlorides

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

Standard Opalescence

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

2.3.3 –Limit Test For Heavy Metals

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

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

Special Reagents –

Acetic acid Sp. – *Acetic acid* which complies with the following additional test : Make 25 ml alkaline with *dilute ammonia solution Sp.*, add 1 ml of *potassium cyanide solution Sp.*, dilute to 50 ml with *water* and add two drops of *sodium sulphide solution*; no darkening is produced.

Dilute acetic acid Sp. – *Dilute acetic acid* which complies with the following additional test – Evaporate 20 ml in a porcelain dish, nearly to dryness on a water-bath. Add to the residue 2 ml of the acid and dilute with *water* to 25 ml, add 10 ml of *hydrogen sulphide solution*. Any dark colour produced is not more than that of a control solution consisting of 2 ml of the acid and 4.0 ml of *standard lead solution* diluted to 25 ml with *water*.

Ammonia solution Sp. – *Strong ammonia solution* which complies with the following additional test : Evaporate 10 ml to dryness on a water-bath; to the residue add 1 ml of *dilute hydrochloric acid Sp.* and evaporate to dryness. Dissolve the residue in 2 ml of dilute acetic acid Sp. Add sufficient *water* to produce 25 ml.

Add 10 ml of *hydrogen sulphide solution*. Any darkening produced is not greater than in a blank solution containing 2 ml 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 20 ml add 1 ml of *potassium cyanide solution Sp.*, dilute to 50 ml with *water*, and add two drops of *sodium sulphide solution*; no darkening is produced.

Hydrochloric acid – *Hydrochloric acid* which complies with the following additional test : Evaporate off the acid in a beaker to dryness on a water-bath. Dissolve the residue in 2 ml of *dilute acid Sp.*, dilute to 17 ml with *water* and add 10 ml of *hydrogen sulphide solution*; any darkening produced is not greater than in a blank solution containing 2.0 ml of *standard lead solution*, 2 ml of *dilute acetic acid Sp.* and dilute to 40 ml with *water*.

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

Lead nitrate stock solution – Dissolve 0.1598 g of *lead nitrate* in 100 ml of *water* to which has been added 1 ml of *nitric acid*, then dilute with *water* to 1000 ml.

This solution must be prepared and stored in polyethylene or glass containers free from soluble lead salts.

Standard lead solution – On the day of use, dilute 10.0 ml of *lead nitrate stock solution* with *water* to 100.0 ml. 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 1.0 g of the substance being tested, the equivalent of 20 parts per million of lead.

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

Potassium cyanide solution Sp. – See Appendix 2.3.5.

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

Method A

Standard solution – Into a 50 ml *Nessler cylinder*, pipette 2 ml of *standard lead solution* and 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 35 ml, and mix.

Test solution – Into a 50 ml *Nessler cylinder*, place 25 ml of the solution prepared for the test as directed in the individual monograph, or using the stated volume of acid when specified in the individual monograph, dissolve and dilute with *water* to 25 ml 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 10 ml of freshly prepared *hydrogen sulphide solution*, mix, dilute with *water* to 50 ml, allow to stand for five minutes, and view downwards over a white surface; the colour produced in the *test solution* is 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 individual monograph, add sufficient *sulphuric acid Sp.* to wet the sample, and ignite carefully at a low temperature until thoroughly charred. Add to the charred mass 2 ml of *nitric acid Sp.* and five drops of *sulphuric acid Sp.* and heat cautiously until white fumes are no longer evolved. Ignite, preferably in a muffle furnace, at 500° to 600° until the carbon is completely burnt off. Cool, add 4 ml of *hydrochloric acid Sp.*, cover, digest on a water bath for 15 minutes, uncover and slowly evaporate to dryness on a water-bath. Moisten the residue with one drop of *hydrochloric acid Sp.*, add 10 ml of hot water and digest for two minutes. Add *ammonia solution Sp.*, dropwise, until the solution is just alkaline to *litmus paper*, dilute with *water* to 25 ml and adjust with dilute acetic acid *Sp.* to a pH between 3.0 and 4.0. Filter if necessary, rinse the crucible and the filter with 10 ml of water, combine the filtrate and washings in a 50 ml *Nessler cylinder*, dilute with *water*, to about 35 ml, and mix. Procedure : Proceed as directed under Method A.

Method C

Standard solution – Into a 50 ml *Nessler cylinder*, pipette 2 ml of *standard lead solution*, add 5 ml of *dilute sodium hydroxide solution.*, dilute with *water* to 50 ml and mix.

Test solution – Into a 50 ml *Nessler cylinder*, place 25 ml of the solution prepared for the test as directed in the individual monograph; or, if not specified otherwise in the individual monograph, dissolve the specified quantity in a mixture of 20 ml of *water* and 5 ml of *dilute sodium hydroxide solution*. Dilute 50 ml with *water* and mix.

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

2.3.4. Limit Test For Iron

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

Method

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

Standard colour – Dilute 2.0 ml of *standard iron solution* with 40 ml of *water* in a *Nessler cylinder*. Add 2 ml of a 20 per cent w/v solution of *iron-free citric acid* 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.

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 2 g of *potassium cyanide* in 15 ml of *strong ammonia solution* and dilute with *water* to 100 ml.
- (2) **Ammonium citrate solution Sp.** – Dissolve 40 g of *citric acid* in 90 ml *water*. Add two drops of *phenol red solution* then add slowly *strong ammonia solution* until the solution acquires a reddish colour. Remove any lead present by extracting the solution with 20 ml quantities of *dithizone extraction solution* until the dithizone solution retains its orange-green colour.
- (3) **Dilute standard lead solution** – Dilute 10.0 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 *diphenylthiocarbazon*e 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 20 g of *hydroxylamine hydrochloride* in sufficient *water* to produce about 65 ml. Transfer to separator, add five drops of *thymol blue solution*, add *strong ammonia solution* until the solution becomes yellow. Add 10 ml of a 4 per cent w/v solution of *sodium diethyldithiocarbamate* and allow to stand for five minutes. Extract with successive quantities, each of 10 ml, of *chloroform* until a 5 ml portion of the extract does not assume a yellow colour when shaken with dilute copper sulphate solution. Add *dilute hydrochloric acid* until the solution is pink and then dilute with sufficient *water* to produce 100 ml.
- (6) **Potassium cyanide solution Sp.** – Dissolve 50 g of *potassium cyanide* in sufficient *water* to produce 100 ml. Remove the lead from this solution by extraction with successive quantities, each of 20 ml of *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 10 g of *potassium cyanide* in each 100 ml.
- (7) **Standard dithizone solution** – Dissolve 10 ml of *diphenylthiocarbazon*e in 1000 ml of *chloroform*. Store the solution in a glass-stoppered, lead-free bottle, protected from light and in a refrigerator.
- (8) **Citrate-cyanide wash solution** – To 50 ml of *water* add 50 ml of *ammonium citrate solution Sp.* and 4 ml of *potassium cyanide solution Sp.*, mix, and adjust the pH, if necessary, with *strong ammonia solution* to 9.0.
- (9) **Buffer solution pH 2.5** – To 25.0 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 *diphenylthiocarbazon*e in 1000 ml of *carbon tetrachloride*. Prepare this solution fresh for each determination.
- (11) **pH 2.5 wash solution** – To 500 ml of a 1 per cent v/v *nitric acid* add *strong ammonia solution* until the pH of the mixture is 2.5, then add 10 ml of *buffer solution pH 2.5* and mix.
- (12) **Ammonia-cyanide wash solution** – To 35 ml of *pH 2.5 wash solution* add 4 ml of *ammonia-cyanide solution Sp.*, and mix.

Method

Transfer the volume of the prepared sample directed in the monograph to a separator, and unless otherwise directed in monograph, add 6 ml of *ammonium citrate solution Sp.*, and 2 ml *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 ammonia solution*. Cool the solution if necessary, and add 2 ml of *potassium cyanide solution Sp.* Immediately extract the solution with several quantities each of 5 ml, of *dithizone extraction solution*, draining off each extract into another separating funnel, until the dithizone extraction solution retains its green colour. Shake the combine dithizone solutions for 30 seconds with 30 ml of a 1 per cent w/v solution of *nitric acid* and discard the chloroform layer. Add to the solution exactly 5 ml of *standard dithizone solution* and 4 ml of *ammonia-cyanide solution Sp.* and shake for 30 seconds; the colour of the chloroform layer is of no deeper 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 2 g of the substance, accurately weighed, into the crucible, ignite gently at first, until the substance is thoroughly charred. Cool, moisten the residue with 1 ml of *sulphuric acid*, heat gently until white fumes are no longer evolved and ignite at $800^{\circ} \pm 25^{\circ}$ 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 15 ml of 0.5 M *barium chloride*, 55 ml of *water*, and 20 ml of *sulphate free alcohol*, add 5 ml of a 0.0181 per cent w/v solution of potassium sulphate, dilute to 100 ml with *water*, and mix. Barium sulphate reagent must be freshly prepared.

0.5 M Barium chloride – *Barium chloride* dissolved in *water* to contain in 1000 ml 122.1 g of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$.

Method

Dissolve the specified quantity of the substance in *water*, or prepare a solution as directed in the text, transfer to a *Nessler cylinder*, and add 2 ml of *dilute hydrochloric acid*, except where *hydrochloric acid* is used in the preparation of the solution. Dilute to 45 ml with *water*, add 5 ml of barium sulphate reagent. Stir immediately with a glass rod, and allow to stand for five minutes. The turbidity produced is not greater than the *standard turbidity*, when viewed transversely. *Standard turbidity* : Place 1.0 ml of 0.1089 per cent w/v solution of potassium sulphate and 2 ml of *dilute hydrochloric acid* in a *Nessler cylinder*, dilute to 45 ml with *water*, add 5 ml of barium sulphate reagent, stir immediately with a glass rod and allow to stand for five minutes.

APPENDIX -3

3.1 PHYSICAL TESTS AND DETERMINATIONS

3.1.1 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 μm 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.

NOTE – Avoid prolonged shaking that would result in increasing the fineness of the powder during the testing.

With oily or other powders which tend to clog the openings, carefully brush the screen at interval during siftings. Break up any lumps that may form. A mechanical sieve shaker which reproduces the circular and tapping motion given to sieves in hand sifting but has a uniform mechanical action may be employed.

3.1.2 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 $25^\circ(\pm 0.5)$ with reference to the wavelength of the D line of sodium ($\lambda = 589.3$ 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	$n_D^{20^\circ}$	Temperature Co-efficient $\Delta n/\Delta t$
Carbon tetrachloride	1.4603	-0.00057
Toluene	1.4969	-0.00056
α -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.

3.1.3 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. Calibrate 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. Subtract 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.

APPENDIX -4

4.1 REAGENTS AND SOLUTIONS

Acetic Acid – Contains approximately 33 per cent w/v of $C_2H_4O_2$. Dilute 315 ml of glacial acetic acid to 1000 ml with *water*.

Acetic Acid, x N – Solutions of any normality xN may be prepared by diluting 60x 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 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 *glycerin* and most fixed and volatile oils.

Boiling range – Between 117° and 119° .

Congealing temperature – Not lower than 14.8° .

Wt. per ml – At 25° about 1.047 g.

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 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 10 ml of *mercuric chloride solution* and make alkaline with *sodium hydroxide solution*, allow to stand for five minutes and acidify with dilute *sulphuric acid*; the solution does not show more than a faint turbidity.

Formic acid and oxidisable impurities – Dilute 5 ml with 10 ml of water, to 5 ml of this solution add 2.0 ml of 0.1 N potassium dichromate and 6 ml of sulphuric acid, and allow to stand for one minute, add 25 ml of water, cool to 15° , and add 1 ml of freshly prepared potassium iodide solution and titrate the liberated iodine with 0.1 N sodium thiosulphate, using starch solution as indicator. Not less than 1 ml of 0.1 N *sodium thiosulphate* is required.

Odorous impurities – Neutralise 1.5 ml with *sodium hydroxide solution*; the solution has no odour other than a faint acetous odour.

Readily oxidisable impurities – To 5 ml of the solution prepared for the test for Formic Acid and Oxidisable Impurities, add 20 ml of water and 0.5 ml of 0.1 N *potassium permanganate*; 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 50 ml of water and titrate with *N* sodium hydroxide, using phenolphthalein solution as indicator. Each ml of sodium hydroxide is equivalent to 0.06005 g of $C_2H_4O_2$.

Acetic Acid, Lead-Free – Acetic acid which complies with following additional test, boil 25 ml until the volume is reduced to about 15 ml, cool make alkaline with lead-free ammonia solution, add 1 ml of lead free potassium cyanide solution, dilute to 50 ml with water, add 2 drops of sodium sulphide solution; no darkening is produced.

Acetone – Propan 2-one; $(CH_3)_2CO = 58.08$

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°.

Acidity – 10 ml diluted with 10 ml of freshly boiled and cooled water; does not require for neutralisation more than 0.2 ml of 0.1 *N* sodium hydroxide, using phenolphthalein solution as indicator.

Alkalinity – 10 ml diluted with 10 ml of freshly boiled and cooled water, is not alkaline to litmus solution.

Methyl alcohol – Dilute 10 ml with water to 100 ml. To 1 ml of the solution add 1 ml of water and 2 ml of potassium permanganate and phosphoric acid solution. Allow to stand for ten minutes and add 2 ml of oxalic acid and sulphuric acid solution; to the colourless solution add 5 ml of decolorised magenta solution and set aside for thirty minutes between 15° and 30°; no colour is produced.

Oxidisable substances – To 20 ml add 0.1 ml of 0.1 *N* potassium permanganate, and allow to stand for fifteen minutes; the solution is not completely decolorised.

Water – Shake 10 ml with 40 ml of carbon disulphide; a clear solution is produced.

Non-volatile matter – When evaporated on a water-bath and dried to constant weight at 105°, leaves not more than 0.01 per cent w/v 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 per cent v/v and not more than 95.2 per cent v/v of C_2H_5OH at 15.56°.

Solubility – Miscible in all proportions with water, with chloroform and with solvent ether.

Acidity or alkalinity – To 20 ml add five drops of phenolphthalein solution; the solution remains colourless and requires not more than 2.0 ml of 0.1 *N* sodium hydroxide to produce a pink colour.

Specific gravity – Between 0.8084 and 0.8104 at 25°.

Clarity of solution – Dilute 5 ml to 100 ml with water in glass cylinder; the solution remains clear when examined against a black background. Cool to 10° for thirty minutes; the solution remains clear.

Methanol – To one drop add one 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 5 ml of freshly prepared *chromotropic acid* solution and heat on a water-bath at 60° for ten minutes; no violet colour is produced.

Foreign organic substances – Clean a glass-stoppered cylinder thoroughly with *hydrochloric acid*, rinse with water and finally rinse with the alcohol under examination. Put 20 ml in the cylinder, cool to about 15° and then add from a carefully cleaned pipette 0.1 ml 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 2 ml of water and 10 ml of *mercuric sulphate solution* and heat in a boiling water-bath; no precipitate is formed within three minutes.

Aldehydes and ketones – Heat 100 ml of *hydroxylamine hydrochloride solution* in a loosely stoppered flask on a water-bath for thirty minutes, cool, and if necessary, add sufficient 0.05 N *sodium hydroxide* to restore the green colour. To 50 ml of this solution add 25 ml 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 0.9 ml of 0.05 N *sodium hydroxide* is required.

Fusel oil constituents – Mix 10 ml with 5 ml of *water* and 1 ml of *glycerin* and allow the mixture to evaporate spontaneously from clean, odourless absorbent paper; no foreign odour is perceptible at any stage of the evaporation.

Non-volatile matter – Evaporate 40 ml in a tared dish on a water-bath and dry the residue at 105° for one hour; the weight of the residue does not exceed 1 mg.

Storage – Store in tightly-closed containers, away from fire.

Labelling – The label on the container states “Flammable”.

Dilute Alcohols : Alcohol diluted with water to produce dilute alcohols. They are prepared as described below :

Alcohol (90 per cent)

Dilute 947 ml of alcohol to 1000 ml with water.

Specific Gravity –At 15.56°/15.56°, 0.832 to 0.835.

Alcohol (80 per cent)

Dilute 842 ml of alcohol to 1000 ml with water.

Specific Gravity –At 15.56°/15.56°, 0.863 to 0.865,

Alcohol (60 per cent)

Dilute 623 ml of alcohol to 1000 ml with water.

Specific Gravity –At 15.56°/15.56°, 0.913 to 0.914,

Alcohol (50 per cent)

Dilute 526 ml of alcohol to 1000 ml with water

Specific Gravity –At 15.56°/15.56°, 0.934 to 0.935.

Alcohol (25 per cent)
Dilute 263 ml of alcohol to 1000 ml with water.
Specific Gravity –At 15.56°/15.56°, 0.9705 to 0.9713.

Alcohol (20 per cent)
Dilute 210 ml of alcohol to 1000 ml with water.
Specific Gravity –At 15.56°/15.56°, 0.975 to 0.976.

Alcohol, Aldehyde-free. –Alcohol which complies with the following additional test :

Aldehyde – To 25 ml, contained in 300 ml flask, add 75 ml of *dinitrophenyl hydrazine solution*, heat on a water bath under a reflux condenser for twenty four hours, remove the alcohol by distillation, dilute to 200 ml with a 2 per cent v/v solution of sulphuric acid, and set aside for twenty four hours; no crystals are produced.

Alcohol, Sulphate-free. –Shake alcohol with an excess of anion exchange resin for thirty minutes and filter.

Ammonia, xN. –Solutions of any normality xN may be prepared by diluting 75 x ml of strong ammonia solution to 1000 ml with water.

Ammonia-Ammonium Chloride Solution, Strong. –Dissolve 67.5 g of *ammonium chloride* in 710 ml of strong *ammonia solution* and add sufficient *water* to produce 1000 ml.

Ammonia Solution, Dilute. – Contains approximately 10 per cent w/w of NH₃.

Dilute 425 ml of *strong ammonia solution* to 1000 ml with *water*.

Wt. per ml – At 25°, about 0.960 g.

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 NH₃ (limit, 24.5 to 25.5). About 13.5 N 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.

Heavy metals –Evaporate 5 ml to dryness on a water-bath. To the residue, add 1 ml of *dilute hydrochloric acid* and evaporate to dryness. Dissolve the residue in 2 ml of *dilute acetic acid* and add *water* to make 25 ml; the limit of heavy metals is 15 parts per million, Appendix 2.3.3.

Iron –Evaporate 40 ml on a water-bath to about 10 ml. The solution complies with the *limit test for iron*, Appendix 2.3.4

Chloride –Evaporate 40 ml on a water-bath to about 5 ml. The solution complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate –Evaporate 20 ml on a water-bath to about 5 ml. The solution complies with *the limit test for sulphates*; Appendix 2.3.7.

Tarry matter – Dilute 5 ml with 10 ml of *water*, mix with 6 g of powdered *citric acid* in a small flask, and rotate until dissolved; no tarry or unpleasant odour is perceptible.

Non-volatile residue –Evaporate 50 ml to dryness in a tared porcelain dish and dry to constant weight at 105°, not more than 5 mg of residue remains.

Assay –Weigh accurately about 3 g in flask containing 50 ml of *N sulphuric acid* and titrate the excess of acid with *N sodium hydroxide*, using *methyl red solution* as indicator. Each ml of *N sulphuric acid* is equivalent to 0.01703 g of NH_3 .

Storage –Preserve strong Ammonia Solution in a well-closed container, in a cool place.

Ammonia Solution, Iron-free –Dilute ammonia solution which complies with the following additional test :-

Evaporate 5 ml nearly to dryness on a water-bath add 40 ml of *water*, 2 ml of 20 per cent w/v solution of *iron free citric acid* and 2 drops of *thioglycollic acid*, mix, make alkaline with *iron-free ammonia solution* and dilute to 50 ml with *water*, no pink colour is produced.

Ammonia Buffer pH 10.00 –Ammonia buffer solution. Dissolve 5.4 g of *ammonium chloride* in 70 ml of 5 *N ammonia* and dilute with *water* to 100 ml.

Ammonium Chloride – NH_4Cl = 53.49

Description – Colourless crystals or white crystalline powder; odourless; taste, saline.

Solubility – Freely soluble in *water*, sparingly soluble in alcohol.

Arsenic – Not more than 4 parts per million, Appendix 2.3.1.

Heavy metals –Not more than 10 parts per million, determined by method A, on 2.0 g dissolved in 25 ml of *water*, Appendix 2.3.3.

Barium – Dissolve 0.5 g in 10 ml of *water* and add 1 ml of *dilute sulphuric acid*; no turbidity is produced within two hours.

Sulphate – 2 g complies with the limit test for sulphates, Appendix 2.3.7

Thiocyanate – Acidify 10 ml 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 0.1 g, dissolve in 20 ml of *water* and add a mixture of 5 ml of *formaldehyde solution*, previously neutralised to *dilute phenolphthalein solution* and 20 ml of *water*. After two minutes, titrate slowly with 0.1 *N sodium hydroxide*, using a further 0.2 ml of *dilute phenolphthalein solution*. Each ml of 0.1 *N sodium hydroxide* is equivalent to 0.005349 g of NH_4Cl .

Ammonium Chloride Solution –A 10.0 per cent w/v solution of *ammonium chloride* in *water*.

Ammonium Citrate Solution –Dissolve with cooling, 500 g *citric acid* in a mixture of 200 ml of *water* and 200 ml of 13.5 M ammonia, filter and dilute with *water* to 1000 ml.

Ammonium Nitrate – $\text{NH}_4\text{NO}_3 = 80.04$

Description – Colourless crystals

Solubility – Freely soluble in water

Acidity – A solution in water is slightly acid to litmus *solution*.

Chloride – 3.5 g complies with the limit test for chloride, Appendix 2.3.2.

Sulphate – 5 g complies with the limit test for sulphates, Appendix 2.3.7.

Sulphated ash – Not more than 0.05 per cent, Appendix 2.3.6.

Ammonium Oxalate – $(\text{CO}_2\text{NH}_4)_2 \cdot \text{H}_2\text{O} = 142.11$.

Description – Colourless crystals

Solubility – Soluble in water

Chloride – 2 g, with an additional 20 ml of *dilute nitric acid*, complies with the limit test for chlorides, Appendix 2.3.2.

Sulphate – Dissolve 1 g in 50 ml of water, add 2.5 ml of hydrochloric acid and 1 ml of *barium chloride solution* and allow to stand for one hour; no turbidity or precipitate is produced.

Sulphated ash – Not more than 0.005 percent, Appendix 2.3.6.

Ammonium Oxalate Solution – A 2.5 per cent w/v solution of *ammonium oxalate* in water.

Ammonium Phosphate – $(\text{NH}_4)_2\text{HPO}_4$ –

Description – White crystals or granules.

Solubility – Very soluble in water; insoluble in alcohol.

Reaction – 1 g 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 – 2 g complies with the limit test for iron, Appendix 2.3.4.

Chloride – 2 g with an additional 3.5 ml of nitric acid complies with the limit test for chlorides, Appendix 2.3.2.

Sulphate – 2.5 g with an additional 4 ml of hydrochloric acid, complies with the limit test for sulphate, Appendix 2.3.2.

Ammonium Phosphate, Solution – A 10.0 per cent w/v solution of ammonium phosphate in water.

Ammonium Thiocyanate – $\text{NH}_4\text{SCN} = 76.12$.

Description – Colourless crystals.

Solubility – Very soluble in water, forming a clear solution, readily soluble in alcohol.

Chloride – Dissolve 1 g in 30 ml of solution of hydrogen peroxide, add 1 g of *sodium hydroxide*, warm gently, rotate the flask until a vigorous reaction commences and allow to stand until the reaction is complete; add a further 30 ml of *hydrogen peroxide solution* boil for two minutes, cool, and add 10 ml of *dilute nitric acid* and 1 ml of *silver nitrate solution*; any opalescence produced is not greater than that obtained by treating 0.2 ml of 0.01 *N hydrochloric acid* in the same manner.

Sulphated ash – Moisten 1 g with *sulphuric acid* and ignite gently, again moisten with sulphuric acid and ignite; the residue weighs not more than 2.0 mg.

Ammonium Thiocyanate, 0.1N – $\text{NH}_4\text{SCN} = 76.12$; 7.612 in 1000 ml. Dissolve about 8 g of *ammonium thiocyanate* in 1000 ml of water and standardise the solution as follows :

Pipette 30 ml of standardised 0.1 *N silver nitrate* into a glass stoppered flask, dilute with 50 ml of water then add 2 ml of *nitric acid* and 2 ml of *ferric ammonium sulphate solution* and titrate with the *ammonium thiocyanate solution* to the first appearance of a red brown colour. Each ml of 0.1N silver nitrate is equivalent to 0.007612 g of NH_4SCN .

Ammonium Thiocyanate Solution – A 10.0 per cent w/v solution of *ammonium thiocyanate solution*.

Anisaldehyde-Sulphuric Acid Reagent – 0.5 ml *anisaldehyde* is mixed with 10 ml *glacial acetic acid*, followed by 85 ml methanol and 5 ml concentrated *sulphuric acid* in that order.

The reagent has only limited stability and is no longer usable when the colour has turned to redviolet.

Arsenic Trioxide – $\text{As}_2\text{O}_3 = 197.82$. 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 0.50 g and dissolve in 10 ml 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 0.2 g and dissolve in 20 ml of boiling water and 5 ml of *N sodium hydroxide*, cool, and 5 ml of *N hydrochloric acid* and 3 g of *sodium bicarbonate*, and titrate with 0.1 *N iodine*. Each ml of 0.1N iodine is equivalent to 0.004946 g of As_2O_3 .

Barium Chloride - $\text{BaCl}_2, 2\text{H}_2\text{O} = 244.27$.

Description – Colourless crystals.

Solubility – Freely soluble in water.

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

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

Barium Chloride Solution – A 10.0 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, microcrystalline powder.

Solubility – Practically insoluble in *water*, in *alcohol*; freely soluble in *dilute nitric acid* and in *dilute hydrochloric acid*.

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

Borax -Sodium Tetraborate, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ = 381.37. Contains not less than 99.0 per cent and not more than the equivalent of 103.0 per cent of $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$.

Description – Transparent, colourless crystals, or a white, crystalline powder; odourless, taste, saline and alkaline. Effloresces 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 – 1g 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 $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$.

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 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_3BO_3 .

Storage –Store in well-closed containers.

Labelling –The label on the container states “Not for internal use”.

Boric Acid Solution –Dissolve 5 g of boric acid in a mixture of 20 ml 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, 1-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 0.1 g 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* has been added is bluish-violet. Not more than 0.20 ml of 0.02 M *hydrochloric acid* is required to change the colour to yellow.

Bromophenol Blue –4,4' –(3H-2, 1-Benzoxathiol-3-ylidene) bis-(2-6-dibromophenol) SS-dioxide $C_{19}H_{19}Br_2O_5S = 670$.

Gives a yellow colour in moderately acid solutions, and a bluish-violet colour in weakly acid and alkaline solutions (pH range, 2.8 to 4.6).

Bromophenol Blue Solution – Warm 0.1 g 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 *alcohol* (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 0.1N *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 0.05 N *sodium hydroxide* and 5 ml of alcohol (90 per cent); after solution is effected, add sufficient alcohol (20 per cent) to produce 250 ml.

Complies with the following test :

Sensitivity –A mixture to 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 – $CaCl_2 \cdot H_2O = 147.0$.

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 – $CaSO_4 \cdot 2H_2O = 172.17$.

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 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° .

Specific optical rotation – + 41° to + 43° , determined in a 10 per cent w/v solution of Natural Camphor in *alcohol*. 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 to *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°.

Wt. per ml – At 25°, about 1.263 g.

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 – $\text{CCl}_4 = 153.82$

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°.

Wt per ml – At 20°, 1.592 to 1.595 g.

Chloride, Free acid –Shake 20 ml 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 1 ml of *starch solution*, no blue colour is produced.

Oxidisable impurities –Shake 20 ml for five minutes with a cold mixture of 10 ml of *sulphuric acid* and 10 ml of 0.1 N *potassium dichromate*, dilute with 100 ml of water and add 3 g of *potassium iodide* : the liberated iodine 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 –

Dissolve 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 powder –Add 0.10 g to 50 ml of 0.006 per cent w/v solution of *bromophenol blue* in ethanol (20 per cent) contained in a 250 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 – $\text{CCl}_3\text{CH}(\text{OH})_2 = 165.40$.

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 mixture 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 solution of potassium chromate as indicator. Add two-fifteenths of the 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 $C_2H_3Cl_3O_2$.

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 – A 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 available chlorine by weight when heated to 100° for two hours (The available chlorine is determined by the Assay described below).

Assay – Weigh accurately about 4 g, triturate in a mortar with successive small quantities of water and transfer to a 1000 ml flask. Add sufficient water to produce 1000 ml and shake thoroughly. To 100 ml to 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 iodine with 0.1 N sodium thiosulphate. Each ml of 0.1 N sodium thiosulphate is equivalent to 0.003545 g of available chlorine.

Storage – Preserve in a well-closed container.

Chlorinated Lime Solution. – Mix 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.

Boiling range – A variable fraction, not exceeding 5 per cent v/v, distils below 60° and the remainder distils between 50° to 62°.

Acidity – Shake 10 ml with 20 ml of freshly boiled and cooled water for three minutes, and allow to separate. To a 5 ml portion of the aqueous layer add 0.1 ml of *litmus solution*; the colour produced is not different from that produced on adding 0.1 ml of *litmus solution* to 5 ml of freshly boiled and cooled water.

Chloride – To another 5 ml portion of the aqueous layer obtained in the test for Acidity, add 5 ml of water and 0.2 ml of *silver nitrate solution*; no 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 two drops of starch solution; no blue colour is produced.

Aldehyde – Shake 5 ml with 5 ml of water and 0.2 ml of *alkaline potassium mercuri-iodide solution* in a stoppered bottle and set aside in the dark for fifteen minutes; not more than a pale yellow colour is produced.

Decomposition products – Place 20 ml of the *chloroform* in a glass-stoppered flask, previously rinsed with *sulphuric acid*, add 15 ml of *sulphuric acid* and four drops of *formaldehyde solution*, and shake the mixture frequently during half an hour and set aside for further half an hour, the flask being protected from light during the test; the acid layer is not more than slightly coloured.

Foreign organic matter – Shake 20 ml with 10 ml of *sulphuric acid* in a stoppered vessel previously rinsed with *sulphuric acid* for five minutes and set aside in the dark for thirty minutes, both the acid and chloroform layers remain colourless. To 2 ml of the acid layer add 5 ml of water; the liquid remains colourless and clear, and has no unpleasant odour. Add a further 10 ml of water and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Foreign odour – Allow 10 ml to evaporate from a large piece of filter paper placed on a warm plate; no foreign odour 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 – CrO₃ = 99.99

Analytical reagent grade.

Chromotropic Acid – C₁₀H₈O₈S₂·2H₂O = 356.32

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

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

Sensitivity –Dilute exactly 0.5 ml *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 – $C_6H_8O_7 \cdot H_2O = 210.1$

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 – $Cu(C_2H_3O_2)_2 \cdot H_2O = 199.65$

Contains not less than 98.0 per cent of $C_4H_6O_4Cu \cdot H_2O$

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 *acetic acid* and 3 g of *potassium iodide*, and titrate the liberated iodine with 0.1 N *sodium thiosulphate*, using starch solution as indicator, until only a faint blue colour remains; add 2 g of *potassium thiocyanate* and continue the titration until the blue colour disappears. Each ml of 0.1 N *sodium thiosulphate* is equivalent to 0.01997 g of $C_4H_6O_4Cu \cdot H_2O$.

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

Copper Sulphate – $CuSO_4 \cdot 5H_2O = 249.68$

Contains not less than 98.5 per cent and not more than the equivalent of 101.0 per cent of $CuSO_4 \cdot 5H_2O$.

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 the 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 – $\text{CuSO}_4 = 159.6$

Prepared by heating copper sulphate to constant weight at about 230°.

Copper Sulphate Solution – A 10.0 per cent w/v solution of *copper sulphate* in water.

Catechol Violet – 4,4'-(3H-2, 1-Benzoxathiol-3-ylidene) diphycatechol SS-dioxide.

Gives a blue colour with bismuth ions in moderately acid solution. When metal ions are absent, for example, in the presence of an excess of *disodium ethylenediamine 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-ylidene) di-o-cresol SS-dioxide; $\text{C}_{12}\text{H}_{18}\text{O}_5\text{S} = 382.4$.

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 ml 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.

Sensitivity – A mixture of 0.1 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.15 ml of 0.02 M *sodium 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 – 4-Dimethyl aminoazobenzene; $\text{C}_{14}\text{H}_{15}\text{N}_3 = 225.3$

Gives a red colour in moderately acid alcoholic solutions, and a yellow colour in weakly acid and alkaline solution (pH range, 2.8 to 4.0).

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.

Dinitrophenylhydrazine – 2,4-Dinitrophenylhydrazine; $(\text{NO}_2)_2\text{C}_6\text{H}_3, \text{NH}, \text{NH}_2 = 198.14$.

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.

Sulphated ash –Not more than 0.5 per cent, Appendix 2.3.6.

Dinitrophenylhydrazine Solution –Dissolve 1.5 gm of *dinitrophenylhydrazine* in 20 ml of sulphuric acid (50 per cent v/v). Dilute to 100 ml with *water* and filter.

Dinitrophenylhydrazine solution must be freshly prepared.

Diphenylbenzidine $-(C_6H_5, NH, C_6H_4)_2 = 336.42$.

Description – White for faintly grey coloured, crystalline powder.

Melting range –246° to 250°.

Nitrate –Dissolve 8 mg in a cooled mixture of 45 ml of *nitrogen free sulphuric acid* and 5 ml of *water*; the solution is colourless or not more than very pale blue.

Sulphated ash –Not more than 0.1 per cent, Appendix 2.3.6.

Diphenylcarbazine –1,5-Diphenylcarbazine : $(C_6H_5NH, NH)_2 CO = 242.27$.

Description –White crystalline powder which gradually acquires a pink tint on exposure to air.

Solubility –Practically insoluble in *water*; soluble in alcohol.

Diphenylcarbazine Solution –A 0.2 per cent w/v solution of *diphenylcarbazine* in a mixture of 10 ml of glacial acetic acid and 90 ml of *alcohol (90 per cent)*.

Diphenylthiocarbazon –Dithizone : 1,5-Diphenylthiocarbazon; $C_6H_5N : NCS, NH, NH, C_6H_5 = 256.32$.

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 2.3.6.

Disodium Ethylenediamine tetraacetate –(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 – Acid Red 87; Tetrabromofluorescein disodium salt; $C_{20}H_6O_3Br_4Na_2 = 691.86$.

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, calculated with reference to the substance dried at 110° for two hours, Appendix 2.3.6.

Eosin Solution – A 0.5 per cent w/v solution of eosin in water.

Eriochrome Black T – Mordant Black 11; Sodium 2(1-hydroxy-2-naphthylazo) 5-nitro-2-naphthol-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 – $CH_3CO_2C_2H_5 = 88.11$.

Analytical reagent grade.

A colourless liquid with a fruity odour; boiling point, about 77° ; weight per ml about 0.90g.

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° and 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° .

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, $\text{Fe}(\text{NH}_4)(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O} = 482.18$

Contains not less than 99.0 per cent and not more than the equivalent of 101.0 per cent of $\text{Fe}(\text{NH}_4)(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$.

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

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

Ferrous iron –Dissolve 1 g in 50 ml of water, add 1 ml of dilute hydrochloric 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 $\text{Fe}(\text{NH}_4)(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$.

Ferric Ammonium Sulphate 0.1N – $\text{FeNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O} = 482.18$; 48.22 g 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 3 g of potassium iodide in 10 ml of water. Insert the stopper, allow to stand for ten minutes in the dark, then titrate the liberated iodine with standardised 0.1N 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 $\text{FeNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$.

NOTE –Store 0.1 N Ferric Ammonium Sulphate in tightly-closed, light resistant containers.

Ferric Chloride –Anhydrous Ferric Chloride; $\text{FeCl}_3 = 162.22$

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 – $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} = 278.0$

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.

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

Copper – Dissolve 2 g in 50 ml of water, acidify with 1 ml of dilute sulphuric acid, saturate with solution of hydrogen sulphide; no darkening or precipitate is produced.

Ferrous Sulphate 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; $\text{HCHO} = 30.03$

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.

Assay – Weigh accurately about 3 g and add to a mixture of 50 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 equivalent to 0.03003 g of CH_2O .

Storage – Preserve Formaldehyde Solution in 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 consistency; odourless, taste sweet followed by a sensation of warmth. It is hygroscopic.

Solubility – Miscible with water and with *alcohol*; practically insoluble in chloroform, in solvent ether and in fixed oils.

Acidity – To 50 ml of a 50 per cent w/v solution add 0.2 ml of *dilute phenolphthalein solution*; not more than 0.2 ml of 0.1 *N sodium hydroxide* is required to produce a pink colour.

Wt. per ml – Between 1.252 g and 1.257 g, 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°.

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

Copper – To 10 ml add 30 ml of *water*, and 1 ml of *dilute hydrochloric acid*, and 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 4 g 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 no 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 ml 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 – $(\text{CH}_2)_6\text{N}_4 = 140.2$

Analytical reagent grade.

Hydrazine Hydrate – $\text{NH}_2 \cdot \text{NH}_2 \cdot \text{H}_2\text{O} = 50.06$

Analytical reagent grade.

A colourless liquid with an ammoniacal odour; weight per ml. about 1.03 g.

Hydrochloric Acid – $\text{HCl} = 36.46$

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 add 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 *cadmium 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 0.03646 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 x 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 = 36.460

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, previously 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 0.5299 g of *anhydrous* sodium carbonate is equivalent to 1 ml of N hydrochloric acid.

Hydrochloric Acid, Iron-Free –Hydrochloric acid which complies with the following additional test. Evaporate 5 ml on a water-bath nearly to dryness, add 40 ml of water, 2 ml of a 20 per cent w/v solution of citric acid and two drops of thioglycollic acid, mix, make alkaline with *dilute ammonia solution*, and dilute to 50 ml with water; no pink colour is produced.

Hydrogen Peroxide Solution – (20 Vol.) H₂O₂ = 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 H₂O₂; weight per ml, about 1.02 g.

Hydrogen Sulphide – H₂S =34.08

Use laboratory cylinder grade, 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 H₂S.

Hydroxylamine Hydrochloride; Hydroxylammonium Chloride – NH₂OH, HCl = 69.49

Contains not less than 97.0 per cent w/w of NH₂OH, 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 the 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 dissolve 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 $\text{NH}_2\text{OH}, \text{HCl}$.

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** – $\text{C}_{16}\text{H}_8\text{N}_2\text{Na}_2\text{O}_8\text{S}_2 = 466.4$

Analytical reagent 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 – $\text{I}_2 = 253.8$

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 aqueous 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 I.

Storage – Store in glass-stoppered bottles or in glass or earthen-ware containers with well waxed bungs.

Iodine, 0.1N – $\text{I} = 126.90; 12.69 \text{ g in } 1000 \text{ ml}$.

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*, 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 – $\text{CH}_3\text{CH}(\text{OH})\text{COOH} = 90.08$

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; $(\text{CH}_3\text{CO}_2)_2\text{Pb}, 3\text{H}_2\text{O} = 379.33$

Contains not less than 99.5 per cent and not more than the equivalent of 104.5 per cent of $\text{C}_4\text{H}_6\text{O}_4\text{Pb}, 3\text{H}_2\text{O}$.

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*; a 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 dilute *sulphuric acid*, allow to stand for thirty minutes, and filter; to the filtrate add an excess of *potassium ferrocyanide solution*; no precipitate or colour is produced.

Assay –Weigh accurately about 0.8 g and dissolve in a mixture of 100 ml of *water* and 2 ml of *acetic acid*, add 5 g of hexamine, titrate with 0.05 M *disodium ethylenediaminetetraacetate*, using 0.2 ml of *xylene orange solution* as indicator, until the solution becomes pale bright yellow. Each ml of 0.05 M *disodium ethylenediaminetetraacetate* is equivalent to 0.01897 g of $\text{C}_4\text{H}_6\text{O}_4\text{Pb}, 3\text{H}_2\text{O}$.

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 – $\text{Pb}(\text{NO}_3)_2 = 331.21$

Contains not less than 99.0 per cent of $\text{Pb}(\text{NO}_3)_2$

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 $\text{Pb}(\text{NO}_3)_2$.

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.

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 colour 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 mixture of 45 parts of alcohol and 55 parts of water. After two days decant the clear liquid. Impregnate the strips of filter paper with the extract and allow to dry the paper; complies with the following test—

Sensitivity—Immerse a strip measuring 10 mm x 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.

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 x 60 mm in 100 ml of 0.002 *N sodium hydroxide*. On shaking the paper turns blue within forty-five minutes.

Magenta Basic—Fuchsin; Rosaniline hydro-chloride; $[(\text{H}_2\text{N} \cdot \text{C}_6\text{H}_4)_2\text{C} : \text{C}_6\text{H}_3(\text{CH}_3) : \text{NH}_2^+]\text{Cl}^- = 337.85$.

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 2.3.6.

Magenta Solution, Decolorised –Dissolve 1 g of basic *magenta* 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 2 M *hydrochloric acid* and 2 ml of 5 M *sodium hydroxide*.

Magnesium Sulphate – $\text{MgSO}_4 \cdot 7\text{H}_2\text{O} = 246.47$

Description –Colourless, crystals, usually needle-like; odourless, taste, cool, saline and bitter. Effloresces 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 10 ml of *strong ammonia-ammonium chloride solution*, and titrate with 0.05 M *disodium ethylenediaminetetraacetate* using 0.1 g of *mordant black II* mixture as indicator, until the pink colour is discharged from the blue. Each ml of 0.05 M *disodium ethylenediaminetetraacetate* is equivalent to 0.00602 g of MgSO_4 .

Storage –Store in well-closed containers.

Magnesium Sulphate, Dried, – MgSO₄

Dried, general reagent grade of commerce.

Magnesium Sulphate Solution, Ammoniacal – 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 – HgCl₂ = 271.50.

Contains not less than 99.5 per cent of HgCl₂;

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 completely re-dissolved, 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 HgCl₂.

Mercuric Chloride, 0.02 M –

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 Solution –

See Potassium-Mercuric Iodide solution.

Mercuric Sulphate – Mercury (II) Sulphate $\text{HgSO}_4 = 296.68$

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*, Appendix 2.3.2.

Nitrate – Dissolve 0.40 g in a mixture of 9 ml of *water* and 1 ml of *dilute sulphuric acid*, add 1 ml of indigo carmine solution and 10 ml of *nitrogen-free sulphuric acid* and heat to boiling, the blue colour is not entirely discharged.

Assay – Dissolve 0.6 g in a mixture of 10 ml of *dilute nitric acid* and 40 ml of *water*. Titrate with 0.1 *N ammonium thiocyanate*, using *ferric ammonium sulphate solution* as 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 : $\text{CH}_3\text{OH} = 32.04$.

Description – Clear, Colourless liquid with a characteristic odour.

Solubility – Miscible with water, forming a clear colourless liquid.

Specific Gravity – At 25°, not more than 0.791.

Distillation range – Not less than 95 per cent distils between 64.5° and 65.5°.

Refractive Index – At 20°, 1.328 to 1.329.

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 of *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 requirement.

Water –Not more than 0.1 per cent w/w.

Methylene Blue – $C_{16}H_{18}ClN_3S \cdot 3H_2O$. 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 0.1 g of methyl orange in 80 ml of *water* and dilute to 100 ml with alcohol.

Test for sensitivity –A mixture of 0.1 ml of the methyl orange solution and 100 ml 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 make 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 Mordant Black II 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° .

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 -naphthol solution must be prepared immediately before use.

1-Naphthylamine – $C_{10}H_9N = 143.2$ – 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 sulphuric 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.

Ninhydrin Reagent – 30 mg ninhydrin is dissolved in 10 ml n-butanol, followed by 0.3 ml of 98 % acetic acid.

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.

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 of complies with the limit test for iron, Appendix 2.3.4.

Lead – Not more than 2 parts per million, Appendix 2.3.5.

Chloride – 5 ml neutralised with dilute ammonia solution, complies with the limit test for chlorides, Appendix 2.3.2.

Sulphates –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 HNO₃.

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 HNO₃. Dilute 106 ml of nitric acid to 1000 ml with water.

2-Nitrobenzaldehyde –0-Nitrobenzaldehyde NO₂C₆H₄CHO =151.12.

Description –Yellow needles, odour, resembling that of benzaldehyde.

Solubility –Soluble in alcohol.

Melting range –40° to 45°.

Sulphated ash – Not more than 0.1 per cent, Appendix 2.3.6.

Oxalic Acid –(CO₂H)₂, 2H₂O =126.07.

Contains not less than 99.0 per cent of C₂H₂O₄, 2H₂O, as determined by the methods A and B under 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 2.3.6.

Assay –

(A) Weigh accurately about 3 g and dissolve in 50 ml of carbon dioxide free water and titrate with N sodium hydroxide, using phenolphthalein solution as indicator. Each ml of N sodium hydroxide is equivalent to 0.06304 of C₂H₂O₄, 2H₂O.

(B) Weigh accurately about 3 g, dissolve in water, and add sufficient water to produce 250 ml. To 25 ml of this solution add 5ml of sulphuric acid previously diluted with a little water, and titrate at a temperature of about 70° with 0.1N potassium permanganate. Each ml of 0.1 N *potassium permanganate* is equivalent to 0.006303 g of C₂H₂O₄, 2H₂O.

Oxalic Acid, 0.1 N – C₂H₂O₄, 2H₂O = 126.07, 6.303 g in 1000 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 of 0.1 *N potassium permanganate* is equivalent to 0.006303 g of $H_2C_2O_4 \cdot 2H_2O$.

Petroleum Light – Petroleum Spirit

Description –Colourless, very volatile, highly flammable liquid 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.

Light Petroleum –(Boiling range, 40° to 60°).

Wt. per ml –At 20°, 0.630 to 0.650 g.

Light Petroleum –(Boiling range, 60° to 80°).

Wt. per ml. –At 20°, 0.670 to 0.690.

Light Petroleum –(Boiling range, 80° to 100°).

Wt. per ml. –At 20°, 0.700 to 0.720

Light Petroleum –(Boiling range, 100° to 120°).

Wt. per ml –At 20°, 0.720 to 0.740 g.

Light Petroleum –(Boiling range, 120° to 160°).

Wt. per ml –At 20°, about 0.75 g.

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 scales, 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 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 0.1 *N sodium hydroxide*, and add 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 of 0.02 *N sodium hydroxide* is required to 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 0.10 g 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, $C_6H_3(OH)_3 \cdot 2H_2O$.

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°.

Sulphated ash – Not more than 0.1 per cent, Appendix 2.3.6.

Phloroglucinol should be kept protected from light.

Phloroglucinol Solution –A 1.0 per cent w/v solution of phloroglucinol in alcohol (90 per cent).

Phosphoric Acid – $H_3PO_4 = 98.00$.

(Orthophosphoric Acid; Concentrated Phosphoric Acid).

Description –Clear and colourless syrupy liquid, corrosive.

Solubility –Miscible with water and with alcohol.

Hypophosphorous and phosphorous acid – To 0.5 ml 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 2 ml of *alcohol*; no turbidity is produced.

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

Sulphate - 0.5 ml complies with the limit test for sulphate, Appendix 2.3.7.

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, x N may be prepared by diluting 49 x 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 - $C_4H_{10}N_2 \cdot 6H_2O = 194.2$.

General reagent grade of commerce.

Colourless, glossy, deliquescent crystals, melting point, about 44°.

Potassium Antimonate - $KSbO_3 \cdot 3H_2O = 262.90$.

Contains not less than 40.0 per cent of Sb.

Description - White, crystalline powder.

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

Assay - Weigh accurately about 0.3 g, and dissolve in 100 ml of *water*, add 2 ml of dilute *hydrochloric acid*, and pass in *hydrogen sulphide* until the *antimony* is completely precipitated. Add 2 ml of *hydrochloric acid* and again pass in *hydrogen sulphide*. Boil, filter, 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 car-*

bonate, 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; $\text{KHSO}_4 = 136.16$.

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 – $\text{KBrO}_3 = 167.00$

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 – $\text{KBr} = 119.0$

Analytical reagent grade.

Potassium Bromide, 0.001 N –

Dissolve 0.1190 g of *potassium bromide* in sufficient *water* to produce 1000 ml.

Potassium Carbonate –K₂CO₃ = 138.21

Contains not less than 98.0 per cent of K₂CO₃.

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 –1g, 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 K₂CO₃.

Potassium Carbonate, Anhydrous. –Potassium carbonate dried at 135° for two hours spread in a thin layer and then cooled in a desiccator.

Potassium Chlorate – KClO₃ =122.55

Contains not less than 99.0 per cent of KClO₃.

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*, dissolved in 10 ml of *water*, and then 20 ml of *nitric acid*; stopper the flask and allow to stand for ten minutes; and 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 KClO₃.

Potassium Chloride –KCl = 74.55

Analytical reagent grade

Potassium Chromate – K₂CrO₄ = 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 Tartrate 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 – K₂Cr₂O₇ =294.18.

Contains not less than 99.8 per cent of K₂Cr₂O₇

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 – $K_2Cr_2O_7 = 294.18$, 4.903 g in 1000 ml.

Weigh accurately 4.903 g of *potassium dichromate* 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 – $K_4Fe(CN)_6 \cdot 3H_2O = 422.39$

Contains not less than 99.0 per cent of $K_4Fe(CN)_6 \cdot 3H_2O$.

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 1g 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 $K_4Fe(CN)_6 \cdot 3H_2O$.

Potassium Ferrocyanide Solution –A 5.0 per cent w/v solution of *potassium ferrocyanide* in *water*.

Potassium Hydrogen Phthalate – $CO_2H \cdot C_6H_4 \cdot CO_2K = 204.22$.

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, 0.02 M –

Dissolve 4.084 g of *Potassium hydrogen phthalate* in sufficient *water* to produce 1000 ml.

Potassium Hydrogen Phthalate, 0.2 M –

Dissolve 40.84 g of *potassium hydrogen phthalate* in sufficient *water* to produce 1000 ml.

Potassium Hydroxide –Caustic Potash : KOH = 56.11

Contains not less than 85.0 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 antimonate 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, x N, 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 aqueous 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, 0.05 M – $KIO_3 = 214.0$; 10.70 g in 1000 ml

Weigh accurately 10.700 g of *potassium iodate*, 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, dissolve in about 10 ml of water and add 35 ml of hydrochloric acid and 5 ml of chloroform. Titrate with 0.05 M potassium iodate until the purple colour of iodine disappears from the chloroform. Add the last portion of the iodate solution drop-wise and agitate vigorously and con-

tinuously. 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 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 - $\text{KNO}_3 = 101.1$

Analytical reagent grade.

Potassium Permanganate - $\text{KMnO}_4 = 158.03$

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 – 158.03. 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_4 .

Potassium Tetraoxalate - $\text{KH}_3(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O} = 254.2$.

Analytical reagent grade of commerce.

Potassium Thiocyanate – $\text{KCNS} = 97.18$.

Analytical reagent grade.

Purified Water – $\text{H}_2\text{O} = 18.02$.

Description – Clear, colourless liquid, odourless, tasteless.

Purified water is prepared from potable water by distillation, ion-exchange treatment, reverse osmosis or any other suitable process. It contains no added substances.

pH – Between 4.5 and 7.0 determined in a solution prepared by adding 0.3 ml of a saturated solution of *potassium chloride* to 100 ml of the liquid being examined.

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 mercuric-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 mercuric-iodide solution* to a solution containing 2.5 ml of *dilute ammonium chloride solution (Nessler's)* 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 –1,3 diol; $C_6H_4(OH)_2 = 110.1$

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 – Basic red 2

Microscopical staining grade.

A reddish-brown powder.

Safranine Solution –

Saturated solution of *safranine* in *ethanol* (70 per cent.)

Sesame Oil –

Description – A pale yellow oil, odour, slight; taste, bland.

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.

Wt. Per ml – At 25°, 0.916 to 0.921 g.

Storage –Preserve sesame oil in 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 - $\text{AgNO}_3 = 169.87$

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 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 0.5 g and dissolve in 50 ml of *water*, add 2 ml of nitric acid, and titrate with 0.1 N ammonium thiocyanate, using ferric ammonium sulphate solution as indicator. Each ml of 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, 0.1 N - $\text{AgNO}_3 = 169.87$; 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 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 - $\text{NaHCO}_3 = 84.01$

Description - White, crystalline powder or small, opaque, monoclinic crystals; odourless; taste, saline.

Solubility - Freely soluble in *water*; practically insoluble in *alcohol*.

Carbonate - pH of a freshly prepared 5.0 per cent w/v solution in carbon dioxide-free water, not more than 8.6.

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 ($\text{Na}_2\text{S}_2\text{O}_3$) 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 0.2 g and transfer to a glass-stoppered flask, add 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 – $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O} = 286.2$.

Analytical reagent grade.

Sodium Chloride – $\text{NaCl} = 58.44$

Analytical reagent grade.

Sodium Cobaltinitrite – $\text{Na}_3\text{Co}(\text{NO}_2)_6 = 403.94$

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 2.3.1.

Heavy metals – Not more than 30 parts per million, determined by Method A, Appendix 2.3.3. on a solution prepared by dissolving 0.67 g in 5 ml of *water* and 7 ml of 3 N *hydrochloric acid*. Heat to boiling, cool and dilute to 25 ml with *water*.

Potassium – Acidify 5 ml of a 5 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 persistent pink colour is produced. Each ml of N *sulphuric acid* is equivalent to 0.040 g of total alkali calculated as NaOH and each ml of acid consumed in the titration with *methyl orange* is equivalent to 0.106 g of Na_2CO_3 .

Storage – Store in tightly closed containers.

Sodium Hydroxide, xN – Solutions of any normality, xN may be prepared by dissolving 40 x g of *sodium hydroxide* in water and diluting to 1000 ml.

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 – $\text{NaNO}_2 = 69.00$, Analytical reagent grade.

Sodium Nitroprusside – (Sodium penta cyano nitrosyl ferrate (iii) dihydrate; $\text{Na}_2[\text{Fe}(\text{CN})_5(\text{NO})] \cdot 2\text{H}_2\text{O}$ = 298.0

Analytical reagent grade of commerce.

Sodium Peroxide – $\text{Na}_2\text{O}_2 = 77.98$.

Analytical grade reagent.

Sodium Potassium Tartrate – Rochelle Salt $\text{COONa} \cdot \text{CH}(\text{OH}) \cdot \text{CH}(\text{OH}) \cdot \text{COOK} \cdot 4\text{H}_2\text{O} = 282.17$

Contains not less than 99.0 per cent and not more than the equivalent of 104.0 per cent of $\text{C}_4\text{H}_4\text{O}_6\text{KNa}$, $4\text{H}_2\text{O}$.

Description – Colourless crystals or a white, crystalline powder; odourless; taste saline and cooling. 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 test for iron*, Appendix 2.3.4.

Chloride – 0.5 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate – 0.5 g complies with the *limit test for sulphate*, 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 $\text{C}_4\text{H}_4\text{O}_6\text{KNa}$, $4\text{H}_2\text{O}$.

Sodium Sulphide – $\text{Na}_2\text{S} \cdot \text{aq}$.

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 – $\text{Na}_2\text{SO}_3 = 126.06$

Description –Small crystals or powder.

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

Sodium Thiosulphate – $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O} = 248.17$.

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

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

pH –Between 6.0 and 8.4, determined in a 10 per cent w/v solution.

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

Heavy metals –Not more than 20 parts per million, determined by Method A, Appendix 2.3.3. on a solution prepared in the following manner : Dissolve 1 g in 10 ml of *water*, slowly add 5 ml of *dilute hydrochloric acid* and evaporate the mixture to dryness on a water-bath. Gently boil the residue with 15 ml of *water* for two minutes, and filter. Heat the filtrate to boiling, and add *sufficient bromine solution* to the hot filtrate to produce a clear solution and add a slight excess of *bromine solution*. Boil the solution to expel the *bromine* completely, cool to room temperature, then add a drop of *phenolphthalein solution* and *sodium hydroxide solution* until a slight pink colour is produced. Add 2 ml of *dilute acetic acid* and dilute with *water* to 25 ml.

Calcium –Dissolve 1 g in 20 ml of *water*, and add a few ml of *ammonium oxalate solution*; no turbidity is produced.

Chloride –Dissolve 0.25 g in 15 ml of 2*N nitric acid* and boil gently for three to four minutes, cool and filter; the filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate and Sulphite –Dissolve 0.25 g in 10 ml of *water*, to 3 ml of this solution add 2 ml of *iodine solution*, and gradually add more *iodine solution*, dropwise until a very faint-persistent 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-point is approached. Each ml of 0.1 iodine is equivalent to 0.02482 g of $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$.

Storage –Store in tightly-closed containers.

Sodium Thiosulphate 0.1 N – $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O} = 248.17$, 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* in sufficient *water* to produce 250 ml. To 50 ml of this solution, add 2 g of *potassium iodide* and 3 ml of 2 *N hydrochloric acid* and titrate with the *sodium-thiosulphate solution* using *starch solution*, added towards the end of the titration, as indicator until the blue colour is discharged. Each 0.002784 g of *potassium bromate* is equivalent to 1 ml of 0.1*N sodium thiosulphate*.
Note: –Re-standardise 0.1 *N sodium thiosulphate* frequently.

Stannous Chloride – $\text{SnCl}_2, 2\text{H}_2\text{O} = 225.63$.

Contains not less than 97.0 per cent of $\text{SnCl}_2, 2\text{H}_2\text{O}$.

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 2 ml 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 20 ml of *water* and 5 ml of *chloroform* and titrate rapidly with 0.05 M *potassium iodate* until the *chloroform* layer is colourless. Each ml of 0.05 M *potassium iodate* is equivalent to 0.02256 g of $\text{SnCl}_2, 2\text{H}_2\text{O}$.

Stannous Chloride Solution – May be prepared by either of the two methods given below :

1. Dissolve 330 g of *stannous chloride* in 100 ml of *hydrochloric acid* and add sufficient *water* to produce 1000 ml.
2. Dilute 60 ml of *hydrochloric acid* with 20 ml of *water*, add 20 g of tin and heat gently until gas ceases 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 *boiling water*. Add 5 ml of this solution to 100 ml of *water* and add 0.05 ml of 0.1 N *iodine*. The deep blue colour is discharged by 0.05 ml of 0.1 N *sodium thiosulphate*.

Ash – Not more than 0.3 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 – Sudan III, Solvent Red 23; 1-(4-Phenyl-azophenylazo)-2-naphthol; $\text{C}_{22}\text{H}_{16}\text{N}_4\text{O} = 352.40$.

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 – $\text{NH}_2\text{SO}_3\text{H}$ =97.09.

Contains not less than 98.0 per cent of $\text{H}_3\text{NO}_3\text{S}$.

Description -White crystals or a white crystalline powder.

Solubility –Readily soluble in water.

Melting Range –203° to 205°, with decomposition.

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 x 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 – $(\text{CHOH} \cdot \text{COOH})_2$ =150.1

Analytical reagent grade.

Thioglycollic Acid – Mercapto acetic acid, $\text{HS} \cdot \text{CH}_2\text{COOH}$ =92.11.

Contains not less than 89.0 per cent w/w of $\text{C}_2\text{H}_4\text{O}_2\text{S}$, as determined by both parts of the Assay described below :

Description –Colourless or nearly colourless liquid; odour strong and upleasant.

Iron –Mix 0.1 ml with 50 ml of water and render alkaline with strong ammonia solution; no pink colour is produced.

Assay -

- (1) Weigh accurately about 0.4 g and dissolve in 20 ml of water and titrate with 0.1 N sodium hydroxide using cresol red solution as indicator. Each ml of 0.1 N sodium hydroxide is equivalent to 0.009212 g of $C_2H_4O_2S$.
- (2) To the above 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-Isopropyl-5-methylphenol; $C_{10}H_{14}O = 150.2$

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; $C_{27}H_{30}O_5S = 466.6$

Gives a red colour in strongly acid solutions, a yellow colour in weakly acid and weakly alkaline solutions, and a blue colour 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 0.05 M sodium hydroxide and 5 ml of ethanol (90 per cent); after solution is effected add sufficient ethanol (20 per cent) to produce 250 ml.

Complies with the following test -

Sensitivity -A mixture of 0.1 ml and 100 ml of carbon dioxide-free water to which 0.2 ml of 0.02 N sodium hydroxide has been added is blue. Not more than 0.1 ml of 0.2 N hydrochloric acid is required to change the colour to yellow.

Titanous Chloride Solution -General reagent grade of commerce containing about 15 per cent w/v to $TiCl_3$.

Weight per ml, about 1.2 g.

Dull purplish liquid with a strongly acid reaction.

Titanous Chloride 0.1 N - $TiCl_3 = 154.26$; 15.43 g 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 end point 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 $TiCl_3$.

Vanillin-Sulphuric Acid Reagent - 5 % Ethanolic sulphuric acid (Solution I)
1 % Ethanolic vanillin (Solution II)

The plate is sprayed vigorously with 10 ml Solution I, followed immediately by 5-10 ml of Solution II.

Water -See purified water.

Water, Ammonia-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) methylenitrilo] tetra acetic acid S₈-dioxide or its tetra sodium salt.

Gives a reddish-purple colour with mercury, lead, zinc and contain other metal ions in acid solution. When metal ions are absent, for example, in the presence of an excess of *disodium ethylenediamine tetraacetate*, this solution is yellow.

Xylenol Orange Solution –Shake 0.1 g of *xylenol orange* with 100 ml of *water* and filter, if necessary.

Zinc, Granulated –Zn=65.38.

Analytical reagent grade of commerce.

Zinc Powder –Zn =65.38.

Analytical reagent grade of commerce.

Zinc Sulphate –ZnSO₄, 7H₂O = 287.6.

Analytical reagent grade of commerce.

APPENDIX -5

5.1 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 (μ g) – 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 of 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 Milliimicron (m μ) – the 1000th part of micron.

5.2 APPROXIMATE EQUIVALENTS OF DOSES IN INDIAN SYSTEM AND METRIC SYSTEM :

1	Ratti or Gunja		=125 mg
8	Rattis or Gunjas	=1 Masa	=1 g
12	Masa	=1 Karsa (Tola)	=12 g
2	Karsas (Tolas)	=1 Sukti	=24 g
2	Suktis (4 Karsas or Tolas)	=1 Pal	=48 g
2	Palas	=1 Prasrti	=96 g
2	Prasrtis	=1 Kudava	=192 g
2	Kudavas	=1 Manika	=384 g
2	Manikas	=1 Prastha	=768 g
4	Prasthas	=1 Adhaka	=3 Kg 73 g
4	Adhakas	=1 Drona	= 12 Kg 288 g
2	Dronas	=1 Surpa	= 24 Kg 576 g
2	Surpas	=1 Droni (Vahi)	= 49 Kg 152 g
4	Dronis	=1 Khari	=196 Kg 608 g
100	Palas	=1 Tula	= 4 Kg 800 g
20	Tulas	=1 Bhara	= 96 Kg

APPENDIX-6

6.1 CLASSICAL AYURVEDIC REFERENCES

आकारकरभः, आकल्लकम् (मूलम्)

आकारकरभश्चैवाकल्लकोऽथह्यकल्लकः ।
अकल्लकरोष्णोवीर्येण बलकृत्कटुकोमतः ।
प्रतिश्यायञ्च शोथञ्च वातञ्चैव विनाशयेत् ॥

(शालिग्राम निघण्टु हरीतक्यादिवर्ग 154)

सन्दर्भ

सो० नि० 1/688;

शार्ङ्गि म० ख० 10/23, 6/162, 12/56;

भावप्रकाश संहिता 1/166, 59/15, 72/76

अक्षोडः (-टः) (फलमज्जा)

वातामाभिषुकाक्षोटमुकूलकनिकोचकाः ।
गुरूष्णस्निग्धमधुराः सौरुमाणा बलप्रदाः ॥
वातघ्ना बृंहणा वृष्याः कफपित्ताभिवर्धनाः ।

(च० सू० 27/157)

वातामाक्षोडाभिषुकनिचुलपिचुनिकोचकोरुमाण प्रभृतीनि ।
पित्तश्लेष्महराण्याहुः स्निग्धोष्णानि गुरूणि च ॥
बृंहणानि अनिलघ्नानि बल्यानि मधुराणि च ॥

(सु० सू० 46/187-188)

.....अक्षोडनिकोचकम् ।
.....च बृंहणं गुरुशीतलम् ॥
दाहक्षतक्षयहरं रक्तपित्तप्रसादनम् ।
स्वादुपाकरसं स्निग्धं विष्टम्भिकफशुक्रकृत् ॥

(अ० ह० सू० 6/120-121)

अक्षोडः पर्वतीयश्च फलस्नेहो गुडाशयः ।
कीरेष्टः कर्परालश्च स्वादुमज्जा पृथुच्छदः ॥
अक्षोडकः स्वादुरसो मधुरः पुष्टिकारकः ।
पित्तश्लेष्मकरो बल्यः स्निग्धोष्णः गुरुबृंहणः ॥

(ध० नि० आम्रादिवर्ग 53,54)

आक्षोटो वैधृतफलं कन्दलाभः पृथुच्छदः ।
आक्षोटं मधुरं बल्यं गुरूष्णं वातहृत्सरम् ॥

(म० नि० फलादिवर्ग 68)

आक्षोडकं सरं स्निग्धं मधुरं रसपाकयोः ।
गुरूष्णं बृंहणं वृष्यं बल्यं विष्टम्भि रोचनम् ॥
हृद्यं क्षयास्रपवनदाहघ्नं कफपित्तलम् ॥

(कै० नि० ओषधिवर्ग 375)

अक्षोटो मधुरो बल्यो स्निग्धोष्णो वातपित्तजित् ।
रक्तदोषप्रशामनः शीतलः कफकोपनः ॥

(रा० नि० करवीरादिवर्ग 82)

पीलुः शैलभवोऽक्षोटः कर्परालश्च कीर्तितः ।
अक्षोटकोऽपि वातादसदृशः कफपित्तकृत् ॥
वातादः उष्णः सुस्निग्धो वातघ्नः शुक्रकृद् गुरुः ॥
वाताद मज्जा मधुरो वृष्यः पित्तानिलापहः ॥
स्निग्धोष्णः कफकुन्नेष्टो रक्तपित्तविकारिणाम् ।

(भा० प्र० नि० आम्रादिवर्ग 129;124)

आम्रातः

आम्र ...आम्रातकइति दशमानि हृद्यानि भवन्ति ।

(च० सू० 4/10)

मधुरं बृंहणं बल्यमाम्रातं तर्पणं गुरु ।
सस्नेहं श्लेष्मलं शीतं वृष्यं विष्टभ्यजीर्यति ॥

(च० सू० 27/129)

बृंहणं मधुरं बल्यं गुरु विष्टभ्य जीर्यति ।
आम्रातकफलं वृष्यं सस्नेहं श्लेष्मवर्धनम् ॥

(सु० सू० 46/154)

आम्रातताल मधूकजम् ।

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उरुमाणं प्रियालं च बृंहणं गुरु शीतलम् ।
दाहक्षतक्षयहरं रक्तपित्तप्रसादनम् ।
स्वादुपाकरसं स्निग्धं विष्टम्भि कफशुक्रकृत् ॥

(अ० ह० सू० 6/119-121)

आम्रातकफलं वृष्यं पित्ताम्रकफवह्निकृत् ।
शीतं कषायं मधुरं किञ्चिन्मारुतकृद्गुरु ॥

(ध० नि० आम्रादिवर्ग 10)

आम्रातमामवातघ्नं गुरूष्णं रुचिकृत्सरम् ।
पक्वं स्वादु हिमं वृष्यं मरुत्पित्तक्षयास्रजित् ॥

(म० नि० फलादिवर्ग 93)

आम्रातमम्लं वातघ्नं रुच्यं पित्तकफासृकृत् ।
सरं गुरूष्णं पक्वं तु स्वादुपाकरसं हिमम् ।

(कै० नि० ओषधिवर्ग 410-411)

आम्रातकं कषायाम्लमामं हृत्कण्ठहर्षणम् ।
पक्वं तु मधुराम्लाख्यं स्निग्धं पित्तकफापहम् ॥

(शा० नि० आम्रादिवर्ग 17)

आम्रातमम्लं वातघ्नं गुरूष्णं रुचिकृत्सरम् ।
पक्वन्तु तुवरं स्वादु रसे पाके हिमं स्मृतम् ॥
तर्पणं श्लेष्मलं स्निग्धं वृष्यं विष्टम्भि बृंहणम् ।
गुरु बल्यं मरुत्पित्तक्षतदाहक्षयासृजित् ॥

(भा० प्र० नि० आम्रादिवर्ग 20)

अपामार्गः

प्रत्यक्पुष्पा शिरोविरेचनानाम् ।

(च० सू० 25/40)

अपामार्गस्तु तिक्ततोष्णः कटुश्च कफनाशनः ।
अर्शः कण्डूदरामघ्नो रक्तहृद्ग्राहि वान्तिकृत् ॥

(ध० नि० गुडूच्यादिवर्ग 262)

अपामार्गः कटुस्तिक्तस्तीक्ष्णोष्णो दीपनः सरः ।
पाचनो वामनश्छेदी कफमेदोऽनिलापहः ॥
निहन्ति शूलहिध्मार्शोऽकण्डूददूदरापचीः ॥

(कै० नि० ओषधिवर्ग 1033-1034)

अपामार्गस्तु तिक्ततोष्णः कटुश्च कफनाशनः ।
अर्शकण्डूदरामघ्नो रक्तहृद् ग्राहि वान्तिकृत् ॥

(श० नि० शताह्वादिवर्ग 91)

अपामार्गः सरस्तीक्ष्णो दीपनस्तिक्तकः कटुः ।
पाचनो रोचनश्छेदिकफमेदोऽनिलापहः ॥
निहन्ति हृद्गुजाध्मार्शः कण्डूशूलोदरापचीः ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 220)

अपराजिता

अपराजिते कटू मेध्ये शीते कण्ठ्ये सुदृष्टिदे ॥
कुष्ठमूत्रत्रिदोषामशोथव्रणविषापहे ।
कषाये कटुके पाके तिक्ते च स्मृतिबुद्धिदे ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 112)

आर्द्रकम्

रोचनं दीपनं वृष्यमार्द्रकं विश्वभेषजम् ।
वातश्लेष्मविबन्धेषु रसस्तस्योपदिश्यते ॥

(च० सू० 27/163)

नागरं कफवातघ्नं वृष्यं चैवार्द्रकं स्मृतम् ।

(सु० सू० 46/226-227)

आर्द्रकं कफानिलहरं स्वर्ग्यं विबन्धानाहशूलजित् ।
कटूष्णं रोचनं वृष्यं हृद्यं चैवाऽऽर्द्रकं स्मृतम् ॥

(ध० नि० शतपुष्पादिवर्ग 84)

कटुभद्रं शृंगवेरमार्द्रकं कटुकन्दकम् ।
तत्तुल्यमार्द्रकं विद्यात् सुतीक्ष्णं भेदनं गुरु ।
पाचनं रोचनं वृष्यं कटूष्णं वह्निदीपनम् ॥
कफानिलहरं स्वर्ग्यं विबन्धानाहशूलजित् ।

(कै० नि० औषधिवर्ग 1154, 1155)

कटूष्णमार्द्रकं हृद्यं विपाके शीतलं लघु ।
दीपनं रुचिदं शोफकफकण्ठामयापहम् ॥

(रा० नि० पिप्पल्यादिवर्ग 29)

आर्द्रकं शृङ्गवेरं स्यात्कटुभद्रं तथाऽऽर्द्रिका ।
आर्द्रिका भेदिनी गुर्वी तीक्ष्णोष्णा दीपनी मता ॥
कटुका मधुरा पाके रूक्षा वातकफापहा ।
ये गुणाः कथिता शुण्ड्यास्तेऽपि सन्त्यार्द्रकेऽखिलाः ॥
भोजनाग्रे सदा पथ्यं लवणार्द्रकं भक्षणम् ।
अग्निसन्दीपनं रुच्यं जिह्वाकण्ठविशोधनम् ।
कुष्ठपाण्ड्वामये कृच्छ्रे रक्तपित्ते व्रणे ज्वरे ।
दाहे निदाघशरदीर्घे पूजितमार्द्रकम् ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 49-52)

अरिमेदः

तिन्दुकप्रियालबदरखदिरकदरसप्तपर्णाश्वकर्णार्जुनासनारिमेदा
इति दशोमानि उद्वर्दप्रशमनानि भवन्ति ।

(च० सू० 4/17)

सालसाराजकर्णखदिरकदरकालस्कन्धक्रमुकःकालीयकं चेति ।
सालसारादिरित्येषगणः कुष्ठविनाशनः ।
मेहपाण्ड्वामयहरः कफमेदोविशोषणः ।

(सु० सू० 38/8-9)

मुखरोगहरः शीतो रक्तामस्तम्भकारकः ॥

(ध० नि० आप्रादिवर्ग 122)

अरिमेदः कषायोष्णस्तिक्तो भूतविनाशकः ।
शोफातिसारकासघ्नो विषवीसर्पनाशनः ॥

(रा० नि० शाल्मल्यादि वर्ग 42)

इरिमेदो विट्खदिरः कालस्कन्धोऽरिमेदकः ।
इरिमेदः कषायोष्णो मुखदन्तगदाऽस्रजित् ॥
हन्ति कण्डूविषश्लेष्मकृमिकुष्ठविषव्रणान् ॥

(भा० प्र० नि० वटादिवर्ग 34)

अर्जुनः

अर्जुनः ककुभः पार्थश्चित्रयोधी धनञ्जयः ।
वीरान्तकः किरीटी च नदीसर्जोऽपि पाण्डवः ॥
ककुभस्तु कषायोष्णः कफघ्नो व्रणनाशनः ।
पित्तश्रमतृषार्तिघ्नो मारुतामयकोपनः ॥

(ध० नि० आम्रादिवर्ग 104-105)

अर्जुनः फाल्गुनः पार्थः ककुभो धूर्तभूरुहः ।
श्वेतवाहो नदीसर्जः मधुगन्धिप्रसूनकः ॥
अर्जुनस्तुवरः शीतो जयेत् पित्तकफव्रणान् ।
मेदोमेहास्रहृद्रोगस्वेदभग्नक्षतक्षयान् ॥

(कै० नि० ओषधिवर्ग 819-820)

अर्जुनस्तु कषायोष्णः कफघ्नो व्रणनाशनः ।
पित्तश्रमतृषार्तिघ्नो मारुतामयकोपनः ॥

(श० नि० प्रभद्रादिवर्ग 118)

ककुभोऽर्जुननामाख्यो नदीसर्जश्च कीर्तितः ।
इन्द्रद्रुर्वीरवृक्षश्च वीरश्च धवलः स्मृतः ॥
ककुभः शीतलो हृद्यः क्षतक्षयविषास्रजित् ।
मेदोमेहव्रणान् हन्ति तुवरः कफपित्तहृत् ॥

(भा० प्र० नि० वटादिवर्ग 26-27)

अर्जुनस्य त्वचा सिद्धं क्षीरं योज्यं हृदामये ।

(वृन्दमाधव 31.8)

भल्लातकम् (फलम्)

भल्लातः कटुतिकतोष्णो मधुरः कृमिनाशनः ।
गुल्मार्शोग्रहणीकुष्ठान् हन्ति वातकफामयान् ॥

(ध० नि० चन्दनादिवर्ग 129)

भल्लातकफलं पक्वं स्वादुपाकरसं गुरु ।
विष्टंभि बृंहणं रूक्षं हिमं वातबलासकृत् ॥
शुक्रलं दुर्जरं बल्यं रक्तपित्तविनाशनम् ।

(कै० दे० नि० ओषधिवर्ग 497)

भल्लातकं त्रिषु प्रोक्तमरुष्कोऽरुष्करोऽग्निः ।
तथैवाग्निमुखी भल्ली वीरवृक्षश्च शोफकृत् ॥
भल्लातकफलं पक्वं स्वादुपाकरसं लघु ।
कषायं पाचनं स्निग्धं तीक्ष्णोष्णं छेदिभेदनम् ॥
मेध्यं वह्निकरं हन्ति कफवातव्रणोदरम् ।
कुष्ठार्शोग्रहणीगुल्म शोफानाह ज्वर क्रिमीन् ।
तन्मज्जा मधुरा वृष्या बृंहणी वातपित्तहा ।
वृन्तमारुष्करं स्वादु पित्तघ्नं केश्यमग्निकृत् ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 227-230)

भृङ्गराजः

भृङ्गराजः समाख्यातस्तिकतोष्णो रूक्ष एव च ।
कफशोफामपाण्डुत्वगृह्णद्रोगविषनाशनः ॥

(ध० नि० करवीरादि वर्ग 11)

केशराजो भृङ्गराजः सूर्यावर्तोऽथमार्कवः ।
मार्कवः कटुकस्तिकतो रूक्षोष्णोऽक्षिशरोऽर्तिहृत् ॥
कफवातहरो दन्त्यस्त्वच्यः केशयो रसायनः ।
हन्ति कासकृमिश्वासकुष्ठशोफामपाण्डुताः ॥

(कै० नि० ओषधिवर्ग 1574-1575)

भृङ्गराजास्तु चक्षुष्यस्तिकतोष्णाः केशरञ्जनाः ।
कफशोफविषघ्नाश्च तत्र नीलो रसायनः ॥

(रा० नि० शताह्वादि वर्ग 141)

भृङ्गरः कटुकस्तीक्ष्णो रूक्षोष्णः कफवातनुत् ।
केशयस्त्वच्यः कृमिश्वासकासशोथामपाण्डुनुत् ॥
दन्त्यो रसायनो बल्यः कुष्ठनेत्रशिशरोऽर्तिनुत् ।

(भा० प्र० नि० गुडूच्यादि वर्ग 240-241)

ब्राह्मी

ब्राह्मी इति दशोमानि प्रजास्थापनानि भवन्ति ।

(च० सू० 4/49)

ब्राह्मी सोमा विनिर्दिष्टा दिव्यतेजा महौषधी ।
कपोतवेगा त्वष्टा च सैव ब्रह्मसुवर्चला ॥
ब्राह्मी सौम्या रसे तिक्ता शोफपाण्डुज्वरापहा ।
दीपनी कुष्ठकण्डूघ्नी प्लीहवातबलासजित् ॥

(ध० नि० करवीरादिवर्ग 89, 90)

ब्राह्मी शीता सरा तिक्ता कषाया मधुरा लघुः ।
मेध्या स्वर्या स्वादुपाका हृद्यायुष्या रसायनी ॥
मतिस्मृतिप्रदा हन्ति कुष्ठकण्डूज्वरं मलान् ।
शोफारुचिविषश्वासकासमोहास्रपाण्डुताः ॥

(कै० नि० ओषधिवर्ग 722, 723)

ब्राह्मी हिमा कषाया च तिक्ता वातास्रपित्तजित् ।
बुद्धिं प्रज्ञां च मेधां च कुर्यादायुष्यवर्द्धनी ॥

(रा० नि० पर्पटादिवर्ग 66)

ब्राह्मी कपोतवह्ना च सोमवल्ली सरस्वती ।
मण्डूकपर्णी माण्डूकी त्वाष्ट्री दिव्या महौषधी ॥
ब्राह्मी हिमासरा तिक्ता लघुर्मेध्या च शीतला ।
कषाया मधुरा स्वादुपाकाऽऽयुष्या रसायनी ॥
स्वर्या स्मृतिप्रदा कुष्ठपाण्डुमेहास्रकासजित् ।
विषशोथज्वरहरी तद्वन्मण्डूकपर्णिनी ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 279-282)

बृहती

बृहती सिंहिका कान्ता वार्ताकी राष्ट्रिका कुली ।
सिंहिका कफवातघ्नी श्वासशूलज्वरापहा ॥
छर्दिहृद्रोगमन्दाग्निमामदोषांश्च नाशयेत् ।
बृहती ग्राहिणी सोष्णा वातघ्नी पाचनी तथा ॥

(ध० नि० गुडूच्यादिवर्ग 93, 94)

बृहती कटुका तिक्ता सोष्णा वातकफापहा ।
दीपनी पाचनी हृद्या ग्राहिणी ज्वरकुष्ठनुत् ॥
श्वासास्यमलवैरस्यकासारोचकशूलजित् ।

(कै० नि० ओषधिवर्ग 50-51)

बृहती कटुतिक्तोष्णा वातजिज्वरहारिणी ।
अरोचकामकासघ्नी श्वासहृद्रोगनाशिनी ॥

(रा० नि० शताह्वादिवर्ग 25)

वार्ताकी क्षुद्रभण्टाकी महती बृहती कुली
हिङ्गुली राष्ट्रिका सिंही महोष्ट्री दुष्प्रधर्षिणी
बृहती ग्राहिणी हृद्या पाचनी कफवातहत् ।
कटुतिक्ताऽऽस्यवैरस्यमलारोचकनाशिनी ॥
उष्णा कुष्ठज्वरश्वासशूलकासाग्निमान्द्यजित् ।

(भा० प्र० नि० गुडूच्यादिवर्ग 36-37)

चव्यम्

चविका कोलवल्ली च चव्यं चविकमेव च ।
चव्यं च कटुकोष्णं स्याज्जन्तुहृदीपनं परम् ॥
कफोद्रेकहरं वातप्रकोपशमनं भवेत् ॥

(ध० नि० शतपुष्पादिवर्ग 77)

चव्यं कोला च चविका चव्यनं कोलवल्लिका ।
ग्रन्थि चव्यं रसे पाके कटूष्णं दीपनं लघु ॥
पित्तलं पाचनं तीक्ष्णं रूक्षं रोचनभेदनम् ।
कफवातकृमिप्लीहगुल्मानाहोदरापहम् ॥
गुल्मशूलकृमिहरं चव्यपुष्पं गरापहम् ।

(कै० नि० ओषधिवर्ग 1173, 1174)

चव्यं स्यादुष्णकटुकं लघु रोचनदीपनम् ।
जन्तूद्रेकापहं कासश्वासशूलार्तिकृन्तनम् ॥

(रा. नि. पिप्पल्यादि वर्ग 42)

भवेच्चव्यं तु चविका कथिता सा तथोषणा ।
कणामूलगुणं चव्यं विशेषाद् गुदजापहम् ॥

(भा. प्र. नि० हरीतक्यादि वर्ग 67)

दाडिमः

चरके हृद्ये, छर्दिनिग्रहणे, श्रमहरे च महाकषाये पठ्यते ।

(च० सू० 4/10, 28, 40)

अम्लं कषायमधुरं वातघ्नं ग्राहि दीपनम् ।
स्निग्धोष्णं दाडिमं हृद्यं कफपित्ताविरोधी च ॥
रूक्षाम्लं दाडिमं यत्तु तत् पित्तानिलकोपनम् ।
मधुरं पित्तनुत्तेषां तद्धि दाडिममुत्तमम् ॥

(च० सू० 46, 146-147)

कषायानुरसं तेषां दाडिमं नातिपित्तलम् ।
दीपनीयं रुचिकरं हृद्यं वर्चोविबन्धनम् ।
द्विविधं तत्तु विज्ञेयं मधुरं चाम्लमेव च ॥
त्रिदोषघ्नं तु मधुरमम्लं वातकफापहम् ॥

(सु० सू० 46/141-142)

उद्रिक्तपित्ताञ्जयति त्रीन्दोषान्स्वादु दाडिमम् ।
पित्ताविरोधि नात्युष्णमम्लं वातकफापहम् ॥
सर्वं हृद्यं लघु स्निग्धं ग्राहि रोचनदीपनम् ॥

(अ० ह० सू० 6/117-118)

स्निग्धोष्णं दाडिमं हृद्यं कफपित्तविरोधि च ।
द्विविधं तच्च विज्ञेयं मधुरं चाम्लमेव च ॥

(ध० नि० शतपुष्पादिवर्ग 61-62)

दाडिमं दीपनं हृद्यं रोचनं नातिपित्तलम् ।

(म० नि० फलादिवर्ग 25)

स्वाद्वम्लं मधुरं चाम्लं त्रिविधं दाडिमीफलम् ।
मधुरं तु त्रिदोषघ्नं स्वाद्वम्लं वातपित्तनुत् ।
असृक्पित्तकरं चाम्लं संग्राहि सर्वमुच्यते ॥
दाडिमं रोचनं हृद्यं दीपनं नातिपित्तलम् ।
मेध्यं कण्ठास्यरोगघ्नं तर्पणं कफवातजित् ।
वर्चोविबन्धनं स्निग्धं कषायानुरसं लघु ॥

(क० नि० ओषधिवर्ग 306-308)

दाडिमं मधुरमम्लकषायं कासवातकफपित्तविनाशि ॥
ग्राहि दीपनकरञ्च लघूष्णं शीतलं श्रमहरं रुचिदायि ॥

(रा० नि० आम्रादिवर्ग 75)

दाडिमः करको दन्तबीजो लोहितपुष्पकः ।
तत्फलं त्रिविधं स्वादु स्वाद्वम्लं केवलाम्लकम् ॥
तत्तु स्वादु त्रिदोषघ्नं तृड्दाहज्वरनाशनम् ।
हृत्कण्ठमुखगन्धघ्नं तर्पणं शुक्रलं लघु ॥
कषायानुरसं ग्राहि स्निग्धं मेधाबलावहम् ।
स्वाद्वम्लं दीपनं रुच्यं किञ्चित्पित्तकरं लघु ॥
अम्लं तु पित्तजनकमामं वातकफापहम् ।

(भा० प्र० नि० आम्रादिफलवर्ग 102-104)

दारुहरिद्रा

चरके - लेखनीये, अर्शोघ्ने, कण्डूघ्ने च महाकषाये पठ्यते ।

(च० सू० 4/3, 12, 14)

हरिद्रादारुहरिद्राकलशीकुटजबीजानि मधुकं चेति ॥
एतौ वचाहरिद्रादी गणौ स्तन्यविशोधनौ ।
आमातिसारशमनौ विशेषाद्दोषपाचनौ ॥

(सु० सू० 38/27-28)

हरिद्राद्वययष्ट्याह्वकलशी कुटजोद्भवाः ।
वचाहरिद्रादिगणावामातीसारनाशनौ ।
मेदः कफाक्षयपवनस्तन्यदोषनिबर्हणौ ॥

(अ० ह० सू० 15/35-36)

तिक्ता दारुहरिद्रा स्याद्रूक्षोष्णा व्रणमेहजित् ।
कर्णनेत्रमुखोद्भूतां रुजं कण्डूं च नाशयेत् ॥

(ध० नि० गुडूच्यादिवर्ग 60)

कटह्वटेरी पर्जन्या दार्वी दारुनिशा निशा ।
पीता दारुहरिद्रा स्यात् पीतद्रुः पीतचन्दनम् ॥
पचंपचा हेमकान्तिः पीतदारुः कटकटी ।
(सैव कालीयकः प्रोक्तस्तथा कालेयकोऽपि च)
तद्वद् दार्वी विशेषेण कर्णनेत्रास्यरोगजित् ॥

(कै० नि० 1116-1117)

दार्वी दारुहरिद्रा च पर्जन्या पर्जनीति च ।
कटह्वटेरी पीता च भवेत्सैव पचम्पचा ॥
सैव कालीयकः प्रोक्तस्तथा कालेयकोऽपि च ॥
पीतद्रुश्चहरिद्रुश्चपीतदारु च पीतकम् ।
दार्वी निशागुणा किन्तु नेत्रकर्णास्यरोगनुत् ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 201-202)

द्रोणपुष्पी

भेदिनी कामलाशोफकफक्रिमिहरा कटुः ॥

(म० नि० अभयादिवर्ग 84)

द्रोणपुष्पी स्वादुपाका स्वादूष्णा लवणा गुरुः ।
सक्षारा कटुका रूक्षा भेदनी वातपित्तकृत् ॥
कफामकामलाशोफतमकश्वासकासजित् ।

(कै० नि० ओषधिवर्ग 665-666(1))

द्रोणपुष्पी कटुः सोष्णा रुच्या वातकफापहा ।
अग्निमान्द्यहरा चैव पथ्या वातापहारिणी ॥

(रा० नि० पर्यटादिवर्ग 138)

द्रोणपुष्पी गुरुः स्वादू रूक्षोष्णा वातपित्तकृत् ।
सतीक्ष्णलवणा स्वादुपाका कट्वी च भेदिनी ॥
कफामकामलाशोथतमकश्वासजन्तुजित् ।

(भा० प्र० नि० गुडूच्यादिवर्ग 283)

अञ्जनं कामलात्तानां द्रोणपुष्पीरसः शुभः ।

(वृन्दमाधव 8/12)

द्रोणपुष्पीरसो वापि निहन्ति विषमज्वरान् ।

(शां० म० ख० 2/1-10; भा० प्र० सं० 1-754)

एवारुः

त्रपुसैवारुकं स्वादु गुरु विष्टम्भि शीतलम् ।
मुखप्रियं च रूक्षं च मूत्रलं त्रपुसं त्वति ॥
एवारुकं च संपक्वं दाहतृष्णाक्लमार्तिनुत् ।

(च० सू० 27/110-111)

एवारुबीजं मधुकं सदावि पैत्ते पिबेत्तण्डुलधावनेन ।

(च० चि० 26/52)

त्रपुसैवारुककारुकशीर्णवृन्तप्रभृतीनि ।
स्वादुतिकरसान्याहुः कफवातकराणि च ॥
सृष्टमूत्रपुरीषाणि रक्तपित्तहराणि च ॥

.....
एवारुकं सककारु संपक्वं कफवातकृत् ।
सक्षारं मधुरं रुच्यं दीपनं नातिपित्तलम् ॥

(सु० सू० 46/216-217,219)

कूष्माण्डएवारुतिण्डिशम् ।
तथा त्रपुसचीनाकचिर्भटं कफवातकृत् ॥
भेदि विष्टम्भ्यभिष्यन्दि स्वादुपाकरसं गुरु ।

(अ० ह० सू० 6/87)

एवारुः कर्कटी प्रोक्ता कथ्यन्ते तद्गुणा अथ ।
कर्कटी शीतला रूक्षा ग्राहिणी मधुरा गुरुः ॥
रुच्या पित्तहरा सामा पक्वा तृष्णाग्निपित्तकृत् ।

(भा० प्र० नि० शाकवर्ग 60-61)

गजपिप्पली (फलम्)

गजपिप्पलिका स्वादुः कटुरुष्णा च कीर्तिता ।
बलासं हन्ति वातेन सार्धं जन्तुजयप्रदा ॥

(ध० नि० शतपुष्पादिवर्ग 79)

हस्तिकृष्णा कटुः पाके वीर्योष्णा दीपनी कटुः ॥
वातश्लेष्मकृमिश्वासकण्ठरोगातिसारजित् ।

(कै० नि० ओषधिवर्ग 1176-1177)

गजोषणा कटूष्णा च रूक्षा मलविशोषणी ।
बलासवातहन्त्री च स्तन्यवर्णविवर्द्धिनी ॥

(रा० नि० पिप्पल्यादि वर्ग 15)

गजकृष्णा कटुर्वातश्लेष्महृद्बहिर्वर्धिनी ।
उष्णा निहन्त्यतीसारं श्वासकण्ठामयक्रिमीन् ॥

(भा० प्र० नि० हरीतक्यादि वर्ग 69)

गम्भारी (फलम्)

काशमर्यफलं रक्तसांग्राहिकरक्तपित्तप्रशामनानाम् ।

(च० सू० 25/39)

सारिवाकाशमरीफलउशीरं चेति ।
सारिवादिः पिपासाघ्नो रक्तपित्तहरो गणः ।
पित्तज्वरप्रशामनो विशेषाद्वाहनाशनः ॥

(सु० सू० 38/39-40)

मधुककाशमर्यपलाशतैलानि मधुरकषायाणि कफपित्तप्रशामनानि ।

(सु० सू० 45/121)

हृद्यं मूत्रविबन्धघ्नं पित्तासृग्वातनाशनम् ।
केश्यं रसायनं मेध्यं काशमर्यं फलमुच्यते ॥

(सु० सू० 46/184(2)-185(1))

फलं तु सरं काशमर्यजं हिमम् ।
शकृन्मूत्रविबन्धघ्नं केश्यं मेध्यं रसायनम् ॥

(अ० ह० सू० 6/122(1)-123(1))

गम्भारी भद्रपर्णी च श्रीपर्णी मधुपर्णिका ।
काशमीरी काशमरी हीरा काशमर्यः पीतरोहिणी ॥
तत्फलं बृंहणं वृष्यं गुरु केश्यं रसायनम् ।

(भा० प्र० नि० गुडूच्यादिवर्ग 15, 17)

गाङ्गेरुकी (पादपम्), गाङ्गेरुकं (फलम्)

गाङ्गेरुकंमधुरं सकषायं च शीतं पित्तकफापहम् ।

(च० सू० 27/139(2))

....गाङ्गेरुकी पुष्करवर्तिबिल्वबिम्बीप्रभृतीनि ॥
फलान्येतानि शीतानि कफपित्तहराणि च ।
संग्राहकाणि रूक्षाणि कषायमधुराणि च ॥

(सु० सू० 46/163-164)

सकषायं हिमं स्वादु धान्वनं कफवातजित् ।
तद्वद्गाङ्गेरुकं विद्यादश्मन्तकफलानि च ॥

(सु० सू० 46/170)

गाङ्गेरुकी नागबला खरगन्धनिका झषा ।
विश्वदेवा तथारिष्टा खण्डा ह्रस्वगवेधुका ॥
गाङ्गेरुकी मधुराम्ला कषायोष्णा गुरुस्तथा ।
कटुस्तिक्ता च वातघ्नी व्रणपित्तविकारजित् ।

(ध० नि० गुडूच्यदिवर्ग 284-285)

खङ्गादच्छिन्नगात्रस्य तत्कालं पूरितो व्रणः ।
गाङ्गेरुकीमूलरसैर्जायते गतवेदनः ॥

(शालि० म० ख० 1/24)

गुञ्जा (मूलम्)

गुञ्जाद्वयं च शीतोष्णं बीजं वान्तिकरं शिफा ।
शूलघ्नी विषहृत्पत्रं वश्ये श्वेता प्रशस्यते ॥

(ध० नि० करवीरादि वर्ग 32)

गुञ्जाऽनुष्णा रसे तिक्ता कषाया कफपित्ता ॥
चक्षुष्या शुक्रला केश्या त्वच्या रुच्या बलप्रदा ।
इन्द्रलुप्तहरा तीव्रा सविषा मदमोहकृत् ॥
हन्ति रक्षोग्रहविषकण्डूकुष्ठव्रणकृमीन् ।

(कै० नि० औषधिवर्ग 795-797(1))

गुञ्जाद्वयं तु केश्यं स्याद्वातपित्तज्वरापहम् ॥
मुखशोषभ्रमश्वासतृष्णामदविनाशनम् ॥
नेत्रामयहरं वृष्यं बल्यं कण्डूं व्रणं हरेत् ।
कृमीन्द्रलुप्तकुष्ठानि रक्ता च धवलाऽपि ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 126-128)

इक्षुः

सारिवेक्षुमूलमधुक कण्टकारिका इति दशमानि कण्डयानि भवन्ति

(च० सू० 4/9)

वृष्यः शीतः स्थिरः स्निग्धो बृंहणो मधुरो रसः ।
श्लेष्मलो भक्षितस्येक्षोर्यान्त्रिकस्तु विदह्यते ॥

(च० सू० 27/234)

अविदाही कफकरो वातपित्तनिबर्हणः ।
वक्त्रप्रह्लादनो वृष्यो दन्तनिष्पीडितो रसः ॥
गुरुर्विदाही विष्टम्भी यान्त्रिकस्तु प्रकीर्तितः ।

(सु० सू० 45/157-158)

इक्षुः शीतो गुरुः स्निग्धो मधुरो रसपाकयोः ।
जीवनो बृंहणः वृष्यः कृमिमूत्रकफप्रदः ॥
सरः संतर्पणो बल्यो ह्लादी पित्तास्रनाशनः ।
ओजस्यो वातजित् भुक्तमात्रे वातप्रकोपणः ॥

(कै० नि० ओषधि वर्ग 139-140)

इक्षुदीर्घच्छदः प्रोक्तस्तथा भूरिरसोऽपि च ।
गुडमूलोऽसिपत्रश्च तथा मधुतृणः स्मृतः ॥
इक्षवो रक्तपित्तघ्ना बल्या वृष्याः कफप्रदाः ।
स्वादुपाकरसाः स्निग्धा गुरवो मूत्रला हिमाः ॥

(भा० प्र० नि० इक्षुवर्ग 792)

इन्द्रवारुणी (मूलम्)

चरके - विरेचनद्रव्येषु मूलं पठ्यते ।

(च० सू० 1/76, 78; 2/8) ;

सुश्रुते - विरेचनद्रव्येषु मूलं पठ्यते ।

(सु० सू० 38/29 ; 39/4)

इन्द्रवारुणिकाऽत्युष्णा रेचनी कटुका तथा ।
कृमिश्लेष्मव्रणान् हन्ति सर्वादराण्यपि ॥

(ध० नि० गुडूच्यादि वर्ग 249)

ऐन्द्रवारुद्वयं तिक्तं कटुपाके सरं लघु ।
वीर्योष्णं कामलापित्तकफप्लीहोदरापहम् ॥

(म० नि० अभयादिवर्ग 22)

श्वासकासापचीकुष्ठप्लीहानाहगरोदरम् ।
कामलामूढगर्भाशिमग्रन्थिगण्डामयं विषम् ॥

(कै० नि० ओषधिवर्ग 1027-1028)

इन्द्रवारुणिका तिक्ता कटुशीता च रेचनी ।
गुल्मपित्तोदरश्लेष्म कृमिकुष्ठज्वरापहा ॥

(रा० नि० गुडूच्यादि वर्ग 72)

ऐन्द्रवारुणी चित्रा गवाक्षी च गवादनी ।

.....
गवादनीद्वयं तिक्तं पाके कटु सरं लघु ॥
वीर्योष्णं कामलापित्तकफप्लीहोदरापहम् ।
श्वासकासापहं कुष्ठगुल्मग्रन्थिव्रणप्रणुत् ॥
प्रमेहमूढगर्भामगण्डामयविषापहम् ।

(भा० प्र० गुडूच्यादि वर्ग 203-206)

जम्बूः, जाम्बवम् (फलम्)

कषायमधुरप्रायं गुरु विष्टम्भि शीतलम् ।
जाम्बवं कफपित्तघ्नं ग्राहि वातकरं परम् ।

(च० सू० 27/140)

चरके - छर्दिनिग्रहणे (पल्लवं), पुरीषविरजनीये, मूत्रसंग्रहणीये च
महाकषाये पठ्यते ।

(च० सू० 4/28, 32, 33)

जाम्बवं वातजननानां अग्र्यं

(च० सू० 25/39)

अत्यर्थं वातलं ग्राहि जाम्बवं कफपित्तजित् ।

(सु० सू० 46/165)

जाम्बवं वातलं ग्राहि स्वाद्वम्लं कफपित्तजित्
हृत्कण्ठकर्षणं चान्यत् कषायं क्षुद्रजाम्बवम् ।

(ध० नि० आम्रादिवर्ग 78)

जम्बूः कषायमधुरा श्रमपित्तदाहकण्ठार्तिशोषशमनी कृमिदोषहन्त्री ।
श्वासातिसारकफकासविनाशनी च विष्टम्भिनी भक्षति रोचनपाचनी च ॥

(रा० नि० आम्रादिवर्ग 129)

फलेन्द्रा कथिता नंदी राजजम्बूर्महाफला ।
तथा सुरभिपत्रा च महाजम्बूरपि स्मृता ।
राजजम्बूफलं स्वादु विष्टम्भि गुरु रोचनम् ॥
क्षुद्रजम्बुः सूक्ष्मपत्रा नादेयी जलजम्बुका ।
जम्बूः संग्राहिणी रूक्षा कफपित्तास्रदाहजित् ॥

(भा० प्र० नि० आम्रादिफलवर्ग 69-70)

ग्राही कषायस्तन्मज्जा विशेषान्मधुमेहहा ।

(नि० २०)

तद्वदजाक्षीरसमो जम्बूत्वगुद्भवो रसः ।

(चक्रवत्त 64/46)

जयपालः

रेचको जयपालश्च सारकस्तित्तिरीफलम् ।
दन्तीबीजं मलद्रावी निकुभ्मो बीजरेचकः ॥
कुम्भीबीजं निकुभ्माच बीजं तत्कुम्भिनीफलम् ॥
जेपालः कटुरुष्णश्च कृमिहारी विरेचनः ।
दीपनः कफवातघ्नो जठरामयशोधनः (जलोदरविनाशनः-पाठा.) ॥

(ध० नि० गुडूच्यादिवर्ग 227-228)

जयपालो दन्तिबीजं विख्यातं तित्तिडीफलम् ।
जयपालो गुरुः स्निग्धो रेची पित्तकफापहः ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 201)

शार्धिरे - उदररोगे जैपालः पठितः ।

(शार्धिं म० ख० 12/228)

जयन्ती

विषघ्नी तिक्तकटुका कफपित्तसमीरजित् ।
अपराजिता केशरुहा तथा चैव नियोजिता ॥
विजयानागदमनी निःशेषविषनाशिनी ।
विषमोहप्रशामनी महायोगेश्वरीति च ॥

(ध० नि० करवीरादि वर्गान्ते 3)

बलामोटा सूक्ष्ममूला जयन्ती विजया जया ।
हरिता चैव विज्ञेया सूक्ष्मपत्राऽपराजिता ॥
बलामोटा कटुस्तिक्ता लघुः पित्तकफापहा ।
मूत्रकृच्छ्रं विषं हन्ति विवादे कुरुते जयम् ॥

(कै० नि० ओषधिवर्ग 1111-1112)

जयन्ती तु बलामोटा हरिता च जया तथा ।
विजया सूक्ष्ममूला च विक्रान्ता चापराजिता ॥
ज्ञेया जयन्ती गलगण्डहारी तिक्ता कटूष्णाऽनिलनाशनीच ।
भूतापहा कण्ठविशोधनी च कृष्णा तु सा तत्र रसायनी स्यात् ॥

(रा० नि० शताह्वादिर्ग 131-132)

श्वेतजयन्तीमूलं पीतं पिष्टं च पयसैव ।
शिवत्रं निहन्ति नियतं रविवारे वैद्यनाथाज्ञा ॥

(धै० र० कुष्ठरोग 44)

ज्योतिष्मती

ज्योतिष्मती....इति दशमानि शिरोविरेचनोपगानि भवन्ति ।

(च० सू० 4/27)

ज्योतिष्मती कटुस्तिक्ता सरा कफसमीरजित् ।
अत्युष्णा वामनी तीक्ष्णा वह्निबुद्धिस्मृतिप्रदा ॥

(ध० नि० गुडूच्यादि वर्ग 269)

ज्योतिष्मती तु सुस्निग्धा तिक्तोष्णाकटुकासरा ।
कषाया वामनी तीक्ष्णा मोहमेधाक्षिवर्णदा ॥
कफानिलहरा हन्ति व्रणवीसर्पपाण्डुता ॥

(कै० नि० ओषधिवर्ग 716-717)

ज्योतिष्मती तिक्तरसा च रूक्षा किञ्चित्कटुर्वातकफापहा च ।
दाहप्रदा दीपनकृच्च मेध्या प्रज्ञाञ्च पुष्पाति तथा द्वितीया ॥

(रा० नि० गुडूच्यादि वर्ग 86)

कटु ज्योतिष्मतीतैलं तिक्तोष्णं वातनाशनम् ।
पित्तसंतापनं मेधाप्रज्ञाबुद्धिविवर्धनम् ॥

(रा० नि० क्षीरादिवर्ग 15/19)

ज्योतिष्मती स्यात्कटुभी ज्योतिष्का कुनीति च ।
पारावतपदीपिण्या लता प्रोक्ता ककुन्दनी ॥
ज्योतिष्मती कटुस्तिक्ता सरा कफसमीरजित् ।
अत्युष्णा वामनी तीक्ष्णा वह्निबुद्धिस्मृतिप्रदा ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 171-172)

कदम्बः

चरके शुकुशोधने, वेदनास्थापने च महाकषाये पठ्यते

(च० सू० 4/20,47)

लोध्रकदम्बसालाः कदली चेति ।
एषरोध्रादिरित्युक्तो मेदःकफहरो गणः ॥
योनिदोषहरः स्तम्भी वण्यो विषनाशनः ।

(सु० सू० 38/14,15)

न्यग्रोध कदम्ब ... नन्दीवृक्षश्चेति ।
न्यग्रोधादिर्गणो व्रण्यः संग्राही भग्नसाधकः ॥
रक्तपित्तहरो दाहमेदोघ्नो योनिदोषहृत् ।

(सु०सू० 38/48-49)

कदम्बस्तु कषायः स्याद्रसे शीतो गुणेऽपि च ।
व्रणसंरोहणश्चापि कासदाहविषापहः ॥

(ध० नि० आप्लादिवर्ग 96)

कदम्बः शिशिरो ग्राही कषायो लवणो गुरुः ।
निहन्ति योनिदोषास्रकृच्छ्रदाहविषव्रणान् ॥

(कै० नि० ओषधिवर्ग 957)

कदम्बस्तिक्तकटुकः कषायो वातनाशनः ।
शीतलः कफपित्तार्तिनाशनः शुकुवर्द्धनः ॥

(रा० नि० प्रभदाद्रि वर्ग 98)

कदम्बो मधुरः शीतः कषायो लवणो गुरुः ।
सरो विष्टम्भकद्रूक्षः कफस्तन्यानिलप्रदः ॥

(भा० प्र० नि० पुष्यवर्ग 36)

काकमाची

त्रिदोषशमनी वृष्या काकमाची रसायनी ।
नात्युष्णशीतवीर्या च भेदिनी कुष्ठनाशिनी ॥

(च० सू० 27/89)

मण्डूकपर्णी....काकमाची.....अर्कपुष्पी प्रभृतीनि ।
रक्तपित्तहराण्याहुर्हृद्यानि सुलघूनि च ॥

(सु० सू० 46/262-263)

ईषत्तिकतं त्रिदोषघ्नं शाकं कटु सतीनजम् ।
नात्युष्णशीतं कुष्ठघ्नं काकमाच्यास्तु तद्विधम् ॥

(सु० सू० 46/266)

काकमाची त्रिदोषघ्नी सरा स्वर्या च तिक्तका ।
हन्ति दोषत्रयं कुष्ठं वृष्या सोष्णा रसायनी ॥

(ध० नि० करवीरादिवर्ग 18,19)

काकमाची कटुस्तिकता सोष्णा स्निग्धा रसायनी ।
हृद्या वृष्या सरा स्वर्या त्रिदोषघ्नी लघुर्जयेत् ॥
कुष्ठशोफप्रमेहाशःश्वासकासारुचिज्वरान् ॥
कटुर्नेत्रहिता हिक्काच्छर्दिहृद्रोगनाशिनी ॥

(कै० नि० ओषधिवर्ग 710, 711)

काकमाची कटुस्तिकता रसोष्णा कफनाशिनी ।
शूलाशःशोफदोषघ्नी कुष्ठकण्डूतिहारिणी ॥

(रा० नि० शताह्वादिवर्ग 35)

काकमाची त्रिदोषघ्नी स्निग्धोष्णा स्वरशुक्रदा ।
तिक्तता रसायनी शोथकुष्ठार्शोर्ज्वरमेहजित् ॥
कटुर्नेत्रहिता हिक्काच्छर्दिहृद्रोगनाशिनी ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 246, 247)

कमलम् (पुष्पम्)

पद्मोत्पलनलिनइति दशोमानि मूत्रविरजनीयानि भवन्ति ।

(च० सू० 4/34)

उत्पलरक्तोत्पलकुमुदसौगन्धिककुवलयपुण्डरीकाणि मधुकं चेति ।

उत्पलादिरयं दाहपित्तरक्तविनाशनः ।

पिपासाविषहृद्रोगच्छर्दिमूर्च्छाहरो गणः ।

(सु० सू० 38/52-53)

वीर्ये रक्तोत्पलं शीतं तिक्तं च मधुरं रसे ।

भिनत्ति पित्तसन्तापौ ध्वंसयत्यम्रजां रुजम् ॥

(ध० नि० करवीरादिवर्ग 135, 139)

कमलं शीतलं वर्ण्यं मधुरं कफपित्तजित् ।

तृषादाहास्रविस्फोटविषवीसर्पनाशनम् ॥

(म० नि० कर्पूरादिवर्ग 79)

कमलं शीतलं तिक्तं कषायं स्वादु वर्णकृत् ।

कफपित्तास्रविस्फोटदाहतृष्णाविनाशनम् ॥

(कै० नि० ओषधिवर्ग 1445)

कमलं शीतलं स्वादु रक्तपित्तश्रमार्तिनुत् ।

सुगन्धि भ्रान्तिसन्तापशान्तिदं तर्पणं परम् ॥

(रा० नि० करवीरादिवर्ग 175)

कमलं शीतलं वर्ण्यं मधुरं कफपित्तजित् ।
तृष्णादाहास्रविस्फोटविषवीसर्पनाशनम् ॥

(भा० प्र० नि० पुष्पवर्ग 3)

संवर्तिका हिमातिक्ता कषाया दाहतृप्प्रणुत् ।
मूत्रकृच्छ्रगुदव्याधिरक्तपित्तविनाशिनी ॥
मृणालं शीतलं वृष्यं पित्तदाहास्रजिद् गुरु ।
दुर्जरं स्वादुपाकञ्च स्तन्यानिलकफप्रदम् ॥
संग्राहि मधुरं रूक्षं शालूकमपि तद्गुणम् ॥

(भा० प्र० नि० पुष्पवर्ग 5, 9, 12)

पद्मबीजं हिमं स्वादु कषायं तिक्तकं गुरु ।
विष्टम्भि वृष्यं रूक्षं च गर्भसंस्थापकं परम् ॥
कफवातहरं बल्यं ग्राहि पित्तास्रदाहनुत् ।

(भा० प्र० नि० फलवर्ग 89-90)

कपित्थः (फलम्)

कपित्थमामं कण्ठघ्नं विषघ्नं ग्राही वातलम् ।
मधुराम्लकषायत्वात् सौगन्ध्याच्च रुचिप्रदम् ॥
परिपक्वं तु दोषघ्नं विषघ्नं ग्राहि गुर्वपि ॥

(च० सू० 27/133,134)

आमं कपित्थमकण्ठयानाम् ।

(च० सू० 25/39)

कपित्थमाममस्वर्यं कफघ्नं ग्राहि वातलम् ।
कफानिलहरं पक्वं मधुराम्लं रसं गुरु ॥
श्वासकासारुचिहरं तृष्णाघ्नं कण्ठशोधनम् ।

(सु० सू० 46/147, 148; ध० नि० शतपुष्पादिवर्ग 99, 100)

आमं कपित्थं संग्राहि कषायं लघु लेखनम् ॥
रूक्षाम्लं विषकण्ठघ्नं कफजित् वातपित्तकृत् ।
पक्वं गुरु कषायाम्लं स्वादु हिक्कात्रिदोषजित् ॥
वमिकासत्तृषाश्वासशामनं कण्ठशोधनम् ।
संग्राहि रोचनं हृद्यं दुर्जरं मूत्रदोषजित् ॥

(कै० नि० ओषधिवर्ग 414-416)

कपित्थो मधुराम्लश्च कषायस्तिक्रशीतलः ।
वृष्यः पित्तानिलं हन्ति संग्राही व्रणनाशनः ॥

(रा० नि० शतपुष्पादिवर्ग 156)

कपित्थस्तु दधित्थः स्यात्तथा पुष्पफलः स्मृतः ।
कपिप्रियो दधिफलस्तथा दन्तशठोऽपि च ॥
कपित्थमामं संग्राहि कषायं लघु लेखनम् ।
पक्वं गुरु तृषाहिककाशामनं वातपित्तजित् ॥
स्यादम्लं तुवरं कण्ठशोधनं ग्राहि दुर्जरम् ॥

(भा० प्र० नि० आम्रादिफलवर्ग 61-62)

करमर्दः

....करमर्द मातुलुङ्गनीति दशोमानि हृद्यानि भवन्ति ।

(च० सू० 4/10)

अम्लं तृषापहं रुच्यं पित्तकृत् करमर्दकम् ।

(सु० सू० 46/156)

गुरूष्णवीर्यं वातघ्नं सरं सकरमर्दकम् ॥
नातिपित्तकरं पक्वं शुष्कं च करमर्दकम् ॥

(अ० ह० सू० 6/136,138)

अम्लं तृष्णापहं रुच्यं पित्तकृत्करमर्दकम् ।
पक्वं च मधुरं शीतं रक्तपित्तहरं मतम् ॥

(ध० नि० आम्रादिफलवर्ग 93)

करमर्दं गुरूष्णाम्लं रुच्यं पित्तकफास्रकृत् ॥
तृड्वातजित् सरं पक्वं लघु स्वादु कफास्रजित् ।
शुष्कं पक्ववदप्यामं पक्वमप्यार्द्रमामवत् ॥

(कै० नि० ओषधिवर्ग 372-373)

करमर्दः सतिक्ताम्लो बालो दीपनदाहकः ।
पक्वस्त्रिदोषशामनोऽरुचिघ्नो विषनाशनः ॥

(रा० नि० आम्रादिफलवर्ग 208)

करमर्दः सुषेणः स्यात्कृष्णपाकफलस्तथा ।
तस्माल्लघुफला या तु सा ज्ञेया करमर्दिका ॥
करमर्दद्वयं त्वाममम्लं गुरु तृषाहरम् ।
उष्णं रुचिकरं प्रोक्तं रक्तपित्तकफप्रदम् ॥
तत्पक्वं मधुरं रुच्यं लघु पित्तसमीरजित् ॥

(भा० प्र० नि० आम्रादिफलवर्ग 81-82)

करञ्जः

चरके विरेचनद्रव्येषु (सू० 2/8), कण्डूघ्ने महाकषाये च (सू० 4/14) पठ्यते ।
सुश्रुते आरग्वधादिगणे, वरुणादिगणे, अर्कादिगणे, श्यामादिगणे,
शिरोविरेचने (सू० 39/3) तथा श्लेष्मसंशमने वर्गे (सू० 39/9)
च करञ्जः पठ्यते ।

आरग्वधादिरित्येष गणः श्लेष्मविषापहः ।
मेहकुष्ठज्वरवमीकण्डूघ्नो व्रणशोधनः ॥

(सू० सू० 38/6-7)

वरुणादिगणो ह्येष कफमेदोनिवारणः ॥
विनिहन्ति शिरःशूलगुल्माभ्यन्तरविद्रधीन् ।

(सू० सू० 38/10-11)

उक्तः श्यामादिरित्येष गणो गुल्मविषापहः ॥
आनाहोदरविड्भेदी तथोदावर्तनाशनः ।

(सू० सू० 38/29-30)

करञ्जकिंशुकअरिष्टफलं जन्तुप्रमेहजित् ।

(सू० सू० 46/197)

करञ्जो नक्तमालश्च पूतीकश्चिरबिल्वकः ।
करञ्जश्चोष्णतिकतः स्यात् कफपित्तास्रदोषजित् ।
व्रणप्लीहकृमीन् हन्ति भूतघ्नो योनिरोगहा ॥
चिरबिल्वः करञ्जश्च तीव्रो वातकफापहः ।

(ध० नि० आप्रादिवर्गः 97, 98)

करञ्जः कटुकः पाके रसे तिक्तकषायकः ।
कटुको गुणतस्तीक्ष्णो वीर्योष्णो विनियच्छति ॥

बलासपित्तकुष्ठास्रव्रणमेदोदरक्रिमीन् ।

(कौ० नि० ओषधिवर्ग 964-966)

करञ्जः कटुरुष्णश्च चक्षुष्यो वातनाशनः ।
तस्यस्नेहोऽतिस्निग्धश्च वातघ्नः स्थिरदीप्तिदः ॥

(रा० नि० प्रभद्रादिवर्ग 62)

करञ्जो नक्तमालश्च करजश्चिरबिल्वकः ।
करञ्जः कटुकस्तीक्ष्णो वीर्योष्णो योनिदोषहृत् ॥
कुष्ठो दावर्त्तगुल्मार्शो व्रणकृमिकफापहः ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 119-120)

कारवेल्लकः (कारवेल्ली) (-ल्लकम्)

कफवातहरं तिक्तं रोचनं कटुकं लघु ।
वार्तिकं दीपनं प्रोक्तं जीर्णं सक्षारपित्तलम् ॥
तद्वत् कर्कोटकं विद्यात् कारवेल्लकमेव च ।

(सु० सू० 46/269)

कारवेल्लं सकटुकं दीपनं कफजित्परम् ।

(अ० ह० सू० 6/80)

कारवेल्लं सकटुकं कटुपाकमवातलम् ॥
दीपनं भेदनं तिक्तमवृष्यमहिमं लघु ।
हन्त्यरोचकपित्तास्रकफं पाण्डुव्रणकृमीन् ॥
शवासकासप्रमेहास्रकोठकुष्ठज्वरानपि ।

(कै० नि० ओषधिवर्ग 589-591)

कारवेल्ली सुतिक्तोष्णा दीपनी कफवातजित् ।
अरोचकहरा चैव रक्तदोषहरी च सा ॥

(रा० नि० मूलकाविवर्ग 186)

कारवेल्लं कठिल्लं स्यात्कारवेल्ली ततो लघुः ।
कारवेल्लं हिमं भेदि लघुतिक्तमवातलम् ॥
ज्वरपित्तकफास्रघ्नं पाण्डुमेहकृमीन् हरेत् ।
तद्गुणा कारवेल्ली स्याद्विशेषाद्दीपनी लघुः ।

(भा० प्र० नि० शाकवर्ग 63-64)

कटुका

चरके लेखनीये, भेदनीये, स्तन्यशोधने च महाकषाये पद्यते

(च० सू० 4/3,4,18)

पिप्पली कटुरोहिणी चेति ।
पिप्पल्यादिः कफहरः प्रतिश्यायानिलारुचीः ॥
निहन्याद्दीपनो गुल्मशूलघ्नश्चामपाचनः ॥

(सु० सू० 38/23)

पटोल कटुरोहिणी चेति ।
पटोलादिर्गणः पित्तकफारोचकनाशनः ॥
ज्वरोपशामनो व्रण्यश्छर्दिकण्डूविषापहः ।

(सु० सू० 38/34)

मुस्ताकटुरोहिणी चित्रकश्चेति ।
एष मुस्तादिको नाम्ना गणः श्लेष्मनिषूदनः ।
योनिदोषहरः स्तन्यशोधनः पाचनस्तथा ॥

(सु० सू० 38/55)

कटुरोहिण्यरिष्टा च प्रोक्ता तिक्तकरोहिणी ।
आमघ्नी शतपर्वा च विप्रार्णि जननी जना ।
कटुका पित्तजित्तिक्ता कटुः शीताम्रदाहजित् ।
बलासारोचकान् हन्ति विषमज्वरनाशिनी ॥

(ध० नि० गुडूच्यादिवर्ग 37-38)

कटुका जननी तिक्ताआमघ्नी पञ्चविंशतिः ।
कटुकाऽतिक्कटुस्तिक्ता शीतपित्तास्रदोषजित् ॥
बलासारोचकश्वासज्वरहृद्रेचनी च सा ।

(रा० नि० गुडूच्यादिवर्ग 54-57)

कट्वी तु कटुका तिक्ता कृष्णभेदा कटम्भरा ।
अशोका मत्स्यशकला चक्राङ्गी शकुलादनी ।
मत्स्यपित्ता काण्डरुहा रोहिणी कटुरोहिणी ।
कट्वी तु कटुका पाके तिक्ता रूक्षा हिमा लघुः ।
भेदिनी दीपनी हृद्या कफपित्तज्वरापहा ।
प्रमेहश्वासकासास्रदाहकुष्ठक्रिमिप्रणुत् ।

(भा० प्र० नि० हरीतक्यादिवर्ग 151-152)

कोकिलाक्षः

चरके शुकशोधने महाकषाये पद्यते ।

(च० सू० 4/20)

स्वयंगुप्तेश्वरकयोः फलचूर्णं सशर्करम् ।
धारोष्णेन नरः पीत्वा पयसा न क्षयं व्रजेत् ॥

(सु० चि० 26/33)

कोकिलाक्षकनिर्यूहः पीतस्तच्छाकभोजिना ।
कृपाभ्यास इव क्रोधं वातरक्तं नियच्छति ॥

(अ० ह० चि० 22/18-19)

शोथनुत् कोकिलाक्षस्य भस्म मूत्रेण वाम्भसा ।

(चक्रवत् 39/23)

कोकिलाक्षो हिमस्तिक्तः स्वाद्वम्लः स्निग्धपिच्छिलः ॥
वृष्यो वातामवाताशमत्तृष्णादृष्टिखुडास्रजित् ॥
इष्टुरस्य दलं स्वादु तिक्तं शोफविषापहम् ।
शूलपाण्डूदरानाहवातमूत्रविबन्धनुत् ॥

(कै० नि० ओषधिवर्ग 1091-1092)

कोकिलाक्षस्तु मधुरः शीतः पित्तातिसारनुत् ।
वृष्यः कफहरो बल्यो रुच्यः सन्तर्पणः परः ॥

(रा० नि० शताह्वादिर्ग 193)

कोकिलाक्षस्तु काकेश्वरिश्चुरः क्षुरकः क्षुरः ।
भिक्षुः काण्डेश्वरप्युक्तः इक्षुगन्धेश्वबालिका ॥

क्षुरकः शीतलो वृष्यः स्वाद्वम्लः पिच्छिलस्तथा ।
तिक्तो वातामशोथाशमत्तृष्णादृष्ट्यनिलास्रजित् ॥

(भा० प्र० नि० गुडूच्यादिर्ग 224-225)

(कजुपा) (लोणिका) बृहल्लोणी

सर्वाणि सूयशाकानि

लोणिका पीलुपर्णिका ।
शाकं गुरु च रूक्षं च प्रायो विष्टभ्य जीर्यति ॥
मधुरं शीतवीर्यं च पुरीषस्य च भेदनम् ।
स्विन्नं निष्पीडितरसं स्नेहाद्यं तत्प्रशस्यते ॥

(च० सू० 27/96-101)

लोणिका कुरण्टिका प्रभृतयः ।
स्वादुपाकरसाः शीताः कफघ्ना नातिपित्तलाः ।
लवणानुरसा रूक्षाः सक्षारा वातलाः सराः ॥

(सु० सू० 46/274-275)

लोणिका कटुका रूक्षा वातश्लेष्महरा गुरुः ।
अशोघ्नी दीपनी चुक्रा मन्दाग्निविषनाशिनी ॥

(कै० नि० ओषधिवर्ग 649)

घोटिकाऽम्ला सराचोष्णा वातकृत्कफपित्तहत् ॥
वाग्दोषव्रणगुल्मघ्नी श्वासकासप्रमेहनुत् ।
शोथे लोचनरोगे च हिता तज्जैरुदाहृता ॥

(भा० प्र० नि० शाकवर्ग 21, 22)

लज्जालुः

चरके सन्धानीये, पुरीषसंग्रहणीये च महाकषाये पठ्यते ।

(च० सू० 4/5,31)

सुश्रुते प्रियविंदिगणे, अम्बष्ठादिगणे च सर्मा नाम्ना लज्जालुः पठ्यते

(सु० सू० 38/45-46)

गणौ प्रियविम्बष्ठादौ पक्वातीसारनाशनौ ।
सन्धानीयौ हितौ पित्ते व्रणानां चापि रोपणौ ॥

(सु० सू० 38/47)

रक्तपादी कटुः शीता पित्तातीसारनाशिनी ।
शोफदाहश्रमश्वास व्रणकुष्ठकफास्रनुत् ॥

(ध० नि० करवीरादिवर्ग 110)

नमस्करी रक्तपादा समंगाऽञ्जलिकारिका ।
शमीपत्रा रक्तमूला रुहा खदिरकारुणा ॥
लज्जालुः स्यात् स्पृहा स्पृक्का गन्धकारी प्ररोचनी ।
नमस्करी हिमा तिक्ता कषाया कफपित्तहा ॥
योनिरोगमतीसारं रक्तपित्तं च नाशयेत् ।

(कै० नि० ओषधिवर्ग 1081, 1082)

लज्जालुः स्याच्छमीपत्रा समङ्गा जलकारिका ।
रक्तपादी नमस्करी नाम्ना खदिरकेत्यपि ॥
लज्जालुः शीतला तिक्ता कषाया कफपित्तजित् ।
रक्तपित्तमतीसारं योनिरोगान् विनाशयेत् ॥

(भा० प्र० नि० गुडुच्यादि वर्ग 272-273)

मधूकः

द्राक्षाकाशमर्य मधूकपुष्पखर्जूरप्रभृतीनी ।
रक्तपित्तहराण्याहुर्गुरूणि मणुराणि च ॥
बृंहणीयमहद्यं च मधूककुसुमं गुरु ।
वातपित्तोपशमनं फलं तस्योपदिश्यते ॥

(सु० सू० 46/182, 183(1), 186)

मधूकं मधुरं शीतं पित्तदाहश्रमापहम् ।
वातलं न तु दोषघ्नं वीर्यपुष्टिविवर्धनम् ॥
बृंहणीयमहद्यं च मधूककुसुमं गुरु ।

(ध० नि० आम्रादिवर्ग 40-41)

तत्पुष्पं मधुरं शीतमहद्यं बृंहणं गुरु ॥
(बलशुक्रकरं प्रोक्तं वातपित्तविनाशनम्)
स्निग्धं विकासि तीक्ष्णोष्णं तत्फलं गुरुशीतलम् ॥
अहद्यं शुक्रलं स्निग्धं मधुरं रसपाकयोः ॥
विष्टम्भिः बृंहणं बल्यं कफकृत्मारुतापहम् ।
हन्ति पित्तास्रतृड्दाहश्वासकासक्षतक्षयान् ॥

(कै० नि० ओषधिवर्ग 458-460)

मधूकं मधुरं शीतं पित्तदाहश्रमापहम् ।
वातलं जन्तुदोषघ्नं वीर्यपुष्टिविवर्धनम् ॥

(रा० नि० आम्रादिवर्ग 92)

मधूको गुडपुष्पः स्यान्मधुपुष्पो मधुस्रवः ।
वानप्रस्थो मधुष्ठीलो जलजेऽत्र मधूलकः ॥
मधूकपुष्पं मधुरं शीतलं गुरु बृंहणम् ।
बलशुक्रकरं प्रोक्तं वातपित्तविनाशनम् ॥
फलं शीतं गुरु स्वादु शुक्रलं वातपित्तनुत् ॥
अहद्यं हन्ति तृष्णाऽस्रदाहश्वासक्षतक्षयान् ॥

(भा० प्र० नि० आम्रादिफलवर्ग 95-97)

मत्स्याक्षी

चरके ऐन्द्रसायने पठ्यते ।
(च० चि० 1/3/24)

सुश्रुते मेध्यलेहे पठ्यते ।

(सु० शा० 10/68)

मत्स्याक्षिका मत्स्यगन्धा बाहली नाडीकलायकः ॥
मत्स्यादनी तु गण्डाली तथा गर्तकलम्बुकः ॥
बाहली तिक्तता स्वादुशीता कषाया ग्राहिणी लघुः ॥
वातला कटुका पाके कफपित्तास्रकुष्ठजित् ॥

(कै० शि० ओषधिवर्ग 728, 729)

मत्स्याक्षी ग्राहिणी शीतकुष्ठपित्तकफास्रजित् ।
लघुस्तिकता कषाया च स्वाद्वी कटुविपाकिनी ॥

(भा० प्र० ति० गुडूच्यादिवर्ग 266)

मेथी (मेथिका)

मेथिका कटुरुष्णा च रक्तपित्तप्रकोपनी ।
अरोचकहरा दीप्तिकरी वातप्रणाशिनी ॥

(ध० नि० सुवर्णादिवर्ग 100)

मेथिका चातितिकोष्णा वमिवातकफापहत् ।
वचायुर्बुद्धिस्मृतिदा कफवातामभूतहत् ॥

(सो० नि० 2, 2, 260)

मेथिकामेथिनी मेथी दीपनी बहुपत्रिका ।
बोधिनी बहुबीजा च ज्योतिर्गन्धफला तथा ॥
वल्लरी चन्द्रिका मन्था मिश्रपुष्पा च कैरवी ।
कुञ्चिका बहुपर्णी च पीतबीजा मुनिच्छदा ॥
मेथिका वातशमनीश्लेष्मघ्नीज्वरनाशिनी ।

(भा० प्र० हरीतक्यादि वर्ग 93-94)

मेथिका कटुरुष्णा च रक्तपित्तप्रकोपणी ।
अरोचकहरा दीप्तिकरा वातघ्नदीपनी ॥

(रा० नि० पिप्पल्यादि वर्ग 69)

मूलकम्

बालं दोषहरं, वृद्धं त्रिदोषं, मारुतापहम् ।
स्निग्धसिद्धं, विशुष्कं तु मूलकं कफवातजित् ॥

(च० सू० 27/168)

कटुतिकरसा हृद्या रोचनी वह्निदीपनी ।
सर्वदोषहरा लघ्वी कण्डूया मूलकपोतिका ॥
महत्तद्गुरु विष्टम्भि तीक्ष्णमामं त्रिदोषकृत् ।
तदेव स्नेहसिद्धं तु पित्तनुत् कफवातजित् ॥
त्रिदोषशामनं शुष्कं विषदोषहरं लघु ।
विष्टम्भि वातलं शाकं शुष्कमन्यत्र मूलकात् ॥
पुष्पं च पत्रं च फलं तथैव यथोत्तरं ते गुरवः प्रविष्टाः ।
तेषां तु पुष्पं कफपित्तहन्तु फलं निहन्यात् कफमारुतौ तु ॥

(सु० सू० 46/240-243)

यद्बालमव्यक्तसं किञ्चित्क्षारं सतिककम् ।
तन्मूलकं दोषहरं लघु सोष्णं नियच्छति ॥
गुल्मकासक्षयश्वास व्रणनेत्रगलामयान् ।
स्वराग्निसादोदावर्तपीनसांश्च महत्पुनः ॥
रसे पाके च कटुकमुष्णवीर्यं त्रिदोषकृत् ॥
गुर्वभिष्यन्दि च स्निग्धसिद्धं तदपि वातजित् ॥
वातश्लेष्महरं शुष्कं सर्वम्, आमं तु दोषलम् ॥

(अ० ह० सू० 6/102-105(1))

मूलकं गुरु विष्टम्भि तीक्ष्णमामत्रिदोषनुत् ।
तदेव स्विन्नं स्निग्धं च कटूष्णं कफवातनुत् ॥
त्रिदोषशामनं शुष्कं विषदोषहरं लघु ।

(ध० नि० करवीरादिवर्ग 31)

मूलकं वातलं रुच्यं स्वर्गोष्णं प्राचनं लघु ॥

(म० नि० शाकवर्ग 7/66)

बालमूलकमत्यल्पक्षारं तिक्ततोषणं लघु ।
रोचनं दीपनं स्वर्गमुष्णं हृद्यं त्रिदोषजित् ॥
निहन्याद् दद्रुशूलामकोठो दावर्तपीनसान् ।
गुल्मकासक्षयश्वासव्रणनेत्रजलामयान् ।
महदामं कटुं स्वादु रसे पाके त्रिदोषकृत् ।
रूक्षं विदाहि तीक्ष्णोष्णमुत्कलेशि स्तम्भि गुर्वपि ॥
तदेव स्निग्धसिद्धं तु दोषत्रयनिर्बर्हणम् ।
शुष्कं लघु हरेच्छोफं विषं दोषत्रयं तथा ॥
तत्पुष्पं कफपित्तघ्नं फलं तु कफवातजित् ।

(क० नि० औषधिवर्ग 669-674(1))

मूलकं तीक्ष्णमुष्णञ्च कटूष्णं ग्राहि दीपनम् ।
दुर्नामगुल्महृद्रोगवातघ्नं रुचिदं गुरु ॥

(श० नि० मूलकादिवर्ग 52)

मूलकं द्विविधं प्रोक्तं तत्रैकं लघुमूलकम् ।
शालामर्कटकं विप्रं शालेयं मरुसम्भवम् ॥
चाणक्यमूलकं तीक्ष्णं तथा मूलकपौतिका ।
नेपालमूलकं चान्यत्तद्भवेद्गजदन्तवत् ।
लघुमूलं कटूष्णं स्याद्गुच्यं लघु च पाचनम् ।
दोषत्रयहरं स्वर्गं ज्वरश्वासविनाशनम् ॥
नासिकाकण्ठरोगघ्नं नयनामयनाशनम् ॥
महत्तदेव रूक्षोष्णं गुरुदोषत्रयप्रदम् ॥
स्नेहसिद्धं तदेव स्याद्दोषत्रयविनाशनम् ॥

(भा० प्र० नि० शाकवर्ग 99-103)

मुरा (मूलम्)

मुरा गन्धवती दैत्या गन्धाद्या गन्धमालिनी ।
सुरभिभूरिगन्धा च कुटी गन्धकुटी स्मृता ॥
मुराऽत्यन्तं भवेच्छीता तिक्ता सुरभिगन्धिनी ।
क्षिणोति क्षतपुञ्जांश्च पित्तशान्तिं नियच्छति ॥

(ध० नि० चन्दनादिवर्ग 66-67)

मुरा गन्धवती दैत्या गन्धाद्या सुरभिः कुटिः ।
मुरा शीता लघुः कुष्ठग्रहपित्तानिलास्रजित् ॥

(म० नि० कपूरादिवर्ग 54)

मुरा गन्धवती दैत्या हृद्या गन्धकुटा कुटी ।
भूरिगन्धा च सुरभिर्गन्धाद्या गन्धमादनी ॥
मुरा तिक्ता हिमा स्वाद्वी लघ्वी पित्तनिलापहा ।
ज्वरासृग्भूतरक्षोघ्नी कुष्ठकासविनाशिनी ॥

(क० नि० ओषधिवर्ग 1386-1387)

मुरा तिक्ता कटुः शीता कषाया कफपित्तहृत् ।
श्वसासृग्विषदाहार्त्तिभ्रममूर्च्छातृषापहा ॥

(रा० नि० चन्दनादिवर्ग 132)

मुरा गन्धकुटी दैत्या सुरभिः शालपर्णिका ।
मुरा तिक्ता हिमा स्वाद्वी लघ्वी पित्तनिलापहा ॥
ज्वरासृग्भूतरक्षोघ्नी कुष्ठकासविनाशिनी ॥

(भा० प्र० नि० कपूरादिवर्ग 97-98)

मूर्वा

मूर्वा मधुरसा देवी पृथक्पर्णी त्रिपर्ण्यपि ।
देवश्रेणी स्वादुरसा स्निग्धपर्णी च मोरटा ॥
मूर्वा स्वादुरसा चोष्णा हृद्रोगकफवातजित् ।
कुष्ठकण्डूवमीमेहविषमज्वरनाशिनी ॥

(ध० नि० गुडूच्यादिवर्ग 13-14)

मूर्वा मुरंगिका देवी देवीश्रेणी पृथक्त्वचा ।
मधुस्रवा मधुरसाऽतिरसा पीलुपर्णिका ॥
मूर्वा स्वादुः स्वादुपाका गुरूष्णा तिक्तका सरा ।
जयेत् त्रिदोषकुष्ठास्रमेदोमेहवमिज्वरान् ॥
मुखशोषं कृमिकण्डूतृष्णापित्तास्रहृद्गदान् ।
मूर्वाकन्दस्तु कृमिहत् विषघ्नो गुदकीलहा ।

(कै० नि० ओषधिवर्ग 785-787)

मूर्वा मधुरसा देवी मोरटा तेजनी स्रवा ।
मधुलिका मधुश्रेणी गोकर्णी पीलुपर्ण्यपि ॥
मूर्वा सरा गुरुः स्वादुस्तिकता पित्तास्रमेहनुत् ।
त्रिदोषतृष्णाहृद्रोगकण्डूकुष्ठज्वरापहा ॥

(भा० प्र० गुडूच्यादिवर्ग 244-245)

नागकेशरः

चरके रक्ताशांसि केशरनवनीतशर्कराभ्यासात् ... अशांस्यपयान्ति रक्तानि ।

(च० चि० 14/210)

सुश्रुते एलादिगणे, अञ्जनादिगणे, प्रियङ्गवादिगणे च पठ्यते ।

(सु० सू० 38/24,42,47)

नागकेशरमल्पोष्णं लघु तिक्तं कफापहम् ।
वस्तिरुग्विषवातास्रकण्डूघ्नं शोफनाशनम् ॥

(ध० नि० शतपुष्पादिवर्ग 49)

नागकेशरमल्पोष्णं लघु तिक्तं कफापहम् ।
वस्तिवातामयघ्नं च कण्ठशीर्षरुजापहम् ॥

(रा० नि० पिप्पल्यादिवर्ग 178)

नागपुष्पः स्मृतो नागः केशरो नागकेशरः ॥
चाम्पेयो नागकिञ्जल्कः कथितः काञ्चनाह्वयः ॥
नागपुष्पं कषायोष्णं रूक्षं लघ्वामपाचनम् ॥
ज्वरकण्डूतूषास्वेदच्छर्दिहल्लासनाशनम् ।
दौर्गन्ध्यकुष्ठवीसर्पकफपित्तविषापहम् ॥

(भा० प्र० नि० कर्पूरादिवर्ग 70-71)

नीली (पत्रम्, मूलम्)

चरके विरेचनद्रव्येषु मूलं पठ्यते ।

(च० सू० 2/8)

सुश्रुते अधोभागहरद्रव्येषु मूलं (नीलिनी) पठ्यते ।

(सु० सू० 39/4)

नीलिनी नीलिका काला ग्राम्या तूणी विशोधनी ।
तुत्था श्रीफलिका मोचा भारवाहि च रञ्जनी ॥
नीली तिक्ता रसे चोष्णा कटिवातकफापहा ।
केश्या विषोदरं हन्ति वातासृक्कृमिनाशिनी ।

(ध० नि० गुडूच्यादिवर्ग 232-234)

नीली तिक्ता रसे पांके सरोष्णा भ्रममोहकृत् ।
कफानिलहरा केश्या प्लीहोदरविषापहा ॥
वातरक्तमुदावर्तमामवातगदं हरेत् ।

(क० नि० ओषधिवर्ग 791-792)

नीली तु कटुतिक्तोष्णा केश्या कासकफामनुत् ।
मरुद्विषोदरव्याधिं गुल्मजन्तुज्वरापहा ।

(रा० नि० शताह्वादिवर्ग 83)

नीली तु नीलिनी तूणी काला दोला च नीलिका ।
नीलिनी रेचनी तिक्ता केश्या मोहभ्रमापहा ॥
उष्णा हन्त्युदरप्लीहवातरक्तकफानिलान् ।
आमवातमुदावर्तं मदं च विषमुद्धतम् ॥

(भा० प्र० गुडूच्यादिवर्ग 207-209)

निम्बः

चरके कण्डूघ्ने महाकषाये (सू० 4/14), वमनद्रव्येषु (सू० 2/6),
तित्तस्कन्धे (वि० 8/150) च पठ्यते ।

.... नैम्बं शाकं ... ।
कफपित्तहरं तित्तं शीतं कटु विपच्यते ॥

(च० सू० 27/95)

सुश्रुते आरग्वधादौ, गुडूच्यादौ, लाक्षादौ च गणे पठ्यते ।

आरग्वधादिरित्येष गणः श्लेष्मविषापहः ।
मेहकुष्ठज्वरवमीकण्डूघ्नो व्रणशोधनः ॥

(सू० सू० 38/7)

गुडूचीनिम्बकुस्तुम्बरुचन्दनानि पद्मकं चेति ॥
एष सर्वज्वरान् हन्ति गुडूच्यादिस्तु दीपनः ।
हृल्लासारोचकवमीपिपासा दाहनाशनः ॥

(सू० सू० 38/50-51)

कषायतित्तमधुरः कफपित्तार्तिनाशनः ।
कुष्ठकृमिहरश्चैव दुष्टव्रणविशोधनः ॥

(सू० सू० 38/64-65)

निम्ब फलतैलानि तीक्ष्णानि लघून्युष्णवीर्याणि कटूनी, कटुविपाकानि
सराण्यनिलकफकृमिकुष्ठशिरोरोगापहराणि चेति ।

(सू० सू० 25/115)

निम्बस्तिक्तरसः शीतो लघुः श्लेष्मापित्तनुत् ।
कुष्ठ कण्डूव्रणान्हन्ति लेपाहारादिशीलतः ॥
अपक्वं पाचयेच्छोफं व्रणं पक्वं विशोधयेत् ।

(ध० नि० गुडूच्यादिवर्ग 30)

निम्बस्तिकः कटुः पाके लघुः शीतोऽग्निवातकृत् ।
 ग्राह्यहृद्यो जयेत् पित्तकफमेहज्वरकृमीन् ॥
 कुष्ठकासारुचिश्वासहृल्लासश्वयथुव्रणान् ।
 ग्राहि प्रवालं निम्बस्य रक्तपित्तकफकृमीन् ॥
 कुष्ठघ्नं वातजननं नेत्ररोगान् विनाशयेत् ।
 तद्वत् पत्राणि निम्बस्य व्रणघ्नानि विशेषतः ॥
 शलाका निम्बपत्रस्य कासश्वासविनाशिनी ।
 कृमिघ्ना तु वरिष्ठा स्यात् कुष्ठज्वरविनाशिनी ॥

(कै० नि० ओषधिवर्ग 879-882)

प्रभद्रकः भवतिशीततिक्तकः कफव्रणकृमिवमिशोफशान्तये ।
 बलासभिद्बहुविषपित्तदोषजित् विशेषतो हृदयविदाहशान्तिकृत् ॥

(रा० नि० प्रभद्रादि वर्ग 10)

निम्बः शीतो लघुर्ग्राही कटुपाकोऽग्निवातनुत् ।
 अहृद्यः श्रमतृट्कासज्वरारुचिकृमिप्रणुत् ।
 व्रणपित्तकफच्छर्दि कुष्ठहृल्लासमेहनुत् ॥
 निम्बपत्रं स्मृतं नेत्र्यं कृमिपित्तविषप्रणुत् ।
 वातलं कटुपाकञ्च सर्वारोचककुष्ठनुत् ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 93, 94, 95)

पलाशः

सुश्रुते रोध्रादौ, मुष्ककादौ, अम्बष्ठादौ, न्यग्रोधादौ च गणे पठ्यते ।

(सु० सू० 38/6, 9, 22, 24)

किशुकं (पुष्पं) कफपित्तघ्नं ।

(सु० सू० 46/288)

.....पलाशातैलानि मधुरकषायाणि कफपित्तप्रशामनानि ।

(सु० सू० 45/121)

क्षारश्रेष्ठ पलाशश्च बीजस्नेहः समिद्धरः ।

क्षारश्रेष्ठः कृमिघ्नश्च संग्राही दीपनः सरः ॥

प्लीहगुल्मग्रहण्यर्शोवातश्लेष्मविनाशनः ॥

(ध० नि० आप्रादिवर्ग 148, 149)

पलाशो दीपनो वृष्यः सरोष्णो व्रणगुल्मजित् ।

भग्नसन्धानकृद्दोषग्रहण्यर्शः क्रिमीन् हरेत् ॥

(म० नि० वटादिवर्ग 39)

पलाशास्तुवरस्तिक्तः स्निग्धोष्णो दीपनः कटुः ।

सरः सन्धानकृद् वृष्यो जयेद् दोषव्रणकृमीन् ॥

(कै० नि० ओषधिवर्ग 833)

पलाशो दीपनो वृष्यः सरोष्णो व्रणगुल्मजित् ।

भग्नसन्धानकृद् दोषग्रहण्यर्शः क्रिमीन् हरेत् ॥

कषायः कटुकस्तिक्तः स्निग्धो गुदजरोगजित् ।

तत्पुष्पं स्वादु पाके तु कटु तिक्तं कषायकम् ।

वातलं कफपित्तास्रकृच्छ्रजिद् ग्राहि शीतलम् ॥

तूड्दाहशामकं वातरक्तकुष्ठहरं परम् ।

फलं लघूष्णं मेहार्शकृमिवातकफापहम् ।

विपाके कटुकं रूक्षं कुष्ठं गुल्मोदरप्रणुत् ॥

(भा० प्र० नि० वटादिवर्ग 50-53)

पारिभद्रः

सुश्रुते क्षारकल्पे, कृमिरोगे, मूत्राघाते च पठ्यते ।

(सु० चि० 4/32; उ० 54/26; 58/48)

निम्बद्रुमो रक्तपुष्पः प्रभद्रः पारिभद्रकः ।
मन्दारकः पारिजातः कण्टकी कण्टकिंशुकः ॥
पारिभद्रोऽनिलश्लेष्मशोथमेदःकृमीन् हरेत् ।
तत्पुष्पं पित्तरोगघ्नं कर्णव्याधिविनाशनम् ॥

(कौ० नि० ओषधिवर्ग 898-899)

परिभद्रः कटूष्णः स्यात् कफवातनिकृन्तनः ।
अरोचकहरः पथ्यो दीपनश्चापि कीर्तितः ॥

(रा० नि० शाल्मल्यादिवर्ग 11)

पारिभद्रो निम्बतरुर्मन्दारः पारिजातकः ।
पारिभद्रोऽनिलश्लेष्मशोथमेदः कृमिप्रणुत् ।
तत्पत्रं पित्तरोगघ्नं कर्णव्याधिविनाशनम् ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 100)

पिप्पलीमूलम्

अभयापिप्पलीमूलविश्वैर्वतानुलोमनी (यवागूः) ।

(च० सू० 2/29)

चरके दीपनीये, शूलप्रशमने च महाकषाये पठ्यते ।

(च० सू० 4/6, 45)

पिप्पलीमूलं दीपनीयपाचनीयानाहप्रशमनानाम् ।

(च० सू० 25/39)

पिप्पलीपिप्पलीमूल कटुरोहिणी चेति ।

पिप्पल्यादिः कफहरः प्रतिश्यायानिलारुचीः ।

निहन्याद्दीपनो गुत्मशूलघ्नश्चामपाचनः ॥

(सू० सू० 38/22-23)

कटूष्णं पिप्पलीमूलं श्लेष्मसंघातनाशनम् ।

वातोच्छित्तिकरं हन्ति कृमीन्वद्विप्रदीप्तिकृत् ॥

(ध० नि० शतपुष्पादिवर्ग 76)

कटूष्णं पिप्पलीमूलं श्लेष्मकृमिनाशनम् ।

दीपनं वातरोगघ्नं रोचनं पित्तकोपनम् ॥

(रा० नि० शतपुष्पादिवर्ग 114)

दीपनं पिप्पलीमूलं कटूष्णं पाचनं लघु ॥

रूक्षं पित्तकरं भेदि कफवातोदरापहम् ।

आनाहप्लीहगुल्मघ्नं कृमिश्वासक्षयापहम् ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 64-65)

प्लक्षः

चरके मूत्रसंग्रहणीये महाकषाये पठ्यते ।

(च० सू० 4/33)

न्यग्रोधोदुम्बराश्वत्थप्लक्षपद्मादिपल्लवाः ।
कषायाः स्तम्भनाः शीता हिताः पित्तातिसारिणाम् ॥

(च० सू० 27/103)

न्याग्रोधोदुम्बराश्वत्थप्लक्षनन्दीवृक्षश्चेति ॥
न्यग्रोधादिर्गणो व्रण्यः संग्राही भग्नसाधकः ।
रक्तपित्तहरो दाहमेदोघ्नो योनिदोषहत् ॥

(सु० सू० 38/48-49)

प्लक्षः कटुः कषायश्च शीतलोरक्तपित्तजित् ।
मूर्च्छाभ्रमप्रलापांश्च हरेत् प्लक्षो विशेषतः ॥

(ध० नि० आम्रादिवर्ग 75)

पिप्परिस्तुवरः शीतो व्रणयोनिविसर्पनुत् ।
दाहपित्तकफास्रघ्नो मेदःपितास्रशोफजित् ॥

(कै० नि० ओषधिवर्ग 437)

प्लक्षः कषायः शिशिरो व्रणयोनिगदापहः ।
दाहपित्तकफास्रघ्नः शोथहा रक्तपित्तहत् ॥

(भा० प्र० नि० वट्टदिवर्ग 12)

प्रसारणी

चरके वातनाशकतैले पठितः ।

(च० चि० 28/165)

सुश्रुते वातनाशकतैले पठितः ।

(सु० चि० 15/44)

प्रसारणी गुरुस्तिकता सरा सन्धानकृन्मता ।
त्रिदोषशामनी वृष्या तेजः कन्तिबलप्रदा ॥

(ध० नि० गुडूच्यादिवर्ग 290)

प्रसारणी गुरुष्या च तिक्ता वातविनाशिनी ।
अर्शःश्वयथुहन्त्री च मलविष्टम्भहारिणी ॥

(रा० नि० पर्पटादिवर्ग 38)

प्रसारणी गुरुर्वृष्या बलसन्धानकृत्सरा ।
वीर्योष्या वातहृत्तिक्ता वातरक्तकफापहा ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 235)

प्रियालः (बीजम्)

चरके श्रमहरे, उदरप्रशामने च महाकषाये पद्यते ।

(च० सू० 4/16,17)

गुरूष्णस्निग्धमधुराः सोरुमाणा बलप्रदाः ।
वातघ्ना बृंहणा वृष्याः कफपित्ताभिवर्धनाः ॥
प्रियालमेषां सदृशं विद्यादौष्यं विना गुणैः ॥

(च० सू० 27/157-158)

प्रियालतैलं मधुरं गुरुश्लेष्माभिवर्धनम् ।
हितमिच्छन्ति नात्यौष्ण्यात्संयोगे वातपित्तयोः ॥

(च० सू० 27/291)

न्यग्रोध ... प्रियाल ... नन्दीवृक्षश्चेति ।
न्यग्रोधादिर्गणो व्रण्यः संग्राही भग्नसाधकः ।
रक्तपित्तहरो दाहमेदोघ्नो योनिदोषहत् ॥

(सु० सू० 38/48-49)

वातपित्तहरं वृष्यं प्रियालं गुरु शीतलम् ।
प्रियालमज्जा मधुरो वृष्यः पित्तानिलापहः ।

(सु० सू० 46/156, 205)

उरुमाणं प्रियालं च बृंहणं गुरु शीतलम् ।
दाहक्षतक्षयहरं रक्तपित्तप्रसादनम् ॥
स्वादुपाकरसं स्निग्धं विष्टम्भि कफशुक्रकृत् ॥

(अ० ह० सू० 6/121)

..... अनुष्णं तु प्रियालजम् ।
प्रियालमज्जा मधुरो वृष्यः पित्तानिलापहः ॥

(अ० ह० सू० 6/124)

प्रियालोऽथ खरस्कन्धश्चारो बहुवल्कलः ।
 स्नेहबीजश्चापवटो ललनस्तापसप्रियः ॥
 वातपित्तहरं वृष्यं प्रियालं गुरु शीतलम् ।
 चारस्य तु फलं पक्वं स्वाद्वम्लं दुर्जरं प्रियम् ॥
 चारमज्जा समधुरा वृष्या पित्तानिलापहा ।

(ध० नि० आम्रादिवर्ग 65-66)

चारः पित्तकफास्रघ्नस्तत्फलं मधुरं गुरु ।
 स्निग्धं सरं मरुत्पित्तदाहतृष्णाक्षतापहम् ॥
 तन्मज्जा मधुरा वृष्या शुक्रला पित्तवातजित् ॥

(म० नि० फलादिवर्ग 36-37)

प्रियालः कफपित्तघ्नः कषायोऽस्य फलं गुरु ।
 स्वाद्वम्लं मधुरं पाके सुस्निग्धं शीतलं सरम् ॥
 विष्टम्भि बृंहणं वृष्यं बल्यं श्लेष्मविवर्धनम् ।
 जयेत् मारुतपित्तास्रदाहतृष्णाक्षतक्षयान् ॥

(कै० नि० ओषधिवर्ग 395-396)

चारः खट्वुः खरस्कन्धो ललनश्चारकस्तथा ।
 बहुवल्कः प्रियालश्च नवदुस्तापसः प्रियः ।
 स्नेहबीजश्चापवटो भक्षबीजः करेन्दुधा ।
 चारस्य च फलं पक्वं वृष्यं गौल्याम्लकं गुरु ।
 तद्वीजं मधुरं वृष्यं पित्तदाहार्तिनाशनम् ।

(रा० नि० आम्रादिवर्ग 64-65)

प्रियालस्तु खरस्कन्धश्चारो बहुवल्कलः ।
 राजादनस्तापसेष्टः सन्नकद्रुर्धनुष्पटः ॥
 चारः पित्तकफास्रघ्नस्तत्फलं मधुरं गुरु ।
 स्निग्धं सरं मरुत्पित्तदाहज्वरतृषाऽपहम् ॥
 प्रियालमज्जा मधुरो वृष्यः पित्तानिलापहः ।
 हृद्योऽतिदुर्जरः स्निग्धो विष्टम्भी आमवर्द्धनः ॥

(ध० प्र० नि० फलवर्ग 83-85)

प्रियङ्गुः (पुष्पम्)

चरके सन्धानीये, पुरीषसंग्रहणीये, मूत्रविरजनीये, शोणितास्थापने च महाकषाये पठ्यते ।

(च० सू० 4/5, 31, 34, 46)

गन्धप्रियङ्गुः शोणितपित्तातियोगप्रशमनानाम् ।

(च० सू० 25/40)

प्रियङ्गुधातकीपुष्पैर्दश पुष्पासवा भवन्ति ।

(च० सू० 25/49)

गणौ प्रियङ्गुम्बुष्टादौ पक्वातीसारनाशनौ ।
सन्धानीयौ हितौ पित्ते व्रणानां चापि रोपणौ ॥

(सु० सू० 38/22)

अञ्जन प्रियुं मधुकं चेति ।
अञ्जनादिर्गणो ह्येष रक्तपित्तनिर्बर्हणः ॥
विषोपशमनो दाहं निहन्त्याभ्यन्तरं भृशम् ॥

(सु० सू० 38/20)

प्रियङ्गुः प्रियवल्ली च फलिनी कहुनी प्रिया ।
वृत्रा गोवन्दनी श्यामा कारम्भा वर्णभेदनी ॥
प्रियङ्गुः शीतला तिक्ता मोहदाहविनाशिनी ।
ज्वरवान्तिहरा रक्तमुद्रिकतं च प्रसादयेत् ॥

(ध० नि० चन्दनादिवर्ग 16-17)

प्रियङ्गुः शीतला तिक्ता दाहपित्तास्त्रदोषजित् ।
वान्तिभ्रान्तिज्वरहरा वक्त्रजाड्यविनाशिनी ॥

(रा० नि० चन्दनादिवर्ग 30)

प्रियंगुः शीतला तिक्ता तुवराऽनिलपित्तहृत् ।
 रक्तातीसारदौर्गन्ध्यस्वेददाहज्वरापहा ॥
 गुल्मतृड्विषमेहघ्नी तद्वद् गंधप्रियंगुका ।
 तत्फलं मधुरं रूक्षं कषायं शीतलं गुरु ।
 विबन्धाध्मान बलकृत्संग्राहि कफपित्तजित् ॥

(भा० प्र० नि० कपूरविर्ग 102-104)

शालिः (मूलम्)

शीता रसे विपाके च मधुराश्चाल्पमारुताः ।
बद्धाल्पवर्चसः स्निग्धा बृंहणाः शुक्रमूत्रलाः ॥
रक्तशालिर्वरस्तेषां तूष्णाघ्नस्त्रिमलापहः ।
महांस्तस्यानु कलमस्तस्याप्यनु ततः परे ॥

(च० सू० 27/10,11)

मधुरा वीर्यतः शीता लघुपाका बलावहाः ।
पित्तघ्नान्नाल्पानिलकफाः स्निग्धा बद्धाल्पवर्चसः ।
तेषां लोहितकः श्रेष्ठो दोषघ्नः शुक्रमूत्रलः ।
चक्षुष्यो वर्णबलकृत् स्वर्यो हृद्यस्तृषापहः ॥
व्रणयो ज्वरहरश्चैव सर्वदोषविषापहः ॥

(सु० सू० 46/5-7)

स्वादुपाकरसाः स्निग्धा वृष्या बद्धाल्पवर्चसः ।
कषायानुरसाः पथ्या लघवो मूत्रला हिमाः ॥
शूकजेषु वरस्तत्र रक्तस्तूष्णात्रिदोषहा ।

(अ० ह० सू० 6/4, 5-1)

शीतो गुरुस्त्रिदोषघ्नो मधुरो गौरषष्टिकः ।
किञ्चित् ततो गुरुस्तस्मादपरो रसपाकतः ॥
महाशालिः परो वृष्यः कलमः श्लेष्मपित्तहा ।

(ध० नि० सुवर्णादिवर्ग 64)

शालयो लघवः स्निग्धा मधुरा रसपाकतः ॥
कषायानुरसा हृद्या रुच्या बद्धाल्पवर्चसः ।
शीतला बृंहणा वृष्या लघुपाकातिमूत्रलाः ॥
पित्तघ्नान्नाल्पानिलकफा बल्याः स्वर्याज्वरापहाः ।

(कै० नि० धान्यवर्ग 1,7,8,9-1)

कण्डनेन विना शुक्ला हैमन्ताः शालयः स्मृताः ॥
शालयो मधुराः स्निग्धा बल्या बद्धाल्पवर्चसः ।
कषाया लघवो रुच्याः स्वर्या वृष्याश्च बृंहणाः ॥
अल्पानिलकफाः शीताः पित्तघ्ना मूत्रलास्तथा ।
रक्तशालिर्वरस्तेषु बल्यो वर्ण्यस्त्रिदोषजित् ।
चक्षुष्यो मूत्रलः स्वर्यः शुक्रलस्तृड्ज्वरापहः ।
विषव्रणश्वासकासदाहनुद् वद्विपुष्टिदः ॥

(भा० प्र० नि० धान्यवर्ग 3,7,15,16-1)

शंखपुष्पी

.....समूलपुष्प्याः कल्कः प्रयोज्यः खलु शंखपुष्प्याः ।
आयुःप्रदान्यामयनाशनानि बलाग्निवर्णस्वरवर्धनानि ॥
मेध्यानि चैतानि रसायनानि मेध्या विशेषेण च शंखपुष्पी ॥

(च० चि० 1-3/30-31)

तत् सेव्यं शंखपुष्पी च यच्च मेध्यं रसायनम् ।

(च० चि० 10/62)

शङ्खपुष्पी कम्बुपुष्पी श्लूहा कम्बुमालिनी ।
तिलकी शङ्खकुसुमा मेध्या वनविलासिनी ॥
शङ्खिनी कटुतिक्तोष्णा कासपित्तबलासजित् ।
विषापस्मारभूतादीन् हन्ति मेध्या रसायनी ॥

(ध० नि० करवीरादिवर्ग 101-102)

शंखपुष्पी सरा मेध्या मता चेतोविकारिणी ।
रसायनी कषायोष्णा स्मृतिदा मोहनाशिनी ॥

(म० नि० अभयादिवर्ग 77)

शंखपुष्पी सरा स्वर्या कटुस्तिक्ता रसायनी ।
अनुष्णा वर्णमेधाग्निबलायुःकांतिदा हरेत् ॥
अपस्मारमथोन्मादमनिद्रां च तथा भ्रमम् ॥

(कै० नि० औषधिवर्ग 1496)

शंखपुष्पी हिमा तिक्ता मेधाकृत् स्वरकारिणी ।
ग्रहभूतादिदोषघ्नी वशीकरणसिद्धिदा ॥

(रा० नि० गुडूच्यादिवर्ग 133)

शंखपुष्पी तु शंखाह्वा मल्लिक्यकुसुमाऽपि च ।
शंखपुष्पी सरा मेध्या वृष्या मानसरोगहत् ॥
रसायनी कषायोष्णा स्मृतिकान्तिबलामिन्दा ।
दोषापस्मारभूताश्रीकुष्ठकृमिविषप्रणुत् ॥

(भा० प्र० नि० गुडुच्यादिवर्ग 269-270)

सप्तला

सप्तला चर्मसाहा च बहुफेनरसा च सा ।

ते गुल्मगरहृद्रोगकुष्ठशोफोदरादिषु ।
विकासितीक्ष्णरूक्षत्वाद्योज्ये श्लेष्माधिकेषु तु ॥

सप्तलायाश्च मूलानि गृहीत्वा भाजने क्षिपेत् ॥

(च० क० 11/2-4)

मूलिन्यः षोडशैःसप्तला विरेचने ।

(च० सू० 1/73, 76-77)

त्रिवृतां सप्तलां वचाम् ।

.....
पक्वाशयगते दोषे विरेकार्थं प्रयोजयेत् ॥

(च० सू० 2/9-10)

श्यामा सप्तला चेति ।

उक्तः श्यामादिरित्येष गणो गुल्म विषापहः ॥

आनाहोदरविड्भेदी तथोदावर्तनाशनः ॥

(सु० सू० 38/29-30)

श्यामादन्तीशंखिनीचर्मसाहा ।

श्यामाद्यो हन्ति गुल्मं विषमरुचिकफौ हृद्रुजं मूत्रकृच्छ्रम् ।

(अ० ह० सू० 15/45)

सातला शोधनी तिक्ता कफपित्तास्रदोषनुत् ।

शोफोदराध्मानहरा किञ्चिन्मारुतकृद्भवेत् ॥

(ध० नि० गुडूच्यादिवर्ग 238, 239)

सातला कटुका पाके वातला शीतलो लघुः ।
तिक्ता शोथकफानाहपित्तोदावर्तरक्तजित् ॥

(म० नि० अभयादिवर्ग 56)

सातला शीतला तिक्ता तीक्ष्णा पाके कटुर्लघुः ॥
हृद्याऽनिलं प्रकुरुते हरते हृद्गुं कफम् ।
पित्तोदावर्तकुष्ठाशोऽगुल्मोदरगरं विषम् ॥
आनाहकृमिशोऽफामारुचीरुभयशोऽधनी ॥

(कै० नि० ओषधिवर्ग 923-924)

सातला कटुका पाके वातला शीतला लघुः ।
तिक्ता शोफकफानाहपित्तोदावर्तरक्तजित् ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 77-78)

सातला कफपित्तघ्नी लघुतिक्तकषायिका ।
विसर्पकुष्ठविस्फोटव्रणशोफनिकृन्तनी ॥

(रा० नि० शताह्वादिवर्ग 195)

शताह्वा

शतपुष्पा मिशिर्घोषा पीतिका माधवी शिफा ।
अतिच्छत्रा त्ववाक्पुष्पी शताह्वा कारवी स्मृता ॥

शताह्वा कटुका तिक्ता स्निग्धोष्णा श्लेष्मवातजित् ।
ज्वरनेत्रव्रणान्हन्ति वस्तिकर्मणि शस्यते ॥

(ध० नि० शतपुष्पादिवर्ग 1-2)

शतपुष्पा कटुस्तिकता तीक्ष्णोष्णा दीपनी लघुः ॥
पित्तला कफवातघ्नी मेथ्या स्निग्धा ज्वरापहा ।
निहन्ति शूलदाहाक्षिरोगतृष्णावमिषणान् ॥

(कै० नि० औषधिवर्ग 1190-91)

शताह्वा तु कटुस्तिकता स्निग्धा श्लेष्मातिसारनुत् ।
ज्वरनेत्रव्रणघ्नी च वस्तिकर्मणि शस्यते ॥

(रा० नि० शताह्वादिवर्ग 13)

शतपुष्पा शताह्वा च मधुरा कारवी मिसिः ।
अतिलम्बी सितच्छत्रा संहितच्छत्रिकाऽपि च ॥

शतपुष्पा लघुस्तीक्ष्णा पित्तकृद्दीपनी कटुः ।
उष्णा ज्वरानिलश्लेष्मव्रणशूलाक्षिरोगहृत् ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 89-90)

शिशुः (पत्रम्)

चरके स्वेदोपगे, शिरोविरेचनोपगे च महाकषाये पठ्यते ।

(च० सू० 4/22, 27)

यवानी चार्जकश्चैव शिशु शालेयमृष्टकम् ।
हृद्यान्यास्वादनीयानी पित्तमुत्क्लेशयन्ति च ॥

(च० सू० हरितवर्ग 27/167)

कटुः सक्षारमधुरः शिशुस्तिकतोऽथ पिच्छिलः ।
मधुशिशुः सरस्तिकतः शोफघ्नो दीपनः कटुः ॥

(सु० सू० 46/237)

कुठेरशिशु प्रभृति ग्राहि शालनम् ।
विदाहि कटु रूक्षोष्णं हृद्यं दीपनरोचनम् ॥
दृक्शुक्रमिहतीक्ष्णं दोषोत्क्लेशकरं लघु ।

(अ० ह० सू० 6/106-107)

शिशुस्तिकतः कटुश्चोष्णः कफशोफसमीरजित् ।
कृम्यामविषमेदोघ्नो विद्रधिप्लीहगुल्मनुत् ॥

(ध० नि० करवीरादिवर्ग 36-38)

शिशुस्तीक्ष्णो लघुग्राही वह्निदः कफवातजित् ।
तीक्ष्णोष्णो विद्रधिप्लीहव्रणघ्नो रक्तपित्तकृत् ॥

(म० नि० शाकवर्ग 72)

शिशुश्च कटुतिक्तोष्णस्तीक्ष्णो वातकफापहः ।
मुखजाड्यहरो रुच्यो दीपनो व्रणदोषनुत् ॥

(रा० नि० मूलकादिवर्ग 61)

शिशुपत्रभवं शाकं रुच्यं वातकफापहम् ।
कटूष्णं दीपनं पथ्यं कृमिघ्नं पाचनं परम् ॥

(श० नि० मूलकादिवर्ग 71)

शिशुः कटुः कटुः पाके तीक्ष्णोष्णो मधुरो लघुः ।
दीपनो रोचनो रूक्षः क्षारस्तिकतो विदाहकृत् ॥
संग्राही शुक्रलो हृद्यः पित्तरक्तप्रकोपणः ।
चक्षुष्यः कफवातघ्नो विद्रधिश्चयथुक्रिमीन् ॥
मेदोऽपचीविषप्लीहगुल्मगण्डव्रणान्दहरेत् ।
शिशुवल्कलपत्राणां स्वरसः परमार्तिहृत् ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 105-109)

स्थूलैला

चरके शिरोविरेचनद्रव्येषु , श्वासहरे, अङ्गमर्दप्रशामने च
महाकषाये पठ्यते ।

(च० सू० 2/3 ; 4/37, 44)

एलादिको वातकफौ निहन्याद्विषमेव च ।
वर्णप्रसादनः कण्डूपिडकाकोठनाशनः ॥

(सु० सू० 38/25)

एलादिको वातकफौ विषं च विनियच्छति ।
वर्णप्रसादनः कण्डूपिटिकाकोठनाशनः ॥

(अ० ह० सू० 15/44)

एला तिक्ता च लघ्वी स्यात्कफवातविषत्रणान् ।
वस्तिकण्ठरुजो हन्ति मुखमस्तकशोधनी ॥

(ध० नि० शतपुष्यादिवर्ग 46)

स्थूलैला रोचनी तीक्ष्णा लघूष्णा कफपित्तजित् ।
हल्लासविषबस्त्यास्यशिरोरुग्वभिकासनुत् ॥

(म० नि० कर्पूरादिवर्ग 25-26)

भद्रैला कटुका पाके रसे पित्ताग्निक्ल्लघुः ।
रूक्षोष्णा रोचनी कासकफवातास्रश्वासहा ।
हन्ति हल्लासतृट्कण्डूशिरोवस्त्यास्यरुग्वमीः ॥

(कै० नि० ओषधिवर्ग 1343-1344)

एलाद्वयं शीतलतिकमुक्तं सुगन्धि पित्तार्तिकफापहारि ।
करोति ह्रोगम्लार्तिबस्तिशूलघ्नमत्र स्थविरा गुणाद्या ॥

(रा० नि० पिप्ल्यादिवर्ग 72)

एला स्थूला च बहुला पृथ्वीका त्रिपुटाऽपि च ।
भद्रैला बृहदेला च चन्द्रबाला च निष्कुटिः ॥
स्थूलैला कटुका पाके रसे चानलकृल्लघुः ।
रूक्षोष्णा श्लेष्मपित्तास्रकण्डूश्वासतृषाऽपहा ।
हल्लासविषबस्त्यास्यशिरोरुग्मिकासनुत् ॥

(भा० प्र० नि० कपूरादिवर्ग 60-62)

तेजोवती

तेजस्विनी तेजवती तेजोह्वा तेजनीति च ।
अश्वघ्नी वल्कला शीता पारिजाता महौजसी ॥
तेजोह्वा श्लेष्मवातघ्नी रुच्या दीपनपाचनी ।

(ध० नि० गुडूच्यादिवर्ग 266)

वामनो रक्तसंग्राही रक्तातीसारहन्मतः ।
तेजिनी कफहृद्रोगमुखदंतादिरोगहत् ॥

(सोढल नि० 2/246)

तेजोवती कटुस्तिक्ता रुच्या दीपनपाचनी ॥
उष्णा वातकफश्वासकासहिध्मास्यरोगजित् ।

(कै० नि० ओषधीवर्ग 1040)

तेजस्विनी तेजवती तेजोह्वा तेजनी तथा ॥
तेजस्विनी कफश्वासकासास्यामयवातहत् ।
पाचन्युष्णाकटुस्तिक्ता रुचिवह्निप्रदीपनी ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 169-170)

तुलसी (पञ्चांगम्, पत्रम्)

चरके श्वासहरे महाकषाये (सुरसा नाम्ना) पठ्यते ।

(च० सू० 4/37)

हिककाकासविषश्वासपार्श्वशूलविनाशनः ।
पित्तकृत्कफवातघ्नः सुरसः (तुलसी) पूतिगन्धहा ॥

(च० सू० 27/166)

कफानिलविषश्वासकासदौर्गन्ध्य नाशनः ।
पित्तकृत् पार्श्वशूलघ्नः सुरसः समुदाहृतः ॥

(सु० सू० 46/233-234)

सुरसादिर्गणो ह्येष कफहृत् कृमिसूदनः ।
प्रतिश्यायारुचिश्वासकासघ्नो व्रणशोधनः ॥

(सु० सू० 38/19)

हिष्माकासविषश्वासपार्श्वरुक्पूतिगन्धहा ।
सुरसः सुमुखो नातिविदाही गरशोफहा ॥

(अ० ह० सू० 6/108)

तुलसी लघुरुष्णा च रूक्षा कफविनाशिनी ।
कृमिदोषं निहन्त्येषा रुचिकृद् वह्निदीपनी ॥

(ध० नि० करवीरादि वर्ग 46)

तुलसी सुरसा गौरी भूतघ्नी बहुमञ्जरी ।
तुलसी कटुका तिक्ता हृद्योष्णा दाहपित्तकृत् ॥
दीपनी कुष्ठकृच्छ्रास्त्रपार्श्वरुक्कफवातजित् ।

(म० नि० कर्पूरादिवर्ग 107)

तुलसी तुवरा तिक्ता तीक्ष्णोष्णा कटुपाकिनी
रूक्षा हृद्या लघुः कट्वी दाहपित्ताग्निवर्धिनी
जयेद् वातकफश्वासकासहिध्मावमिकृमीन् ॥
दौर्गन्ध्यपार्श्वरुक्कुष्ठविषकृच्छ्राशमदृग्गदान्

(कौ० नि० ओषधिवर्ग 1554,1555)

तुलसी कटुतिक्तोष्णा सुरभिः श्लेष्मवातजित् ।
जन्तुभूतक्रिमिहरा रुचिकृद्वातशान्तिकृत् ॥

(रा० नि० करवीरादिवर्ग 150)

तुलसी सुरसा ग्राम्या सुलभा बहुमञ्जरी ।
अपेतराक्षसी गौरी भूतघ्नी देवदुन्दुभिः ।
तुलसी कटुका तिक्ता हृद्योष्णा दाहपित्तकृत् ।
दीपनी कुष्ठकृच्छ्रास्रपार्श्वरुक्कफवातजित् ॥
शुक्ला कृष्णा च तुलसी गुणैस्तुल्या प्रकीर्तिताः ।

(भा० प्र० नि० पुष्पवर्ग 62-63)

वचा

चरके विरेचनद्रव्येषु (सू० 2/8) शिरोविरेचनद्रव्येषु च (वि० 8/158) ;
लेखनीये, तृप्तिघ्ने, अर्शोघ्ने, आस्थापनोपगे, शीतप्रशामने, संज्ञास्थापने च
महाकषाये पठ्यते ।

(च० सू० 4/3,11,12,25,42,48)

सुश्रुते पिप्पल्यादौ, वचादौ, मुस्तादौ च गणे पठ्यते ।

(सु० सू० 38/10,12,27)

एतौ वचाहरिद्रादि गणौ स्तन्यविशोधनौ ।
आमातिसारशामनौ विशोषाद्दोषपाचनौ ॥

(सु० सू० 38/12)

सुश्रुते ऊर्ध्वभागहरे वर्गे पठ्यते ।

(सु० सू० 39/6)

‘सौवर्णं सुकृतं चूर्णं कुष्ठं मधु घृतं वचा ।
.....कुमाराणां वपुर्मैधाबलबुद्धिविवर्धनाः ॥’

(सु० शा० 10/68,70)

‘दिवारात्रौ वचाग्रन्थिं मुखे संधारयेत् भिषक् ।
तेन सौख्यं भवेत्तस्य मुखरोगाद्विमुच्यते ॥’

(हारीत संहिता तृतीयस्थान अ० 46/32)

वामनी कटुतिक्तोष्णा वातश्लेष्मरुजापहा ॥
कण्ठ्या मेध्या च कृमिहृद्भिबन्धाध्मानशूलनुत् ॥

(ध० नि० शतपुष्पादि वर्ग 7)

वचा तिक्ता कटुः पाके कटुरुष्णामपाचनी ।
दीपनी वामनी मेध्या जीवनी वाक्स्वरप्रदा ॥
हन्त्युन्मादमपस्मारं रक्षोजन्तुकफानिलान् ।
शूलं विबन्धमाध्मानं शकृन्मूत्रविशोधनी ॥

(कै० नि० ओषधिवर्ग 1216-1217)

वचा तिक्ता कटूष्णा च कफामग्रन्थिशोफनुत् ।
वातज्वरातिसारघ्नी वान्तिकृन्मादभूतनुत् ॥

(रा० नि० पिप्पल्यादिवर्ग 9)

वचोग्रगन्धा षड्ग्रन्था गोलोमी शतपर्विका ।
क्षुद्रपत्री च मङ्गल्या जटिलोग्रा च लोमशा ॥
वचोग्रगन्धा कटुका तिक्तोष्णा वान्तिवह्निकृत् ।
विबन्धाध्मानशूलघ्नी शकृन्मूत्रविशोधनी ॥
अपस्मारकफोन्मादभूतजन्तवनिलान्हरत् ॥

(भा० प्र० नि० हरीतक्यादिवर्ग 101-103)

'यः खादेत् क्षीरभक्ताशी माक्षिकेण वचारजः ।
अपस्मारं महाघोरं सुचिरोत्थं जयेद् ध्रुवम् ॥

(चक्रदत्त अपस्माराधिकार 11)

वत्सनाभः

चरके ऐन्द्रीरसायने अल्पमात्रायां प्रयुक्तः ।

(च० चि० 1/3/23-28)

चरके मूलजविषे पठितः ।

(च० चि० 23/11)

प्रीवास्तम्भो वत्सनाभे पीतविण्मूत्रनेत्रता ।

(सु० क० 2/5 कन्दविषे, 6,12)

विषं प्राणहरं प्रोक्तं व्यायि च विकाशि च ।
आग्नेयं वातकफहृद्योगवाहि मदावहम् ॥
तदेव युक्तियुक्तं तु प्राणदायि रसायनम् ।
योगवाहि त्रिदोषघ्नं बृंहणं वीर्यवर्द्धनम् ॥
(विषं योगवाहि परं वातश्लेष्मजित्सन्निपातहत् ।

(ध० नि० मिश्रकादिवर्ग 114-116)

(भा० प्र० नि० धात्वादि वर्ग 203,204)

वत्सनाभोऽतिमधुरः सोष्णो वातकफापहः ।

कण्ठरुक्सन्निपातघ्नः पित्तसन्तापकारकः ॥

(रा० नि० पिप्पल्यादि वर्ग 222-223)

यः कन्दो गोस्तनाकारो न दीर्घः पञ्चमालिंत् ।

न स्थूलो गोस्तनादूर्ध्वं वत्सनाभं तु पाण्डुरम् ॥

(रस रत्न समुच्चय)

विदारी

जीवनो बृंहणो वृष्यः कण्ठ्यः शस्तो रसायने ।
विदारीकन्दो बल्यश्च मूत्रलः स्वादुशीतलः ॥

(च० सू० 27/118)

चरके कण्ठ्ये, स्नेहोपग महाकषाये च पठ्यते ।

(च० सू० 4/9,21)

मधुरो बृंहणो वृष्यः शीतः स्वर्योऽतिमूत्रलः ।
विदारिकन्दो बल्यश्च पित्तवातहरश्च सः ॥

(सु० सू० 46/300)

सुश्रुते विदारिगन्धादिवर्गे, वल्लीपंचमूले, पित्तसंशामनवर्गे च पठ्यते

(सु० सू० 38/4,72 ; 39/8)

विदारी शिशिरा स्वादुर्गुरुः स्निग्धा समीरजित् ।
पित्तास्रजित्तथा बल्या वृष्या चैवप्रकीर्तिता ॥

(ध० नि० गुडूच्यादिवर्ग 147-148)

विदारी बृंहणी वृष्या सुस्निग्धा शीतला गुरुः ॥
मधुरा मूत्रला स्वर्या स्तन्यवर्णबलप्रदा ।
पित्तानिलास्रदाहघ्नी जीवनीया रसायनी ॥

(कै० नि० ओषधिवर्ग 1583, 1584)

विदारी मधुरा शीता गुरुः स्निग्धाऽस्रपित्तजित् ।
ज्ञेया च कफकृत्पुष्टिबल्या वीर्यविवर्द्धिनी ॥

(रा० नि० मूलकादिवर्ग 101)

विदारी मधुरा स्निग्धा बृंहणी स्तन्यशुक्रदा ॥
शीता स्वर्या मूत्रला च जीवनी बलवर्णदा ।
गुरुःपित्तास्रपवनदाहान् हन्ति रसायनी ॥

(भा० प्र० नि० गुडूच्यादिवर्ग 181,182)

यवः (फलम्)

रूक्षः शीतोऽगुरुः स्वादुर्बहुवातशकृद्यवः ।
स्थैर्यकृत्सकषायस्तु बल्यः श्लेष्मविकारनुत् ॥
हृत्पाण्डुग्रहणीदोषप्लीहानाहगलग्रहान् ।
कासं कफजमर्शांसि यावशूको(क्षार) व्यपोहति ।

(च० सू० 27/18,300)

यवः कषायो मधुरो हिमश्च कटुर्विपाके कफपित्तहारी ।
व्रणेषु पथ्यतिलवच्च नित्यं प्रबद्धमूत्रो बहुवातवर्चाः ॥
स्थैर्याग्निमेधास्वरवर्णकृच्च सपिच्छिलः स्थूलविलेखनश्च ।
मेदोमरुत्तृडहरणोऽतिरूक्षः प्रसादनः शोणितपित्तयोश्च ॥

(सु० सू० 27/41-42)

रूक्षः शीतो गुरुः स्वादुः सरो विड्वातकृद्यवः ॥
वृष्यः स्थैर्यकरो मूत्रमेदःपित्तकफाञ्जयेत् ।
पीनसश्वासकासोरुस्तम्भकण्ठत्वगामयान् ॥

(ध० नि० सुवर्णादिवर्ग (धान्यानि) 67-68)

यवः कषायो मधुरः सुशीतलः प्रमेहजित्तिकफापहारकः ।
अशूकमुण्डस्तु यवो बलप्रदो वृष्यश्च नृणां बहुवीर्यपुष्टिदः ॥

(रा० नि० शाल्यादिवर्ग 70)

यवः कषायो मधुरः शीतलो लेखनो मृदुः ।
व्रणेषु तिलवत्पथ्यो रूक्षो मेधाऽग्निवर्धनः ॥
कटुपाकोऽनभिष्यन्दी स्वर्यो बलकरो गुरुः ।
बहुवातमलो वर्णस्थैर्यकारी च पिच्छिलः ॥
कण्ठत्वगामयश्लेष्मपित्तमेदःप्रणाशनः ।
पीनसश्वासकासोरुस्तम्भलोहिततृट्प्रणुत् ॥

(भा० प्र० नि० धान्यवर्ग 28-30)

यवासकः

चरके अर्शोघ्ने, तृष्णानिग्रहणे महाकषाये च धन्वयासक नाम्ना
तथा दुरालभा नाम्ना हिक्कानिग्रहणे, कासहरे महाकषाये च पठ्यते

(च० सू० 4/12,29,30,36)

कषायमधुरा शीता सतिक्ता यासशर्करा ।

(च० सू० 27/238.2)

यवासशर्करा मधुरकषाया तिक्तानुरसा श्लेष्महरी सरा चेति ।

(सु० सू० 45/167)

यवासकः स्वादुतिक्तो ज्वरतृड् रक्तपित्तनुत् ।

(ध० नि० गुडूच्यादिवर्ग 22, 23)

धन्वयासो हिमस्तिक्तः कषायो मधुरो लघुः ॥
सरो निहन्ति पित्तास्रकफमेदोमदभ्रमान् ।
विसर्पकुष्ठवातास्रतृष्णाकासवमिज्वरान् ॥

(कै० नि० ओषधिवर्ग 985-986)

यासो मधुरतिक्तोऽसौ शीतः पित्तार्तिदाहजित् ॥
बलदीपनकृत्तृष्णा कफछर्दिविसर्पजित् ॥

(सो० नि० शताह्वादिवर्ग 43,46)

यासो यवासो दुःस्पर्शो धन्वयासः कुनाशकः ।
दुरालभा दुरालम्भा समुद्रान्ता च रोदिनी ॥
गान्धारी कच्छुराऽनन्ता कषाया हरिविग्रहा ।
यासः स्वादुः सरस्तिक्तस्तुवरः शीतलो लघुः ॥
कफमेदोमदभ्रान्ति पित्तास्रकुष्ठकासजित् ॥
तृष्णाविसर्पवातास्रवमिज्वरहरः स्मृतः ।

(भा० प्र० नि० गुडूच्यादिवर्ग 211-214)

INDEX

[A]

- Abja -69
Abrus precatorius Linn. -46
Acacia leucophloea Willd. -15
Acetic Acid -209
Acetic Acid Dilute -209
Acetic Acid Glacial -209
Acetic Acid, Lead free -210
Acetic Acid, XN -209
Acetone -210
Acetone Solution Standard -210
Achcu -44
Achyranthes aspera Linn. -7
Aconite -171
Aconitum chasmanthum Stapf. Ex Holmes -171
Acorin -169
Acorus calamus Linn. 168
Ada -12
Adamalati -98
Adarakha -12
Adavimamidi -5
Adhero -7
Adi -12
Adkebeeluvalli -40
Adrak -12
Adu -12
Aghada -7
Akharotu -3
Akalakarabha -1
Akalbasing -3
Akalkara -1
Akallaka Hommugulu-1
Akallakar -1
Akarakara -1
Akarakarabh -1
Akarakarabha -1
Akharoda -3
Akharot -3
Akharota -3
Akhrot -3
Akhu -48
Akkalakada -1
Akkalakarra -1
Akkalgaro -1
Akkallakara -1
Akkaraka -1
Akkarakaram -1
Akki -145
Akkikaruka -1
Akravu -1
Akrod -3
Akrodappu -3
Akrottu -3
Akrotu -3
Aksiva -155
Aksoda -3
Aksota -3
Albumin -176
Albuminoid -142
Alcohol -210
Alcohol (20 Percent) -212
Alcohol (25 Percent) 212
Alcohol (50 Percent) 211
Alcohol (60 Percent) 211
Alcohol (80 Percent) 211
Alcohol (90 Percent) 211
Alcohol, Aldehyde Free -212
Ale -12
Aleicha -158
Alhagi pseudalhagi (Bieb.) Desv. -177
Alkaloid -2,23,26,30,34,37,43,51,53,63,65,68,
70,84,90,94,100,108,132,134,136,140,149,172
Alla -12
Alla Nereduchettu -54
Allam -12
Altemanthera denticulata R.Br. -104
Altemanthera nodiflora R.Br. -104
Altemanthera repens Gmel., non Link. -104
Altemanthera sessilis (Linn.) R. Br. -104
Altemanthera triandra Lam. -104
Amada -5
Amari -122
Ambada -5

- Ambadam -5
 Ambado -5
 Ambalam -5
 Ambate -5
 Ambazham -5
 Ambeda -5
 Ambinadi Desavaram -133
 Ammonia, Ammonium Chloride Solution, Strong -212
 Ammonia, Buffer Solution -213
 Ammonia, Solution, Dilute -212
 Ammonia, Solution, Iron free -213
 Ammonia, Solution, Strong -212
 Ammonia, XN -212
 Ammonium Chloride -213
 Ammonium Chloride Solution -213
 Ammonium Nitrate -214
 Ammonium Oxalate -214
 Ammonium Oxalate Solution -214
 Ammonium Phosphate -214
 Ammonium Phosphate Solution -214
 Ammonium Thiocyanate -214
 Ammonium Thiocyanate, 0.1 N -215
 Ammonium Thiocyanate Solution -215
 Amomum subulatum Roxb. -158
 Ampozham -5
 Amputtai -5
 Amra -5
 Amrata -5
 Amratakamu -5
 Amvara -5
 α -Amyrin -45
 β -Amyrin -16,45
 Anacardic acid, -20
 Anacyclus pyrethrum DC. -1
 Anaitippalee -40
 Anar -31
 Anbalamu -5
 Anethum graveolens DC. -153
 Anethum graveolens Linn. Var. sowa Roxb. -153
 Anethum sowa Roxb. -153
 Anisaldehyde-sulphuric Acid Reagent -215
 Anomalin -115
 Anthocephalus cadamba Miq. -64
 Anthocephalus indicus A. Rich. -64
 Apamarga -7
 Apamg -7
 Aparajita -10
 Aqarqarha -1
 Arattam -64
 Aravindan -69
 Ardrak -12
 Ardraka -12
 Ari -145
 Arimeda -15
 Arintajinamgi -60
 Arishi -145
 Arishimajingai -60
 Arista -124
 Arjun -17
 Arjuna -17
 Arjunetine -18
 Arjunine -18
 Arsenic Trioxide -215
 Arulundi -124
 Aruskara -19
 Aruthummatti -50
 Aruveppu -126
 Aryaveppu -124
 Asamyl alcohol -169
 Asarone -169
 Ascorbic acid -156
 Aspartic acid -32
 Asteracantha longifolia Nees -88,91,93
 Atees -171
 Atti -60
 Attipali -40
 Attutekka -64
 Aviri -122
 Avittal -120
 Avuri -122
 Azadirachta indica A. Juss. -124, 126.
- [B]**
- Baara aliach -158
 Bach -168
 Bachhnaag -171
 Bachnaga -171
 Bachnak -171
 Bacopa monnieri Linn. -25
 Bada aleicha -158
 Badanuni -95
 Badi Elaichi -158
 Badi Lona -95
 Badikateri -27
 Badisa -131
 Badishep -153
 Badjam -54
 Bahli -104
 Bahukanda -38
 Bahuvalkala -141
 Baje -168

Bakan -124
 Bakayan -124
 Balada -71
 Baladur -19
 Balantanimba -124,126
 Ballidurabi -177
 Bamanavari -25
 Bana Tulsi -165
 Baraloniya -95
 Baranunia -95
 Barium Chloride -215
 Barium Chloride Solution -216
 Barley -175
 Barlibiyam -175
 Barly -175
 Basanaag -171
 Basanalli -171
 Basari -135
 Bassia latifolia Roxb. -99
 Bastard peak -125
 Beesh -171
 Bekalu -71
 Belada hannu -71
 Belalu -71
 Beraelam -158
 Berberine -161
 Berberis aristata DC. -33
 Berberry -33
 Bevinama -124
 Bevu -124, 126
 Bhadra -158
 Bhadraila -158
 Bhalata -19
 Bhangara -21
 Bhangaraiya -21
 Bhangaro -21
 Bhangra -21
 Bhangro -21
 Bhata -145
 Bhata Chamul -145
 Bhatta -145
 Bhatto -145
 Bhatuashak -177
 Bhedeleton -173
 Bhedilata -136
 Bheemraja -21
 Bhela -19
 Bhelaguti -19
 Bhilamu -19
 Bhilava -19
 Bhilavan -19
 Bhilawa -19
 Bhodroparni -42
 Bhoikolu -173
 Bholai -19
 Bholghasiya -35
 Bholllataki -19
 Bhonykoru -173
 Bhringiraja -21
 Bhrnga -21
 Bhrngaja -21
 Bhrngaraja -21
 Bhudraparni -42
 Bhuiankakharu -173
 Bhuikohala -173
 Bhumikusmanda -173
 Bibba -19
 Bilikalli -150
 Bilikantisoppu -147
 Bilimatti -17
 Bilvara -71
 Birami -25
 Biranj -145
 Bisa -171
 Bish -171
 Bismuth Oxynitrate -216
 Bitter Apple -52
 Bitter Gourd -83
 Bitter Principle -127
 Biyyamu -145
 Borax -226
 Boric Acid -226
 Boric Acid Solution -217
 Brahmi -25
 Brahmi vazhukkai -25
 Brahmibuti -25
 Brhati -27
 Brhatphala -38
 Bromine -217
 Bromine Solution -217
 Bromocresol Purple -217
 Bromocresol Purple Solution -217
 Bromophenol Blue -217
 Bromophenol Blue Solution -217
 Bromothymol Blue -218
 Bromothymol Blue Solution -218
 Buchanania lanzan Spreng. -141
 Buchanania latifolia Roxb. -141
 Budi Eleichi -158
 Butea monosperma (Lam.) Kuntze. -128
 Butyl Crotonyl isothiocyanate sulphide -111
 Butyric acid -43
 Byakud -27

[C]

- Cadmium Iodide -218
 Cadmium Iodide Solution -218
 Cala -145
 Calcium -61
 Calcium Carbonate -218
 Calcium Chloride -218
 Calcium Chloride Solution -218
 Calcium Hydroxide -218
 Calcium Hydroxide Solution -218
 Calcium Sulphate -218
 Callicarpa macrophylla Vahl. -143
 Camata -128
 Campesterol -106
 Camphene -13,166
 Camphor -219
 Canada Balsam Reagent -219
 Canuga -75
 Carbohydrate -97,156
 Carbon Dioxide -219
 Carbon Disulphide -219
 Carbon Tetrachloride -220
 Cardol -20
 Carissa carandas Linn. 73
 Carmasahva -150
 Carotene -156
 Carvacrol -166
 Caryophyllene -166
 Catechol Violet -224
 Catechol Violet Solution -224
 Caustic Alkali Solution 5 Percent -220
 Cavika -29
 Celastrus paniculatus Willd. -62
 Cerupunnari -62
 Chab -29
 Chabak -29
 Chagalpupti -150
 Chagaveru -116
 Chagulputputi -150
 Chaikath -29
 Chama Tha-128
 Chanothee -46
 Charal -141
 Charcoal Decolorising -220
 Charoli -141
 Chasma Lantha -150
 Chavaka -29
 Chaval -145
 Chavka -29
 Chavya -29
 Chavyam -29
 Chawl -145
 Chedu Puchcha -50
 Chedupuchcha -52
 Cheeyakattuvellari -50
 Chei-29
 Cheno-175
 Chenthamara -69
 Chepaan -29
 Chera -19
 Cheru Vazhuthina -27
 Chettu -128
 Chevuyam -29
 Chevyamu -29
 Chhotalunia -95
 Chhuimui -98
 Chhuimui -98
 Chichuriti -27
 Chinnadoolagondi -177
 Chirangi -141
 Chiraungi -141
 Chirchita -7
 Chironji -141
 Chiru vazhuthalai -27
 Chloral Hydrate -220
 Chloral Hydrate Solution -221
 Chloral Iodine Solution -221
 Chlorinated Lime -221
 Chlorinated Lime Solution -221
 Chloroform -221
 Chloroform water -222
 Chonotee -46
 Chowli -141
 Chromic Sulphuric Acid Mixture -222
 Chromium Trioxide -222
 Chromotropic Acid -222
 Chromotropic Acid Solution -222
 Cineol -13,159
 Citric Acid -32,72,223
 Citric Acid, Iron Free -223
 Citrullus colocynthis Schrad -52
 Clitoria -10
 Clitroria ternatea Linn. -10
 Cobras Saffron -118
 Coke -145
 Colocynth -50
 Colocynthin -53
 Common Indian Purslane -95
 Convolvulus pluricaulis Choisy -147
 Copper Acetate -223
 Copper Acetate Solution -223
 Copper Sulphate -223
 Copper Sulphate Anhydrous -224

Copper Sulphate Solution -224
Coral tree -131
Corava -145
Cresol Red -224
Cresol Red Solution -224
Croton -58
Croton tiglium Linn. -58
Cubeb -29
Cucumis melo var. utilissimus Duthie & Fuller -38
Cucumis utilissimus Roxb -38
Culli -91,93
Cuvanna Kunni -46

[D]

Dadama -31
Dadima -31
Dadimacchada -31
Dadimba -31
Dahara Karanja -75,77,79,81
Daitya -114
Dalimba -31
Damgara -145
Danamma -31
Danta Satha -71
Dantabija -31
Darhald -33
Darigummadi -173
Daruhald -33
Daruhaldi -33
Daruhaldi -33
Daruhaldi -33
Daruharidra -33
Daruhuladur -33
Darvi -33
Datkachu -66
Delphinidin diglycoside -32
Demethoxy Kanugin -76,78,80
Dengabheji -27
Dhak -128
Dhamasa -177
Dhan -145
Dhana -145
Dhanarmul -145
Dhanvayasamu -177
Dhanya -145
Dhanyamu -145
Dhvanksamaci -66
Diastase -94
Dihydro Stigmasterol -134
Dihydropyrano Coumarine -115

Dimethyl Yellow -224
Dimethyl Yellow Solution -224
Dinitrophenyl Hydrazine -224
Dinitrophenyl Hydrazine Solution -225
Dintena -10
Diphenyl Benzidine -225
Diphenyl Carbazide -225
Diphenyl Carbazide Solution -225
Diphenyl Thiocarbazon -225
Disodium Ethylenediamine Tetraacetate -225
Dithouri -81
Dodda Yalakki -158
Doddaganugae -62
Doddagoni Soppu -95
Dorale -27
Dorli -27
Dosakaya -38
Dragendorffs Reagent -225
Dronaphool -35
Dronapuspi -35
Drum Stick Tree -155
Dudagorai -95
Duralabha -177

[E]

Eagio -173
Eandri -52
Eclipta alba Hassk -21
Ecliptine -23
Ekharo -88
Ekthro -91
Elaicho -158
Ellagic acid -32,55
Eluppa -102
Endrayana -50
Endri -52
Enugopippal -40
Eosin -226
Eosin Solution -226
Eppimara -102
Eriochrome Black T -226
Ervaru -38
Erythrina indica Lam -131
Essential Oil -18,92,119,154,164,166
Estrone -31
Ether -226
Ethyl Acetate -226
Ethyl Alcohol -226
Eugenia cuminii Druce. -54,56
Eugenia jambolana Lam. 54,56
Eugenol -166,169

Euphorbia dracunculoides Lam -150
Euphorbine -152

[F]

Fat -32,65,176
Fenugreek-107
Feronia elephantum Correa -71
Feronia limonia (Linn.) Swingle -71
Ferric Ammonium Sulphate -227
Ferric Ammonium Sulphate, 0.1 N -227
Ferric Chloride -227
Ferric Chloride Solution -227
Ferrous Sulphate -228
Ferrous Sulphate Solution, Acid -228
Ferrous Sulphate Solution -228
Ficus infectoria Roxb. -135
Ficus lacor Buch. Ham. -135
Ficus lucescens Blume. -135
Filfil Daraz -133
Fixed oil 41,59
Flavone -76,80
Flavone glycoside -176
Flavonoid -37,53
Formaldehyde Solution -228
Formaldehyde Solution, Dilute -228
Furano Compound -80
Furanoflavone -80
Furanoflavone -3'methoxy pongapin -82

[G]

Gaisha -35
Gajakesara -118
Gajakrisna - 40
Gajapeepal - 40
Gajapipalee - 40
Gali -120
Galiparna -120
Gallic acid -32,55,129
Gamargachha -42
Camatin -80
Gambar - 42
Gambhari - 42
Gambu -54
Gandali -104
Gandha Prasarini -137
Gandhakuti -114
Gandhapatra -137
Gandhapriyangu -138
Gandhavati -114
Ganger - 44

Gangeran - 44
Gangeru - 44
Gangeruki - 44
Gangeti -33,44
Gangunge beeja -62
Gangunge humpu -62
Ganikayeagida -66
Ganike -66
Ganikegida -66
Ganikesopu -66
Ganna - 48
Ganthoda -133
Gantoda -133
Ganuga -75,77,79,81
Garakshachakule - 44
Garden Night Shade -66
Garden Purslane -95
Gari -122
Garna -73
Gartkalambuka -104
Garujalu -21
Garukhiye - 50
Gavaksi -50,52
Gavhala -143
Gheraku - 48
Ghodaguli -44
Ghodavaca -168
Ghoduvaj -168
Ghodvach -168
Ghodvel -173
Ghola -95
Ghongchi -46
Ghotika -95
Ghrtakaranja -75,77,79,81
Ghungchi -46
Ginger -12
Girikamika -10
Girikamika Balli -10
Glabra I & II -80
Globulin -176
Gluconic acid -174
Glucoside -41,47,86,111,113,169
Glutamine -32
Glutinin -176
Glycerin -229
Glycerin Solution -229
Glyco-alkaloid -152
Glycoside -30,37,55,74,84,121, 123,144
Glycyrrhizin - 47
Gmelina arborea Roxb -42
Gnazalpoo -143
Gnazhal -143

- Gobbi -93
 Gokarna -10
 Gokarni -10
 Golimidi -91
 Golmidi -88
 Gomobati -35
 Gontima goru-Teega -137
 Gora-bach -168
 Gothakakucti - 50
 Gothkakudi -52
 Granthika -133
 Greater Cardamom -158
 Grewia populifolia Vahl - 44
 Grewia tenax (Forsk.) Aschers & Schwf. - 44
 Guar Babool -15
 Gudakamai -66
 Gudapuspa -102
 Gudari Sag -104
 Gulagunja - 46
 Gulla -27
 Guluganji -46
 Guma -35
 Gumaditeku -42
 Gumadi belli -173
 Gumadigida -173
 Gumma -35
 Gunja -46
 Guntagalagara -21
 Guntakalagara -21
 Guriginga -46
 Gurivinda -46
 Gurugada Soppu-21
 Guyababla -15
- [H]**
- Hagalakai -83
 Haggoratige -114
 Halippe -102
 Halivanadamar -131
 Halukaratige-116
 Halukoratige -114
 Haminamara -71
 Hannu - 42
 Hanzal - 50,52
 Haramibaval -15
 Haranvel -137
 Haribaval -15
 Hasishunti -12
 Hastipani -38
 Hastipipali - 40
 Havamikke -52
- Havumakke -50
 Havumekke -52
 Havumekke Kayi -52
 Heel Kalan -158
 Heggulla -27
 Hellebore -85
 Hema -118
 16-Hentriacontane -106
 Herpestis monnieria (Linn.) H.B. & K. -25
 Hesarani -137
 n-Hexacosanol -16
 Hippali -133
 Hippe -102
 Hippegida -102
 Hippenara -102
 Hiranvel -137
 Holy Basil -162, 165
 Holiptiya -64
 Honagonne soppu -104
 Hongar -131
 Honge - 81
 Honge Beru -77,79
 Hordeum sativum Pers. -175
 Hordeum vulgare Linn. -175
 Horse Radish Tree -155
 Hulagilu -81
 Hydrazine Hydrate -230
 Hydrochloric Acid -231
 Hydrochloric Acid, N -231
 Hydrochloric Acid, XN -230
 Hydrochloric Acid Concentrated -230
 Hydrochloric Acid Dilute -230
 Hydrogen Peroxide Solution -231
 Hydrogen Sulphide -231
 Hydrogen Sulphide Solution -231
 Hydroxylamine Hydrochloride -231
 Hydroxylamine Hydrochloride Solution -232
 Hygrophila spinosa T. Anders -88,91,93
- [I]**
- Icchi -135
 Ikha -48
 Iksu -48
 Iksura -88,91,93
 Iksuraka -88,91,93
 Ilippa -102
 Iluppa -102
 Iluppai -102
 Iluppi - 102
 Inchi -12
 Indian Dil Fruit -153

Indian Indigo -122
 Indian Butter tree -102
 Indian Hog Plum -5
 Indican -121,123
 Indigo -120
 Indigo Carmine -232
 Indigo Carmine Solution -232
 Indigofera tinctoria Linn. 120,122
 Indramanoa - 50
 Indravalli - 50
 Indravarana -50
 Indravarana -50
 Indravarana -50
 Indravarana -50
 Indravaruna -50
 Indravarunika -50
 Indrayana -50
 Indrayana -52
 Indrayanalata -50
 Indrayanoa -52
 Indulam -64
 Injee-12
 Inji -12
 Insbak -52
 Invert Sugar -179
 Iodine -232
 Iodine Solution -233
 Iodine, O.IN -232
 Ippa -102
 Ippa puvvu -102
 Irimeda -15
 Irippa -102
 Isopteryxin -115
 Isoquercetin -32
 Itthi -135
 Itthikkanni -60
 Itthy -135
 Itti -135
 Ittiyadi -135

[J]

Jaam -56
 Jaamun -56
 Jaequirity -46
 Jainta - 60
 Jaipala -58
 Jait -60
 Jaita -60
 Jalajambo -104
 Jalnam -25
 Jalugu -60
 Jam -56

Jam Kol -54
 Jamalagota -58
 Jamalgota -58
 Jambhool -56
 Jamboline -55
 Jambu -56
 Jambu Nerale -54
 Jambuda -56
 Jambul -54
 Jambul tree -54
 Jammu -56
 Jamneralae -56
 Jantumma -52
 Jamu -56
 Jamu Kol -54
 Jamukoli -56
 Jamun -54
 Jamuna -54
 Jangli Aam -5
 Jangali Ambo -5
 Japal -58
 Japal beej -58
 Japala -58
 Japolota -58
 Jartor -116
 Jau -175
 Jav -175
 Java -175
 Javasa -177
 Javaso -177
 Javegambu -175
 Javo -175
 Jaya -60
 Jayanti -60
 Jayantipatra -60
 Jayapala -58
 Jayata -60
 Jeevibasari -135
 Jepal -58
 Jhona -145
 Jimmi -160
 Jomuna -56
 Joyachi -150
 Juglans regia Linn. -3
 Juvvebasari -135
 Jyotishmati -62
 Jyotismati -62

[K]

Kaakara Kaaya -83
 Kabab-e-Khandan -160

Kababah -29
 Kabbu -48
 Kadaluhaleballi -116
 Kadam -64
 Kadamb -64
 Kabamba -64
 Kadamba Mara -64
 Kadamba Nipo -64
 Kadambal -64
 Kadambamu -64
 Kadambu Needam -64
 Kadappai -64
 Kadavala -64
 Kadu -85
 Kadu Indrayan -52
 Kadubasari -135
 Kadugurohini -85
 Kaduk rohini -85
 Kadukavadi -50
 Kadumenasinaballi -29
 Kadunili -122
 Kadunimb -124,126
 Kadvo Limbdo -126
 Kage hanninagids -66
 Kahibevu -126
 Kainch -46
 Kainth -71
 Kaippa -83
 Kaith -71
 Kaitha -71
 Kakadi -38
 Kakamachi -66
 Kakamaci -66
 Kakananti - 46
 Kakari -38
 Kakattam -147
 Kakiral -83
 Kakkanam -10
 Kakkanangudi -147
 Kakkarikkay -38
 Kakral -83
 Kakri -38
 Kakubha -17
 Kakur -38
 Kalajam -54
 Kalakke -73
 Kalara -83
 Kalhara -69
 Kalikutki -85
 Kallalnaram -135
 Kalli -150
 Kallu Shambu -116
 Kalsunda -88
 Kaluva -69
 Kalyanamurongai -131
 Kamal -69
 Kamala -69
 Kamalam -69
 Kamanchi -66
 Kamkadi -38
 Kamoni -66
 Kanaji -75,77,79,81
 Kanajo -81
 Kanchari -104
 Kanchori -177
 Kanda Tippili -133
 Kandiarivaddi -27
 Kangi -150
 Kangondiballi -62
 Kanibish -58
 Kanjone -82
 Kantakimsuka -131
 Kanuga -75,77,79,81
 Kanugin -76,78,80
 Kanwal -69
 Kapalphotla -62
 Kapipriya -71
 Kapitha -71
 Kapotavamka -25
 Karakhuratt -147
 Karamach -73
 Karamadan -73
 Karamanda -73
 Karamarda -73
 Karanj -75,77,79,81
 Karanja -75,77,79,81
 Karanjaka -75,77,79,81
 Karanjin -78,80,82
 Karaunda -73
 Karavallaka -83
 Karavalli -83
 Karavella -83
 Karela -83
 Karibasari -135
 Karijige -73
 Karijimangai -60
 Karikuda -38
 Karimkar -73
 Karimpu -48
 Karinthakkali -66
 Karisalal -21
 Karisalanganni -21
 Karisalanganni -21
 Karivelam -15

Karla -83
Kamja -81
Karparala -3
Karru -85
Karuaini -81
Karum sampai -60
Karumbu -48
Karunili -120,122
Kaskati -38
Kasmarya -42
Kasmeri -42
Katalati -7
Katamkateri -33
Katampu -64
Kateli -27
Kathavish -171
Kathilla -83
Katiluppai -102
Katki -85
Kattu Elam -158
Kattu Iluppai -102
Kattumulaku -29
Kattumulakunveru -29
Kattuthippaliver -133
Katu -85
Katu vellari -52
Katubhadra -12
Katuka -85
Katuka Rohini -85
Katuki -85
Katuku Rohini -85
Katumba -35
Katurhini -85
Katvi -85
Kaudatumma -50
Kaur -85
Kavatalea -71
Kavatha -71
Kavita -71
Kayet Bael -71
Kayyonni -21
Kadimi Chettu -64
Kellemasuthu -17
Kesara -118
Kesaraja -21
Kesari -21
Keshavardhana -21
Kesudo -128
Kesuriya -21
Kettu -88
Khakhapade -128
Khakharo -128

Khambhari -42
Kharamanjar -7
Khurfa -95
Kinotannic acid -129
Kirugullia -27
Knnunni -21
Kodigaraju -21
Kohumba -124
Koilekha -93
Koili rekha -93
Koillekha -91
Koilrekha -91
Kokilaksa -91
Kokilaksi -88,91
Kolarind -88
Kolavali -88
Kolavallike -93
Kolavankae -81,93
Kolavankal -88
Kolavulike -91
Komala -69
Komizhpazham -42
Kondhu -71
Korach -75,77,79,81
Koratige -116
Koratige Hambu -116
Koricchira -95
Korka -141
Kotha -71
Koyal -10
Kozhuppa -95
Kozhuppu -95
Kozuppa -95,104
Kozuppaccira -95
Krsnapakphala -73
Krsnatulasi -165
Ksirapuspi -147
Ksudrajambu -56
Kubo -35
Kudare Kivimase -17
Kulekhade -88
Kulekhara -91,93
Kulfa -95
Kuliyakhara -88
Kumbil -42
Kumizhu -42
Kunch -46
Kundamani -46
Kundumani -46
Kunni -46
Kunrimani -46
Kurfah -95

Kusiyar -48
Kutki -85
Kwfa -95

[L]

Lactic Acid -233
Lactophenol -233
Lajaka -98
Lajakuri -98
Lajalu -98
Lajamani -98
Lajan -98
Lajauni -98
Lajavanti -98
Lajjalu -98
Lajjavanti -98
Lajjavati -98
Lajubilata -98
Lakottai -12
Lata Priyangu -143
Latjira -7
Lead Acetate -233
Lead Acetate Solution -233
Lead Nitrate -233
Lead Solution Standard -234
Leucas cephalotes Spreng. -35
Lignan -134
Limado -124
Limba -124
Limbado -124
Lipase -94
Liquid Paraffin -234
Litmus -234
Litmus Paper, Blue -234
Litmus Paper, Red -234
Litmus Solution -234
Lohitapuspa -31
Lonak -95
Loni -95
Lonika -95
Lotus -69
Luni -95
Lunilunika -66
Lunlunia -66

[M]

Maadalai -31
Machikegida -98
Madalai -31
Madalam -31

Maddi -17
Madhuca indica J.F. Gmel. -102
Madhuca latifolia Roxb. -102
Madhuka -102
Madhuras -116
Madhusrava -116
Madikatta -133
Madugudamara -98
Magadhisipa -133
Magenta Basic -234
Magenta Solution Decolorised -235
Magha -133
Magnesium Carbonate -235
Magnesium Sulphate -235
Magnesium Sulphate Dried -236
Magnesium Sulphate Solution, Ammonical -236
Mahajambu -56
Mahakal -52
Mahamaram -56
Mahanim -124,126
Mahawash tree -102
Mahua -102
Mahudo -102
Mahula -102
Mahura -171
Mahuva -102
Mahuwa -102
Maka -21
Makhal -52
Mako -66
Makoh -66
Makoya -66
Mal-Bheda -35
Malic Acid -32,174
Malkangani -62
Malkangoni -62
Malkanguni -62
Mambulichchi -5
Mampuiti -5
Mampuli -5
Manarthakkali -66
Manatakkali -66
Mandukaparni -25
Manitakkali -66
Maniththakkali -66
Manjathakkali -66
Mannitol -115
Manupasupu -33
Maradarishana -33
Maradarishina -33
Maramanjnal -33
Maramannal -33

Margosa Tree -126
 Markatamra -5
 Markava -21
 Marking Nut -19
 Marsdenia tenacissima Wight & Arn. -116
 Marudam -17
 Marusambhava -112
 Matalam -31
 Mathichakke -17
 Matsagandha -104
 Matsyadunai -104
 Matsyangandha -104
 Matsyaksi -104
 Matti -17
 Mattimora -17
 Maua -102
 Mayura -7
 Mayuraka -7
 Meethabisha -171
 Melia azadirachta Linn. -126
 Melizitose -179
 Mendium -107
 Mente -107
 Menthe -107
 Mentulu -107
 Merale -56
 Mercuric Chloride -236
 Mercuric Chloride, 0.2 M -236
 Mercuric Chloride, Solution -236
 Mercuric Oxide Yellow -236
 Mercuric Potassium Iodide -237
 Mercuric Sulphate -237
 Mercuric Sulphate Solution -237
 Mesua ferrea Linn. -118
 Methi -107
 Methini -107
 5-Methoxy -3',4'-Methylene dioxyfurano
 (2'',3'',7,8)-flavone -80
 5-Methoxyfurano (2'',3'',7,8)-flavone -80
 7-Methoxyfurano (4'',5'',-6,5)-flavone -82
 8-Methoxyfurano (4'',5'',-6,7)-flavone -82
 Methyl Alcohol -237
 Methyl Alcohol Dehydrated -238
 Methyl Ether -166
 Methyl Mercaptan -113
 Methyl Orange -238
 Methyl Orange Solution -238
 Methyl Red -238
 Methyl Red Solution -238
 Methylene Blue -238
 Methylene Blue Solution -238
 24-Methylene cycloartanol -106
 Mimosa pudica Linn. -98
 Mineral Matter -32
 Mithatelia -171
 Mithavish -171
 Mithavisha -171
 Mithvisa -171
 Mocaka -155
 Moclengi gadde -112
 Modi -133
 Modikaddi -133
 Moduga -128
 Modugu -128
 Mohda -102
 Molisch Reagent -238
 Momordica charantia Linn. -83
 Momordicine -84
 Moolangi -109, 112
 Moravel -116
 Mordant Black II -238
 Mordant Black II Mixture -238
 Moringa pterygosperma Gaertn. -155
 Moringa oleifera Lam. -155
 Morvel -116
 Mothi Elayachi -158
 Mothi Elichi -158
 Moti Luni -95
 Motopeepar -40
 Mucilage -72,97,108
 Mudakku -173
 Mudiyar Kundal -137
 Mugunigadde -112
 Mukula -58
 Mula -112
 Mulaa -112
 Mulaka -112
 Mulakam -112
 Muli -112
 Mullamkatti -27
 Mullangi -109,112
 Mullangu -112
 Mullanki -109,112
 Mulmurungai -131
 Mulo -109,112
 Munaga Aku -155
 Munga -155
 Mungna -155
 Munika -155
 Muolaima -141
 Mura -114
 Mural -114,141
 Mural Maram -141
 Muramanchi -114

Muramansi -114
Murga -116
Murha -116
Muringa -155
Muringa Elai -155
Murinna -155
Murrikku -131
Murungai -155
Murungai Ilai -155
Murva -116
Musamansi -114
Muttala -128
Muttidasenui -98
Muttug -128
Muttuga -128

[N]

Naabhi -171
Naagapheni -150
Naaval -56
Nabhi -171
Naga -118
Nagachampakam -118
Nagachampakamu -118
Nagakesara -118
Nagakesari -118
Nagal -56
Nagappovu -118
Nagapuspa -118
Nagchampa -118
Nagesar -118
Nagesvara -118
Nageswar -118
Nagkesar -118
Nagkesara -118
Nagppu -118
Nagsampige -118
Nahar -118
Naidile -69
Naishkar -48
Naktahva -75,77,79,81
Naktamala -75,77,79,81
Nallajidi -19
Nallajidiginga -19
Namaskari -98
Nangaa -118
Nantiyah -52
Naphthol -239
Naphthol Solution -239
1-Naphthylamine -239
Naphthylamine Sulphanilic Acid Reagent -239

Narmushk -118
Narru Berua -168
Nataranja 75,77,79,81
Nauga -118
Naugaliral -118
Naugu -118
Naval -54,56
Navval Sambu -56
Nayuruvi -7
Neege -155
Neel -120,122
Neelamar -120
Neeli -122
Neem -124
Neerbrahmi -25
Neermatti -17
Neervalam -58
Negeshvar -118
Neirumavinamara -64
Neladangara -177
Nelagumbala -173
Nelagumbala Gudde -173
Nelagumbula -173
Nelagummuda -173
Nellu -145
Nelumbine -70
Nelumbium speciosum Willd -69
Nelumbo nucifera Gaertn -69
Nelver -145
Nepal Cardamom -158
Nepal -58
Nepalamu -58
Nepalo -58
Nepdi Elakki -158
Neralamara -56
Nerale Beeja -54
Nereduchettu -54
Nerol -166
Nerugobbi -88
Nervala -58
Nervalam -58
Neervalam -58
Nesedu -56
Nicotine -23
Nicotinic Acid -32
Nil -122
Nila -120,122
Nilam -122
Nilapoosani -173
Nilbam -120,122
Nili -122
Nili Chettu -120

Nilika -120, 122
 Nilini -120,122
 Nim -124
 Nimb -126
 Nimba -124,126
 Nimbam -124
 Nimbin -127
 Nimboli -127
 Nimgach -124
 Nimgacha -126
 Nitrohydrin Reagent -239
 Nirabrahmi -25
 Nirchulli -91
 Nirguvireru -88
 Nirmasuthu -17
 Nirmuli -88
 Nirmulle -91
 Nirmulli -91
 Nirubrahmi -25
 Nirugobbi -91
 Nite -93
 Nitric Acid -239
 Nitric Acid Dilute -240
 Nitric Acid, XN -240
 2-Nitrobenzaldehyde -240
 Nivadung -150
 Nivara -145
 Njaval -54
 Njazhal -143
 Njettikuzhiyan Mavu -5
 Non-Volatile alcohol -20
 Nugge ele -155
 Nurlaal -141

[O]

Ocimum sanctum Linn. -162,165
 Odalu -145
 Oil -39,63,142
 Oilevevu -123
 Oleo-resin-13,119
 Olievevu -124
 Olleneeli -122
 Ondelaga -25
 Orakam -44
 Orientin -176
 Orientoside -176
 Oryza sativa Linn. -145
 Oxalic Acid -240
 Oxalic Acid, 0.1 N -240

[P]

Paddy -145
 Padma -69
 Padam Phool -69
 Paduman -69
 Paederia foetida Linn. -137
 Paharkai -83
 Paikamatti -50
 Pakad -135
 Pakal -135
 Pakali -135
 Pakhad -135
 Pakur -135
 Palas -128
 Palasa -128
 Palash -128
 Palash Gachha -128
 Palaspapda -128
 Pamposh -69
 Pandal Babal -15
 Panderavo -131
 Pangara -131
 Pankaja -69
 Papparamulli -27
 Pappukura -95
 Paras -128
 Paras pipalo -135
 Paribhadra -131
 Paribhadra -131
 Partha -17
 Paruppukkeerai -95
 Pasalai -95
 Pathiri -150
 Pattemadar -131
 Pavackkai -83
 Pavilikura -95
 Payilikura -95
 Paythumatti -50
 Pectin -32
 Pedda Elakulu -158
 Peddamaveru -62
 Peddapavila Kura -95
 Peepal Chab -29
 Pepli -135
 Perelam -158
 Periya Elam -158
 Persian Manna Plant -177
 Perumkurumba -116
 Perunkurinjan -116
 Perunkurmizh -42
 Petroleum Light 241

Peucedanum graveolens Benth. -153
 Peucedanum sowa Roxb -153
 Peyakkumutti -52
 Peykhumutti -52
 Peythumatti -52
 Phalini -143
 Pharahada -131
 Phellandrene -13
 Phenacetin -241
 Phenol -241
 Phenol Liquified -242
 Phenol Red -242
 Phenol Red Solution -242
 Phenolic Compound -144
 Phenolphthalein -242
 Phenolphthalein Solution -242
 Phloroglucinol -242
 Phloroglucinol Solution -242
 Phorbol ester -59
 Phosphoric Acid -242
 Phosphoric Acid Dilute -243
 Phosphoric Acid, XN -243
 Phosphorus -61
 Picrorhizin -86
 Picumarda -126
 Pila Nagkesara -118
 Pillai maruntho -168
 Pilobaval -15
 Piludi -66
 Pilunagkesar -118
 Pimplimula -133
 Pinnatin -80
 Piparamula -133
 Piper chaba Hunter non Blume -29
 Piper officinarum DC. -29
 Piper retrofractum Vahl -29
 Piper root -133
 Piperlongumine -134
 Piperlonguminine -134
 Pippalijala -133
 Pippalimula -133
 Pipulmul -133
 Pitakarchini -42
 Pitkachia -66
 Piyal -141
 Piyalaka -141
 Piyar -141
 Plaksa -135
 Plasu -128
 Podum -69
 Pomegranate -31
 Pongachromene -78
 Pongamia glabra Vent -75,77,79,81
 Pongamia pinnata Linn. -75,77,79,81
 Pongana -81
 Pongapin -80
 Pongu -75,77,79,81
 Ponnaganti Kooru -104
 Ponnanganni -104
 Ponnankanni -104
 Portulaca oleracea Linn. -95
 Potassium Antimonate -243
 Potassium Antimonate Solution -244
 Potassium Bisulphate -244
 Potassium Bromate -244
 Potassium Bromide -244
 Potassium Bromide, 0.001 N -245
 Potassium Carbonate -245
 Potassium Carbonate Anhydrous -245
 Potassium Chlorate -245
 Potassium Chloride -246
 Potassium Chromate -246
 Potassium Chromate Solution -246
 Potassium Cupritartrate Solution -246
 Potassium Cyanide -246
 Potassium Cyanide Solution, Lead-Free -246
 Potassium Cyanide Solution -246
 Potassium Dichromate -246
 Potassium Dichromate Solution, -247
 Potassium Dichromate Solution, 0.1 N -247
 Potassium Dihydrogen Phosphate -247
 Potassium Ferricyanide -247
 Potassium Ferricyanide Solution -247
 Potassium Ferrocyanide -247
 Potassium Ferrocyanide Solution -247
 Potassium Hydrogen Phthalate -247
 Potassium Hydrogen Phthalate 0.02 M -248
 Potassium Hydrogen Phthalate 0.2 M -248
 Potassium Hydroxide -249
 Potassium Hydroxide Solution -249
 Potassium Hydroxide, XN -249
 Potassium Iodate -249
 Potassium Iodate Solution -249
 Potassium Iodate, 0.05 M -249
 Potassium Iodide -249
 Potassium Iodide, M -250
 Potassium Iodide Solution -250
 Potassium Iodide and Starch Solution -250
 Potassium Iodo-bismuthate Solution, Dilute -250
 Potassium Iodo-bismuthate Solution -250
 Potassium Mercuric-Iodide Solution (Mayer's Reagent) -250
 Potassium Mercuric-Iodide Solution, Alkaline (Nessler's Reagent) -250

Potassium Nitrate -250
 Potassium Permanganate -250
 Potassium Permanganate, Solution -251
 Potassium Permanganate, 0.1 N Solution -251
 Potassium Tetraoxalate -251
 Potassium Thiocyanate -251
 Prakhanam -143
 Prasarini -137
 Prasarini bail -137
 Pratakpushpa -7
 Prenkanamu -143
 Prickly Chaff Flower-7
 Priyaka -64
 Priyala -141
 Priyalam -141
 Priyangu -143
 Prolamin -176
 Protease -94
 Protein -32,61,97,156,176
 Pueraria tuberosa DC. -173
 Pulikkirai -95
 Punaikanjuri -177
 Pungai -75,77,79
 Pungan -81
 Pungu -81
 Punica granatum Linn. -31
 Punicic acid -32
 Purasu -128
 Puthakanda -7
 Putigandha -137
 Putirichunda -27
 Pyrethrin -2

[R]

Radish -109
 Rahhalasa -52
 Raihan -162
 Raja jambu -56
 Rajashinganee -60
 Rakhai Sasa Mul -50
 Rakhyasamula -112
 Rakhyasmula 109
 Raktika -46
 Ranamba -5
 Ranambo -5
 Rangapatri -120,122
 Raphanus sativus Linn. 109,112
 Rati -46
 Ratti -46
 Reducing Sugar -65
 Resin -11,43,59,117,132,144,161

Resorcinol Solution -252
 Resorcinol -252
 Riboflavin -32
 Rice -145
 Risamani -98
 Roghu -64
 Rohini -85
 Rumman -31

[S]

Sabasige -153
 Saccharine -43
 Saccharum officinarum Linn. -48
 Sachunagkeshara -118
 Sacred Basil -165
 Sadababla -15
 Sadad -17
 Sadada -17
 Sadapa -153
 Sadgrantha -168
 Safranine -252
 Safranine Solution -252
 Sailabhava -3
 Sajada -17
 Sajana -155
 Sajina -155
 Sajna -155
 Sajne -155
 Sakharvel -173
 Salamarkataka -112
 Salaphool -69
 Salara -83
 Saleya -112
 Sali -145
 Salincha Saaga -104
 Salincha Sak -104
 Samanga -98
 Sambarani -25
 Sambarenu -25
 Sanchesak -104
 Sanghupushpam -147
 Sanhika -27
 Sankhahuli -147
 Sankhapushpam -10
 Sankhapuspa -147
 Sankhapuspi -147
 Sankhava -147
 Sapogenin -108
 Saponin -9,18,51,68,106,136,144
 Saptala -150
 Sara -141

Saragavo Pama -155
 Sarani -137
 Sarapappu -141
 Saraparuppu -141
 Saraswati -25
 Sargavo -155
 Sarojam -69
 Satahva -153
 Satakratulata -50,52
 Satakuppa -153
 Satala -150
 Satale -150
 Satapuspa -153
 Satdhan -141
 Saute -38
 Scindapsin -A-41
 Scindapsin -B-41
 Scindapsus officinalis Schoott -40
 Scramkotati -19
 Sesame oil -252
 Seevan - 42
 Seevani - 42
 Seegata -155
 Segata pana -155
 Sehjan -155
 Sekato -155
 Selenium candollei DC -114
 Selenium tenuifolium Wall. ex DC. -114
 Semecarpus anacardium Linn. -19
 Semidrying oil -94
 Semp -60
 Senthamara -69
 Serdi -49
 Sesamin -134
 Sesbania aegyptiaca Pers -60
 Sesbania sesban (Linn) Merr. -60
 Sevaga -155
 Shajoma -155
 Shalichokha -141,145
 Shankhapushpi -147
 Shankhauli -147
 Shankhavali -147
 Shankhavela -147
 Shepa -153
 Shepu -153
 Sherdi -48
 Shewgachi pane -155
 Shibt -153
 Shivani - 42
 Shree Tulasi -162
 Shulupa -153
 Sigru -155
 Siju -150
 Sikhari -7
 Silica gel -253
 Silver Carbonate -252
 Silver Nitrate -253
 Silver Nitrate Solution -253
 Silver Nitrate, 0.1 N -253
 Sirunagappu -118
 Sitosterol -16,32,37,74
 Sitotpala -69
 Sivan -42
 Smooth leaved pongamia -81
 Snake Cucumber -38
 Sobhanjana -155
 Sodium Bicarbonate -253
 Sodium Bicarbonate Solution -254
 Sodium Bisulphite -254
 Sodium Bisulphite Solution -254
 Sodium Carbonate -254
 Sodium Chloride -254
 Sodium Cobaltnitrite -254
 Sodium Diethyldithiocarbamate -255
 Sodium Cobaltnitrite Solution -255
 Sodium Hydroxide -255
 Sodium Hydroxide, XN -256
 Sodium Hydroxide Solution -256
 Sodium Hydroxide Solution, Dilute -256
 Sodium Nitrite -256
 Sodium Nitroprusside -256
 Sodium Peroxide -256
 Sodium Potassium Tartrate -256
 Sodium Sulphide -256
 Sodium Sulphide Solution -256
 Sodium Sulphite Anhydrous -256
 Sodium Thiosulphate -257
 Sodium Thiosulphate, 0.1 N -257
 Sohanjana -155
 Solanum indicum Linn. -27
 Solanum nigrum Linn. -66
 Sominta -60
 Sova -153
 Sowa -153
 Soya -153
 Spondias pinnata Linn. -5
 Sriparni -42
 Srngavera -12
 Staff Tree -62
 Stannous Chloride -258
 Stannous Chloride Solution -258
 Starch -6,11,142,169,176
 Starch Soluble -258
 Starch Solution -258

Steroid -28,30,65
 Steroidal Alkaloid -28
 Sterol -45,106,125,134,136
 Sthavaravisa -171
 Sthulaela -158
 Sucrose -49,115,179
 Sudan Red G -258
 Sugar -32,39,41,45,103,106,136,146,176,179
 Sugarcane -48
 Suksma patra -60
 Sulpha -153
 Sulphamic Acid -259
 Sulphuric Acid -259
 Sulphuric Acid, Chlorine-Free -259
 Sulphuric Acid, Dilute -259
 Sulphuric Acid, Nitrogen-Free-259
 Sumalu -33
 Surabhi -114
 Surasa -162,165
 Sutiktaka -85
 Suva -153
 Svetavaha -17
 Syzygium cuminii (Linn.) Skeels -56

[T]

Tahara -171
 Tala nili -137
 Talikhana -88
 Talimakhana -91
 Talmakhana -88,91
 Tamara -69
 Tamarai -69
 Tamarapuvow -69
 Tamranagkesar -118
 Tandulamul -145
 Tannin -4,6,11,16,18,45,55,57,63,136,169
 Taraxerol -11
 Taraxerone -11
 Tarry oil -20
 Tartaric acid -43
 Tatamkottai -19
 Tavare -69
 Tavaregedd -69
 Tejabal -160
 Tejabala -160
 Tejapatri -160
 Tejbal -160
 Tejohva -160
 Tejovanti -160
 Tejovathi -160
 Tejovati -160

Tekaraja -21
 Teliya Bish -171
 Tella Mulaka -27
 Terminalia arjuna W. & A. -17
 Terpene -144
 Tesu -128
 Tetra-O-Methylfisetin -78,80
 Thamarapoo -69
 The Sweet Flag -168
 Thejyovathi -160
 Thiamine -32
 Thioglycollic Acid (Mercapto Acetic Acid) -259
 Thiru Theezai -162
 Thotta Vati -98
 Thottavadi -98
 Thuhar -150
 Thulasi -162,165
 Thumboonal -160
 Thumbooni -160
 Thusimullai -150
 Thyme Leaved Gratiola -25
 Thymol -260
 Thymol Blue -260
 Thymol Blue Solution -260
 Tiksnagandha -155
 Tikta -85
 Tilabhakuri -27
 Tillakada -150
 Tintidiphala -58
 Tippali -133
 Tippaliveru -133
 Tishnagandha -155
 Titali -150
 Titanous Chloride 0.1 N -260
 Titanous Chloride Solution -260
 Toremati -17
 Tottalchurungi -98
 Touch-me-not -98
 Triacontan-1-ol -45
 Trigonella foenum-graecum Linn. -107
 Triterpenoids -125
 Triterpenoid saponin -80
 Tulasi -162,165
 Tumba -35
 Tumbai -35
 Tumbe -35
 Tumbi -50
 Tumbura -160
 Tumburudra -160
 Tumma -52
 Tummi -35
 Tuntikai -50

Turanjabeen -177
Turbud safed -116
Turuchana gida -177
Turuve - 44

[U]

Ubhibhuyaringa -27
Ubhibharingani -27
Ugra -168
Uragandha -168
Uluva -107
Umimuyaringani -27
Ungu -81
Unu - 81
Ursolic Acid -32
Ush -48
Uttarani -7
Uttarenu -7
Uzhinja -62

[V]

Vaca -168
Vachanaga -171
Vachhanaag -171
Vajranaga -171
Valabrahmi -25
Valiya Elam -158
Valiya Kotithuva -177
Valiya Pekkumatti -50
Valiyakattuvell -50
Valiyavaluzhavam -160
Valnka -38
Valuluvai -62
Vanabharata -27
Vanillin-Sulphuric Acid Reagent -260
Vanita -143
Varakranta -98
Varatiu manjal -33
Varch -168
Varifamu -131
Varithummati -50
Varivalli -83
Vasa -168

Vasanaavi -171
Vasanabhi -171
Vasambu -168
Vatsanaabhi -171
Vatsanabha -171
Vatsanabhi -171

Vatsanagaka -171
Vayalchulli -91
Vayalculli -88
Vayambu --168
Vekhanda -168
Velaga -71
Vellai Kadambam -64
Vellai Kadambu -64
Vellaikhadambu -64
Vellamaruthi -17
Vellarika -38
Vellarikkai -38
Veluthapala -118
Velvelakam -15
Velvelam -15
Vembu -126
Vemmu -124
Vemu -124,126
Venkatithura -177
Ventaiyam -107
Venthamara -69
Vepa -124,126
Veppa -124
Veppai -126
Veppan -124
Veppu -124,126
Verittumatti -52
Vidari -173
Vidarika -173
Vidarikanta -173
Vidkhadir -15
Vilamaram -71
Vilangai -71
Vilar maram -71
Villanga Kaaya -71
Visa -171
Vishnu Tulasi -162
Visnukranta -10
Visra -112
Vitamin-C-32, 97
Vitexin -176
Volatile Oil -2,13,111,113,140,159,161,169
Vrihi -145
Vrta puspa -64

[W]

Waja-e-Turki -168
Walnut -3
Walnut oil -4
Water -260
Water, Ammonia-Free -261

Wild Mango -5
Wood Apple -71

[X]

Xylenol Orange -261
Xylenol Orange Solution -261

[Y]

Yasa -177
Yava -175

Yavasa -177
Yavasaka -177

[Z]

Zanthoxylum alatum Roxb -160
Zanthoxylum armatum DC. -160
Zinc Granulated -261
Zinc Powder -261
Zinc Sulphate -261
Zingiber officinale Rosc -12
Zingiberene -13