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OF

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PREFACE

The Unani drugs are symbol of life as they are drown from natural resources and most of the plants are generally free from adverse side effects. Drugs those are toxic in crude form are processed and detoxified in many ways before use. So it is considered free from side effects. Unani system of Medical Science prefers treatment through single drugs and their combination in raw form, rather than compound formulations. In the system, there is great emphasis on proper identifications of single drugs. Dioscorides (40-90 A.D.) is known in the field of Elmul Advia (Pharmacology) as its founder. He described about five hundred single drugs, later on, Galen, Abu Hanifa, Ibn Sina etc. contributed a lot to this field. Ibn Baitar (1176-1248 A.D.), the great scientist of Unani Medicine, compiled a book on pharmacology after extensive field survey and research described 1500 single drugs used in Unani medicine.

Now a days, the increasing popularity and acceptance of herbal drugs around the world is a major demand of a standard book. So, to ensure the quality and standard of herbs practicing in Unani system of medicine, the Government of Bangladesh has taken initiatives to establish a book 'The Unani Pharmacopeia of Bangladesh' to maintain the identification, purity, quality and safety through scientific and standard quality control parameters.

In this context the govt. of Bangladesh has already published I, II and III volumes of 'The Unani Pharmacopoeia of Bangladesh, Part-01' consisting of fifty monographs of single drugs in each volume. This present Volume-IV is a continuation of such efforts. It also comprises fifty monographs.

The features of this volume-IV is that, the monographs of single drugs selected here are basically indigenous, easily available, cost-effective, acquainted to the country people. These drugs are also has its own reference in the Unani texts and other books of herbal drugs published in the country and abroad. Among them only the scientifically evaluated and research based drugs are taken in to account.

The pictures, included with every monograph are contains high resolution/pixel so that, it can be viewed clearly. The Unani name of drugs is used as title name. Some of the drugs which are essential in medical service, but imported in our country are also included in the volumes due to its necessity.

Each monographs deals with necessary botanical descriptions which helps to identify it physically. Other than Unani name the botanical, English and Bengali name also mentioned here. To evaluate on scientific manner microscopic and macroscopic description also comprised here. The drug's parts of use also maintain with title name but under the heading 'Parts Used', all parts of drugs which are using in the medical practice have been mentioned in the monographs.

Every monograph has information about phytoconstituents, research based pharmacological activities, temperament and required correctives, available proximal substitutes, side-effects or adverse effects or precautions (if any), TLC behavior etc.

In the efforts to compile pharmacopoeial monographs of Unani drugs the classical attributes of the drugs, according to Unani medical science like Mijzaj (Temperament), Aa'maal-e-Adviya (Pharmacological action), Mahall-e-Istemalat (Therapeutic use) and Meqdar-e-Khorak (Dose), Musleeh (Corrective), Badal (Proximal substitute), Muzir (Side-effects / adverse-effects) have been mentioned.

The Pharmacopoeial Team expect that the publication of the this Unani Pharmacopeia of Bangladesh, volume-IV, will also facilitate and assist the researchers and organizations to plan and expedite their research works, manufacturing of drugs or others related job.

Being limitation of facilities, opportunities and time frame, the Pharmacopoeia Team were unable to maintain the procedure require to prepare a pharmacopoeia, thus the Team followed the Unani pharmacopeia of India as main standard book. The Team also followed other Unani, herbal books and different research papers/ journals/articles etc.
The pharmacopeia Team put their enthusiastic efforts to complete it with the limitation of facilities to make it appropriate for the users.

As the first efforts of its kind in the field of Unani System of Medical Science, there is always scope for further improvement and we would like greatly welcome suggestion and advice from the experts in the field.

Foreword

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AAK

(Leaves)

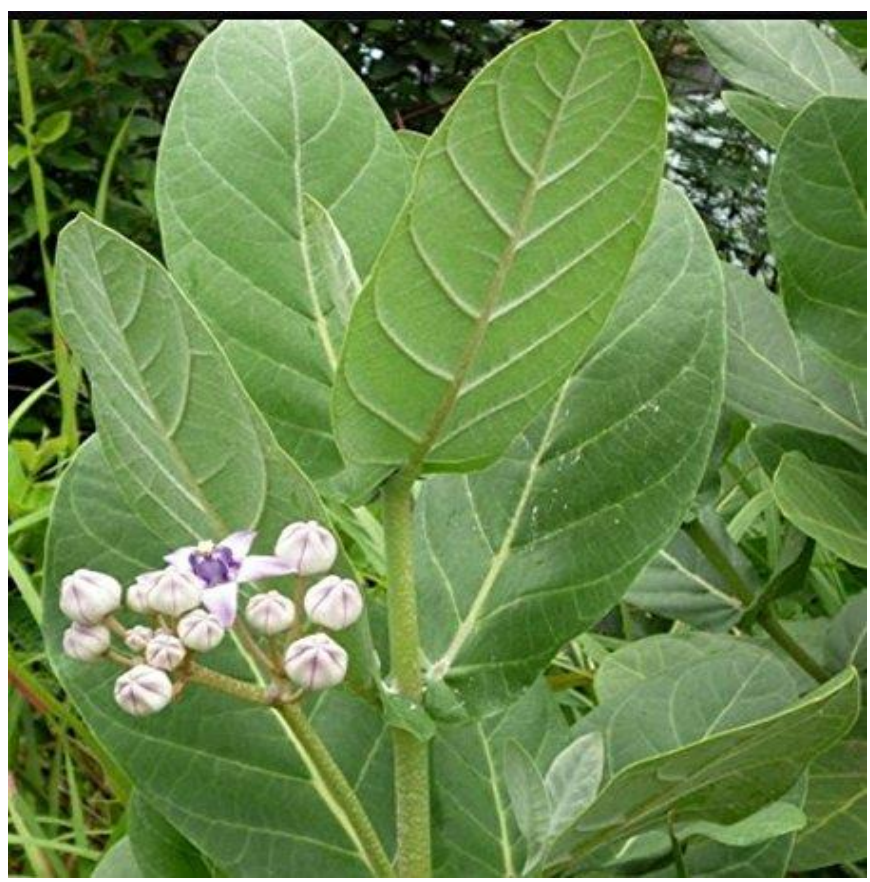
Aak is a flowering plant which is considered as a scared plant in Bangladesh. The Aak has two varieties which blooms white flowers or pinkish white flowers. The plant's juice is highly poisonous. It's dried leaves are used as medicine for treatment of different diseases in Unani system of medicine for centuries.

Naam-e-Degar (Other names):

a. Botanical : *Calotropis procera*
b. Family : Asclepiadaceae
c. Bengali : Akanda, Akond.
d. English : Madar Tree

Tafseel (Description):

Aam (General) : Aak (Calotropis) is a spreading shrub or medium-sized tree reaching 2.5 to 6 m in height. It has a deep taproot, 3-4 m deep, and a secondary root system with woody lateral roots that may rapidly regenerate adventitious shoots when the plant is injured.



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

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

Lamina: Dorsiventral with mesophyll diferentiated into a palisade and spongy tissue, upper and lower epidermis covered externally with a thick, striated cuticle, below upper epidermis three rows of elongated, closely arranged palisade parenchyma present, spongy parenchyma tissues almost radially elongated with intercellular spaces, central, cells irregular in shape, laticifers and vascular bundle salso presents cattered in this region.

Juz-e-Mustamil (Parts used): The roots, leaves, flowers, milky fluid and wood.

Maskan (Habitat) : The Aak is native to North Africa, tropical Africa, Western Asia, South Asia, and Indochina. *Calotropis procera* originated from the Afro-Asian monsoonal regions. It spread on an arc expanding from north western Africa (Mauritania, Senegal), through the Arabian Peninsula and Middle-East to the Indo-Pak subcontinent including Bangladesh. It was introduced to subtropical America, the Mascarene Islands, drier parts of Australia and probably South-East Asia. It is found from sea level up to an altitude of 1300 m in semi-arid conditions (150 to 1000 mm annual rainfall) on sandy soils as well as in the drier parts of tropical and sub-tropical regions. A weed of disturbed sites, roadsides, waste areas, near inland watercourses, coastal sand dunes, grasslands, open woodlands and pastures.

.**Jwoher'e Nabatati (Phytoconstituents):** Cardenolides, steroids, tannins, glycosides (Calotropin), phenols, terpenoids, sugars, flavonoids, alkaloids and saponins.

Mizaj (Temperament): Hot 3^0 and dry 3^0

Musleh (Correction) : Filfil Siyah, Rowghan-e-Zard(Ghee)

Badal (Proximal substitute): Another part of same plant, if available.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	: Not more than 2 per cent, Appendix 2.2.2
Total ash	: Not more than 21 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 5 per cent, Appendix 2.2.4

Alcohol-soluble extractive : Not less than 5 per cent, Appendix 2.2.6
Water- soluble extractive : Not less than 24 per cent, Appendix 2.2.7

TLC behavior of chloroform extract:
TLC of the alcoholic extract of the drug on silica gel 'G' plate using Chloroform : Methanol (1 : 1) shows under U.V. (366 nm) four fluorescent zones at Rf. 0.63, 0.71, 0.81, 0.87 (all blue). On spraying Dragendroff reagent followed by 5% Methanolic Sulphuric acid reagent and one spots appear at Rf. 0.08 (orange). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mohallil-e- Warm, Munaffis-e—Balgam, Hazim, Jali, Qatil-e-Deedan-e-A'ama.

Mahall-e-Istemalat (Therapeutic uses): Zeequn Nafas, Waj-ul-Mafasil, Bawaseer, Zaheer, Jiryan, Deedan-e-A'ama.

Meqdar-e-khorak (Dose): External use(As required)

Muzir (Side-effects / adverse-effects): Calotropis is unsafe, especially in high doses. It contains chemicals that can interfere with heart function, particularly at high doses. It can cause serious side effects including vomiting, diarrhea, slow heartbeat, convulsions, and death.

Aaham Nukhsajat (Important formulations): Raughan-e-Haft Barg, Raughan-e-Chahar Barg, Raughan-e-Gul-e-Aak, Habb-e-Usher, Nemak Mader.

ANJABAR
(Rhizome)

The drug Anjabar consists of dry rhizome of Anjabar plant. It is a small perennial shrub with woody root.

Naam-e-Degar (Other names):

a) Scientific name : *Polygonum bistorta* Linn. (Synonym; *P. vivparum*)
b) Family : Polygonaceae,
c) Bengali name : Machutie
d) English name : Snake-root, Adder wort, Bistort, Dragon wort.

Tafseel (Description):

Aam (General): It is a small perennial shrub with woody root stock and 10-30 cm stem where leaves are 3.5-5 cm, linear, short pointed minutely round with sharp base give the shape of heart. Flowers are pink in color and solitary erect.

Klaa Beeni (Macroscopic): Rhizome in pieces or 6.0 cm to 12.0 cm in length and 1.0 to 2.0 cm in thickness, solid, cylindrical and somewhat flattened in shape, longitudinally wrinkled and twisted; a few show marks of annulation of leaf bases and parts of lateral roots with traces of attached rootlets; external surface dark brown, but freshly broken surface cinnamon brown; fracture hard, tough and uneven; odour slightly aromatic, taste pungent and slightly bitter.

Khurd Beeni (Microscopic): A cross section of the rhizome shows an almost circular or oval outline, cuticle present; phellem is composed of 4 or 5 layers of large, compact, rectangular to oval cork cells slightly thick and somewhat wavy; containing yellowish-brown contents positive for tannin; followed by 3 or 4 layers of phellogen several layers of cortical cells, elliptical or circular, thin walled, parenchymatous cortical cells usually containing abundant starch grains that are simple, elliptic to oval or circular in shape, hilum at centre and fissured with distinct striations; a few cells show also the presence of a single cluster crystal of calcium oxalate; a group of sclerenchymatous cells, thick walled and polygonal in shape, present adjacent to vascular bundles, which are numerous, radially arranged, collateral; phloem cells present below the group of sclerenchymatous cells; cambium distinguished at some places only; vessels mostly in small groups showing simple pits; xylem fibres are found in small groups or isolated and associated with vessels; rays-bi- or triseriate, rectangular and slightly radially elongated; pith, cells oval to circular, thin walled, parenchymatous and loosely arranged with large intercellular spaces. Cells are usually filled with many starch grains; a few of them contain clusters of calcium oxalate crystals.

Powder: Powder Pinkish-brown, coarse, free flowing, slightly bitter taste, fragments of cork, cork cambium, parenchyma from cortex, filled with starch grains; in surface view, the sclerenchymatous cells, thick walled to polygonal, highly lignified; ray cells found in groups of 2 to 4; cluster of calcium oxalate crystals are usually present in free state, broken or intact. from 30 to 50 µ in size; starch grains about 4 to 10 µ wide and upto 15 µ in length are also found in large numbers; fibres long, upto 400 µ long and upto 25 micron wide in the middle, almost spindle shaped, unseptate, wall lidgnified with wide lumen, tips pointed, a few of them pitted and a few are branched at the tip. Vessels short but wide, thick walled, with simple pits and having spiral or reticulate thickenings; tracheids are also present but less in number, short, wide, spindle shaped, strongly pitted and their tips are rounded or truncated; xylem parenchyma thick walled, and rectangular.

Juz-e-Mustamil (Part used): The leaves, root, rhizome of Shrub Anjabar used as drugs purpose.

Maskan (Habitat): It is commonly found in marshy places, in alpine areas of Pakistan as Chitral, Gilgit, Swat and Ladakh and in India, found in Himalayas from Kashmir to Sikkim & hills of Assam at 2,700-4,500 meters. It's also available in many other countries like China, Iran etc. Anjabar is native to Europe, Asia and North America.

Jwoher'e Nabatati (Phytoconstituents):
Polygonum bistorta has been widely studied for its chemical profiling and found to possess different classes of constituents such as phenolics, Flavonoids, steroids, triterpenoids and tannins. Phytochemical investigations revealed the presence of gamma-sitosterol, beta-sitosterol, beta-sitosterone, friedelin and cycloartane type triterpenoids like, 24(E)-ethylidenecycloartanone and 24(E)-ethylide-necycloartan- 3alpha-ol and some tannin-related compound, bistortaside A in *P. bistorta* as plant constituents.

Mizaj (Temperament): Cold 1^o & Dry 1^o

Musleeh (Corrective): Zanjabel, Shahad, Habbul Aas (Kabiruddin 2007)

Badal (Proximal substitute): Bartang, Zarishk, Gile Armani, Habb al-Ās (Rafiquddin 1985)

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 7 %	Appendix 2.2.3
Acid insoluble ash	Not more than 3 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 6 %	Appendix 2.2.6
Water soluble extractive	Not less than 16 %	Appendix 2.2.7

TLC behavior of Ethanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Ethyl Acetate : Acetic Acid (5:4:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	4	0.33 0.55 0.83 0.90

Aa'maal-e-Adviya (Pharmacological action): Qabiz, Habis-e-Dam, Muqawwi-e-Meda, Muqawwi- e-Ama, Daf-e-Taffun, Musakkin-e- waja, Muhafiz-e-Kabed.

Mahall-e-Istemalat (Therapeutic use): Ishal, Zaheer, Baul-ul-dam, Ishal-e-Damvi, Sil, Zof-e-Ishteha, Sahaj-e-Ama, Ghasayan, Bawaseer-e-Damia, Wajaul mafasil, Wajaul amma.

Meqdar-e-Khorak (Dose): 3-5 gm

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed.

Aaham Nukhsajat (Important formulations): Sharbat-e-Anjabar, Safoof Istehaza, Qurs Anjabar, Majoon Hamal Ambri Alvi Khani, Majoon Tewaj

ATTEES SHIREEN

(Roots)

Attees Shireen is a medicinal plant that is used as the main ingredient in many formulations mentioned in the Unani and Ayurvedic formularies of this Sub-continent. Aconitum species are also used as major components in Chinese and Bhutanese herbal medicines.

Naam-e-Degar (Other names) :

a. Botanical : *Aconitum heterophyllum* Wall ex.
b. Family : Ranunculaceae
c. Bengali : Ataieha
d. English : Indian Atees

Tafseel (Description):

Aam (General): Attees Shireen (*Aconitum heterophyllum*) is a perennial growing to 1.5 m (5ft). It is in flower from August to September, and the seeds ripen from September to October. The flowers are pollinated by Bees. It is suitable for light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay soil. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

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

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

Powder: Ash coloured to light brown, under Khurd Beeni (Microscopic) shows abundant simple and compound starch grains and parenchymatous cells.
Juz-e-Mustamil (Parts used) : Dried tuberous roots.

Maskan (Habitat): Drug yielding plant is a prerennial herb, native of western Himalayas and found in Garhwal, Kumaon and Kashmir at altitude between 2500-4000 meter and is usually found on humus-rich soils in the alpine and subalpine zones, and in forests in East Asia to West Himalayas.

Jwoher'e Nabatati (Phytoconstituents): Aconitine, mesaconitine, hypaconitine, benzoylaconine, benzoylmesaconine, and benzoylhypaconine, alisine, dehydroatisine, hetisine and heteratisine.

Mizaj (Temperament): 4th Degree Hot & 3rd Dry
Or, 3rd Degree Hot & Dry

Musleh (Correction): No sufficient information is available regarding correction.

Badal (Proximal substitute): Sa'd Kufi/Nagarmutha**(***Cyperus rotundus)*

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

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

Acid-insoluble ash	: Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 6 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 24 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action): Daf-e-Humma, Qabiz, Habis-ud-Dam, Muqawwie-e-Meda, Moharrik-e-Asab.

Mahall-e-Istemalat (Therapeutic uses): Jof-e-Meda, Qai, Ishal, Zaheer-e-Muzmin.

Meqdar-e-khorak (Dose): 2-3 gm

Muzir (Side-effects / adverse-effects): Nausea, vomiting, weakness or inability to move, sweating, breathing problems, heart problems, and even death.

Aaham Nukhsajat (Important formulations): Majoon-e-Jograj Gugal.

BAKAYIN
(Stem Bark)

This drug is a dried, mature stern bark of Bakayin tree. It is a small to medium deciduous tree attaining a height up to 45 m tall; bole fluted below when old, up to 30-60 (max. 120) cm in diameter, with a spreading crown and sparsely branched limbs.

Naam-e-Degar (Other names):

a) Botanical name	: *Melia azedarach* Linn.
b) Family	: Meliaceae
c) Bengali name	: Ghoranim or Mahanim Fol
d) English name	: Persian lilac, Lilac, Indian Lilac, Barbados lilac, Pride of China,Paradise tree, Umbrella tree, Bead tree, Hoop tree, Pride of India.

Tafseel (Description) :

a) Aam (General): **Description:** It is grown as an ornamental avenue tree and sometimes as a shade tree in coffee and tea plantation. The plant regenerates freely from seeds during rain under natural condition. It can also be artificially propagated by direct sowing, transplanting seedlings from nursery or by cutting and root suckers. Bark is smooth, greenish-brown when young, turninggrey and fissured with age. Leaves are alternate, 20-40 cm long, bipinnate or occasionally tripinnate. Leaflets 3-11, serrate, dark green on the upper surface and paler underneath. They produce a pungent odour when crushed. Inflorescence a long, axillary panicle up to 20 cm long. Flowers are purple and fragrant, numerous on slender stalks, white to lilac; sepals 5-lobed, 1 cm long; pentamerous, each petal 5-lobed, 0.9 cm long, pubescent; staminal tube deep purple blue brown 6 cm long. Fruit or berries are small, yellow drupe, nearly round, about 15 mm in diameter, smooth and hard as a stone, containing 4 to 5 black seeds. Seed are oblongoid, 3.5 mm x 1.6 mm, smooth, brown and surrounded by pulp.

b) Klaa Beeni (Macroscopic): Bark curved, length is 4 to 8 cm, breadth 1 to 2 cm, thickness 1 to 1.5 cm; outer surface cracked and scaly; colour blackish grey outside and snuff brown after scrapping; cracks both transverse and longitudinal; shallow fissures with clear edges, inner surface straw coloured with fine striations, fractures splintery, bitter on chewing.

c) Khurd Beeni (Microscopic): Transverse section of stem bark shows the presence of rhytidome along with alternate zones of cork and secondary phloem. Cork cells rectangular; inter cellular space absent, phellogen indistinct. Phelloderm present inside the cork not prominent everywhere. Cortex not visible into outer and inner zones; divided into many layers but newly originated cork layers. In secondary phloem sieve tube elements are always present along with compound sieve plates; end wall oblique. Phloem fibres with tapering ends; angular in transverse section, fibre pits indistinct, fibres solitary or in aggregates of 2-30 µ thick walled; sclereids absent; phloem parenchyma thin walled; crystals prismatic, rectangular rhomboidal and aggregated rhomboids in rosettes in chambered parenchyma. Radially compressed soft cells occasional, having tangential walls thickened and the lumen

filled up with a yellowish resinuous content. Rays usually multiseriate; rosettes and prismatic crystals present in ray cells. In radial longitudinal section the ray cells measure 150 to 200 µ in height and 20 to 25 µ in width.

Powder: Chocolate brown, shows the presence of cork cells, medullary ray cells, parenchymatous cells of periderm, phloem fibres measure 8 µ to 16 µ in length and 0.6 µ to 1.2 µ in breadth with pits and aggregated crystals, prismatic and rhomboidal crystals abundant; simple starch measuring 2.8 µ to 5 µ in diameter. Sclerieds absent.

Juz-e-Mustamil (Part used): Bark, fruit or berry, seeds, flowers, leaves oils and gum are used as drugs purpose.

Maskan (Habitat): It grows in temperate and tropical countries like Bangladesh, India, China, and Japan.

Jwoher'e Nabatati (Phytoconstituents):

Stem bark contain terpenoids and limonoids like 7a-Acetoxy-14β, 15β- epoxygedunanl-ene-3-O-β-D-Glucopyranoside, 12-Acetoxyamoorastatin,Amoorastatin, Fraxinellone, 12-Hydroxyamoorastatone, 3: Hydroxy eupha-7,24-diene-21,16-olide, Kula tone, Kulinone, Kulolactone, Methylmalonate, a-Pinene, β-Pinene, a-Terpinene, a-A Terpineol. They also contain flavonoids like 4', 5-Dihydroxy flavone-7-O-u-L-rhamnopyranosyl-(1-4)-β-D-Glucopyranoside, Anthraquinone like 1,3,5,8-Tetrahydroxy-2-methyl anthraquinone; 8-Me ether, 3-O-α-L-rhamnopyranoside, 1,5-dihydroxy-8-methoxy-2-methl-anthraquinone- 3-O-α-L-rhamnopyranoside, 1,8-

dihydroxy-2-methyl anthraquinone-3-O-β-D, Galactopyranosidase. Stem wood contain terpenoids and limonoids like Melianin-A, ~ 90 ~ Melianin-B. Seeds contain terpenoids and limonoids like 3 β, 7aDihydroxy-21, 23-epoxy-apotirucalla-14, 24-diene-21-one, Meldenin. They also contain steroids like Campesterol, Cholesterol, Stigmasterol and acids like Linoleic acid, Linolenic Acid, Oleic acid (9-octadecenoic acid). (Sharma & paul, 2013; Asadujjaman et al.,2013; Azam et al.,2013; Sharma et al.,2005; Bahuguna et al.,2009; Suresh et al.,2008)

Mizaj (Temperament): Hot 2^{O} & Dry 2^{O}

Musleeh (Corrective): Not required.

Badal (Proximal substitute): No proximal substitute identified

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 6 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1 %	Appendix 2.2.4
Alcohol soluble extractive(s)	Not less than 5 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 4 %	Appendix 2.2.7

TLC behaviour of Ethanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Acetate : Acetic Acid (5:4:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	5	0.25 0.45 0.59 0.71 0.87

Aa'maal-e-Adviya(Pharmacological action): Musaffi-e-Dam, Muhallil-e-Warm, Musakkin-e-Aam., Daf-e-Kirm-e-Ama, Daf-e-Humma, Qabiz, Kasir-e-Riyah.

Mahall-e-Istemalat (Therapeutic use): Qula, Juzam, Bars, Arg-un Nisa, Nalkh-e-Shikam.

Meqdar-e-Khorak (Dose): 5-10 g

Muzir (Side-effects / adverse-effects): No significant side effects / adverse-effects have been observed.

Aaham Nukhsajat (Important formulations): Habb-e-Bawaseer, Majoon Musakkin, Dard-e- Rahem, Tila-e-Musakkin.

BAOBARANG

(Fruits)

Baobarang, commonly known as false black pepper, white-flowered embelia, vidanga, vaividang, *vai vidang*, or *vavding*, is a species in the family Primulaceae. It was originally described by Nicolaas Laurens Burman in his 1768 publication, *Flora Indica*. It is widely distributed throughout India. In Unani, Ayurveda and Siddha, it is considered widely beneficial in variety of diseases.

Naam-e-Degar (Other names) :

a. Botanical : Embelia ribes
b. Family : Myrsinaceae
c. Bengali : Biranga
d. English : Embelia

Tafseel (Description) :

Aam (General) : Baobarang is woody creeper shrub with brittle and flexible stem. It is medicinal plant also with terete branches also known as vai vidanga. Because of its appearance and nature it is also called false black pepper. Fruits are found in bunches. Outer covering of fruits is fragile and from inside seeds are spotted. The fruits, leaves and roots are used to cure various diseases.

Klaa Beeni (Macroscopic): Fruit brownish-black globuler,2-4 mm in diameter, warty surface with a beak like projectionat apex, often short, thin pedicel and persistant calyx with usually 3 or 5 seplas present, pericap brittle enclosing a single seed covered by a thin membrane; entire seed, reddish and coveredwith yellowish spots(Chitra tadula); odour, slightly aromatic;taste, astringent.

Khurd Beeni (Microscopic): Transverse section of fruit shows epicarp consisting of single row tabular cells of epidermis, usually in surface view cells rounded with wrinkled cuticle; mesocarp consists of a number of layers of radish-brown coloured cellsand numerous fibro-vascular bundles and rarely a few prismatic crystalsof calcium oxalate; inner part of the mesocarp and endodermis composed of stone cells; endodermis consisting of single layred, thick-walled, large, palisade-like cells; seed coat composed of 2-3 layered radish-brown coloured cells endospermcells irregularin shape, thick-walled containing fixed oil and proteinous masses; embryo small when present otherwise most of the seeds sterile.
Powder: Redish; under microscope shows redish parenchyma and stone cells.

Juz-e-Mustamil (Parts used): Dried mature fruits

Maskan (Habitat): The plant is found in moist and shady places upto an altitude of 1500 meter. Tropical and subtropical climate is required for the cultivation of this crop. Medium black well drained soils are best suited for the crop.The optimum temperature required for the crop is 18ºC-35ºC with annual precipitation of 700 to 1500 mm. E. ribes is propagated through seeds.

Jwoher'e Nabatati (Phytoconstituents): *Embelia ribes* berries contain several chemical constituents like embelin, volatile oil, fixed oil, resin, tannin, christembine (alkaloid), phenolic acids like caffeic acid, vanillic acid, chrorogenic acid, cinnamic acid, o-cumaric acid. 4.33% of the embelin content is observed in the berries of *Embelia ribes*.

Mizaj (Temperament): 2nd Degree Hot & Dry
Red coloured small Baobarang 3rd Degree Hot & Dry.

Musleh (Correction): Filfil Siyah(*Piper nigrum*), Zanjabil (*Zingiber officinale*), Katira Gum(Gum tragakanth) & Honey.

Badal (Proximal substitute): Turmus (*Lupinus albus*), Kalomegh (*Andrographis paniculata*), Halela(*Terminalia cheb*ula)

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	: Not more than 2 per cent, Appendix 2.2.2
Total ash	: Not more than 6 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 1.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 10 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 9 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action): Qatil-e-Deedan-e-A'ama, Mushil.

Mahall-e-Istemalat (Therapeutic uses): Deedan-e-A'ama, waj-ul-Mafasil.

Meqdar-e-khorak (Dose): 1 to 2 gm

Muzir (Side-effects / adverse-effects): Male fertility; impairs spermatogenesis and reduces sperm count to level of infertility, anti-implantation and anti-ovulatory effects, Hastens or facilitates childbirth, especially by stimulating contractions of the uterus, abortion, sexual debility.

Aaham Nukhsajat (Important formulations): Habb-e-Kibrit, Qurs-e-Deedan, Itrifal-e-Deedan, Majoon-e- Jograj Gugal, Majoon-e-Kal-Kalanj,Habb-e-Kabid Naushadri.

BASAL
(Seeds)

It is a seeds of Basal (Allium cepa Linn.). Commonly known as Onion is an herbaceous annual to biannual shrub cultivated in the plains of Bangladesh as a source of vegetable. The onion plant has been grown and selectively bred in cultivation for at least 7,000 years.

Naam-e-Degar (Other names) :

a) Botanical name:	Allium cepa Linn.
b) Family:	Amaryllidaceae
c) Bengali name:	Piyaj Beej
d) English name:	Onion

Tafseel (Description) :

a) Aam (General): Basal is usually thought of as a vegetable but It is also has a long history of medicinal use. Mainly the fleshy bulb that grows below the ground is used medicinally as well as for food but other parts of the plant also has a place in the medicines. There are many varieties. Most onion bulbs are white, yellow, or red. The green stems and leaves are hollow and can reach 3 ft (1 m) in height. It is round and fistulous, of a shining green color.

The plants bear small flowers that are usually white or purple. The fleshy bulb that grows below the ground is used medicinally as well as for food. The Basal or onion is a tunicated bulb, compressed or round, or oblong in figure, invested with a shining, thin, dry membrane, of a reddish or white color. It is less pungent to the taste than garlic, with some degree of sweetness, and a peculiar, well-known odor. Onion bulbs are of various shapes and sizes, usually globular, the layers being juicy. (Jain et. al. 2019)
The onion plant has a fan of hollow, bluish-green leaves and its bulb at the base of the plant begins to swell when a certain day-length is reached. The bulbs are composed of shortened, compressed, underground stems surrounded by fleshy modified scale (leaves) that envelop a central bud at the tip of the stem. In the autumn (or in spring, in the case of overwintering onions), the foliage dies down and the outer layers of the bulb become dry and brittle. The crop is harvested and dried and the onions are ready for use or storage. Some varieties of A. cepa, such as shallots and potato onions, produce multiple bulbs. They are pungent when chopped and contain certain chemical substances which irritate the eyes. (Wikipedia) Basal seeds are collected from its flower when it dries.

b) Klaa Beeni (Macroscopic): Seeds are irregularly triangular. wrinkled, about 3 mm long and 1 mm broad, dark brown to black, rough, slight characteristic odour; 100 seeds weighs about 0.35 to 0.40 g. (Anonymous-2007)

c) Khurd Beeni (Microscopic): Elongated to oval in outline, divided into seed coat and cotyledons; seed coat is covered with dark brownish to black, hyper pigmented, unevenly deposited, wavy, thick cuticle; seed coat cells are thick walled. rectangular, compactly packed, overlapping, 4 to 7 layered, followed by single layered parenchymatous epidermis of cotyledon; cotyledon cells are thick walled. multi layered, transparent, polygonal, polyhedral, varies in diameter, few cells with densely deposited oil globules. (Anonymous-2007)

Powder : Fine, black powder with grey particles; smooth, oily textured, characteristic smell, astringent taste; under microscope shows thick walled, polygonal, transparent cotyledon cells, averages about 270 micron in diameter, few cells with dense oil globules; thick walled, brownish coloured seed coat cells, size about 144 to 360 micron in length and 90 micron in breadth. No effervescence, no tannin, volatile oil present. (Anonymous-2007)

Juz-e-Mustamil (Part used):	The Flowers, Leaves/stem, Roots, Seeds, .Bulbs, etc parts are used as drugs purpose.
Maskan (Habitat):	All over country and around the world.

Jwoher'e Nabatati (Phytoconstituents): Terpenoids. azadirachtin, fixed oils, fatty acids, amino acids. (Anonymous-2007)

Mizaj (Temperament): Hot 2^o Dry 2^o

Musleeh (Corrective): Not required.

Badal (Proximal substitute): No proximal substitute is identified.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 4%	Appendix 2.2.3
Acid insoluble ash	Not more than 1 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 20 %	Appendix 2.2.6
Water soluble extractive	Not less than 8 %	Appendix 2.2.7
Fixed oil	Not less than 16 %	Appendix 2.2.8

TLC behaviour of Ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Pet. Ether : Diethyl ether: Acetic Acid (80 : 20 : 1)	On spraying plate with 10% aquous H_2SO_4 and heating it for 30 minutes at 110 ^{O} C	6	0.26 0.34 0.39 0.69 0.86 0.92 0.98

Aa'maal-e-Adviya (Pharmacological action): Jali, Mukharrish, Moharrik.

Mahall-e-Istemalat (Therapeutic use): Daus-Salab, Kalaf, Behaq, Zof-e-Bah, Zof-e-Asab

Meqdar-e-Khorak (Dose): 2 gm

Muzir (Side-effects / adverse-effects): Frequent contact with onion seeds has been reported as an occupational allergen.

Aaham Nukhsajat (Important formulations): Habbe-e-Khabsul Hadid, Laboob-e-Sagheer, Laboob-e-Kabir

BEHMAN SAFED

(Root)

It is a dried root of shrub Behman Safed (Centaurea behen Linn.). It is native to Iran. (Balbir Sing et.al-2012). Behman safed is an annual hardy herb and it is considered as a source of the drug Safed behman or Bhamana- i- sufeed , found in the hilly areas of Iran. (Anonymous-2006) It looks like wood due to its toughness in dry form and white in colour. It is characterized with a more or less starch like taste but no distinguished odour.

Naam-e-Degar (Other names):

a) Botanical name:	Centaurea behen Linn
b) Family:	Asteraceae
c) Bengali name:	Shewt Behman
d) English name:	White behen,

Tafseel (Description) :

a) Aam (General): Behman Safed **(**Centaurea behen Linn). is an annual perennial herb. Leaves are radical and alternate and they are entirely toothed and pinnatifid. The flower heads solitary corymbose or panicled, heterogamous, purple, violet, blue, white or yellow; Outer flowers seriate, neuter; disk flowers female, fertile, tube slender, limb straight or oblique. Involuvre ovoid or globose; bracts many seriate, imbricate, appressed, margins scarious or coriaceous.Anther-bases sagittate auricles connate, tails long or short entire or lacerate. Style-arms with a thickened hairy basal ring, erect and connate or shortly spreading. Achenes oblong or obovoid, compressed or obtusely 4-angled, often shining , basal areole oblique or lateral.Stems are erect and glabrous attaining a height of 60-150 cm 14,22 .

b) Klaa Beeni (Macroscopic): Cut pieces of root pale yellowish brown, cylindrical; 1 to 2 cm in thickness and 3 to 7 cm in length; hard, longitudinal wrinkles present; lateral roots or root scars absent; fracture, short and splintery; no distinct odour or taste. (Anonymous-2007).

c) Khurd Beeni (Microscopic): Root circular in outline; cork composed of 5 to 15 layers of thin walled, tangentially elongated cells; followed by thin walled, rectangular to polygonal shaped parenchymatous cortex; central core of root consists of xylem with a few wide vessels and thick walled lignified fibres; vascular system consists of radial narrow arms of vascular elements extending towards periphery, consisting of tangential clusters of wide, thick walled vessels, thick walled lignified fibres and parenchyma cells; phloem a patch cupping the ex periphery, consisting of tangential clusters of wide, thick walled vessels, thick walled lignified fibres and parenchyma cells; phloem a patch cupping the xylem tissue: radial bands of cubical shaped parenchymatous and medullary ray present.
Powder : Light yellow: vessel showing scalariform thickening; length varying from 108 µ to 162 µ and breadth from 32 µ to 54 µ, fibres thick walled, narrow lumen; length varying from 338 µ to 648 µ and breadth from 7 µ, to 29 µ. (Anonymous-2007).

Juz-e-Mustamil (Part used): Mainly the Root is used as drugs purpose.

Maskan (Habitat): It is native to Iran, distributed from Europe and North Africa to India and China and also occurs in Pakistan and Israel.

Jwoher'e Nabatati (Phytoconstituents):
The root contains a crystalline alkaloid bahamine, taraxasterol and its acetate, myristate, inulin and a glucoside which on hydrolysis yields centaurea sterol A.

Mizaj (Temperament): Hot 2^o, Dry 2^o

Musleeh (Corrective): Unnab, Katira

Badal (Proximal substitute): Musli siyah, Musli safed, Asgandh

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 3 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 2 %	Appendix 2.2.6
Water soluble extractive	Not less than 45 %	Appendix 2.2.7

(Anonymous-2007)

TLC behaviour of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (5:1:5)	Dipped in Vanillin Sulphuric acid reagent and heated in air oven at 105^{o} for 10 minutes.	4	0. 29 0.47 0.67 0.90

(Anonymous-2007)

Aa'maal-e-Adviya (Pharmacological action): Mughalliz, Mufarreh, Mubahhi, Muqawwie Qalb, Qabiz, Muqawwie-Aam, Mufattite-Hissat, Kasir Riyah.

Mahall-e-Istemalat (Therapeutic use): Zaufe Diamgh, Qalb wa Jigar, Khafqan, Warme Kabid, Malenkolia (Melancholia), Zaufe Bah, Yarqan, Hissate urda, Hissate Masana.

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): Excessive dose of Behman safed is considered harmful causes headache and rectal diseases.

Aaham Nukhsajat (Important formulations): Laboobe Kabeer, Laboobe Sagheer, Majoon Chobchini, Habbe Jadwar, Khamira Gaozaban Sada, Dawaul Misk Motadil.

BEHMAN SURKH
(Root)

Behman surkh is a dried root of herbaceous perennial Salvia haematodes Linn. distributed in the Mediterranean region. Roots are imported into Bangladesh.

Naam-e-Degar (Other names) :

a) Botanical name: Salvia haematodes Linn.
b) Family: Lamiaceae
c) Bengali name: Lal Behman
d) English name: Garden sage, Red Sage, Blood veined sage

Tafseel (Description) :

a) Aam (General): Behman surkh is an herbaceous perennial forming a basal clump 1 to 1.5 m (3.3 to 4.9 ft) tall, with rich green rugose leaves that are slightly ruffled and toothed on the edges. The stems have four edges and are clad in glandular and soft hairs. The leaves are arranged in opposite pairs, with those on the lower part of the stem up to 15 cm (6 in) long, decreasing in size higher up the stem. The flower stalks are typically branched, with four to six flowers in each verticil forming a lax spike. The 2.5 cm (1 in) flowers open from the base of the inflorescence, which grows up to 30.5 cm (12 in) long. (Wikipedia**)**

b) Klaa Beeni (Macroscopic): Cut pieces of roots, 2 to 3 cm in diameter and 0.5 to 5 cm in length; light to reddish brown, hard. shrunk. rough with transverse fissures: lateral roots or root scars absent; cut surface exhibits concentric rings and radial lines from centre; no characteristic odor or taste (Anonymous-2007).

c) Khurd Beeni (Microscopic): Transverse section roughly circular in outline showing remnants of peeled dry tissues towards periphery; cortex present with outer layers collapsed and inner cells rectangular to isodiametric, several showing druses and brown coloured contents; cambium present. vascular system consists of a central core of xylem with about 17 or 20 radially extending narrow arms of tissues, with patches of xylem alternating with parenchyma and capped by a patch of phloem; broad wedges of medullary rays dilating slightly towards periphery present. (Anonymous-2007).

Powder: Brown. shows straight walled isodiametric to rectangular parenchyma cells; reticulate and spiral vessel elements of length 85 u to 268 u and width 35 u to 67 p with transverse or oblique simple pores, occasionally tailed: druses of calcium oxalate crystals varying from 31 p to 64 u. in diameter. (Anonymous-2007).

Juz-e-Mustamil (Part used): Mainly the Root is used as drugs purpose.

Maskan (Habitat): Native to Europe, western Asia and northern Africa where it grows in meadows, fields, banks and rough places.

Jwoher'e Nabatati (Phytoconstituents): Fatty acids, tannins, alkaloids and terpenes (Anonymous-2007).

Mizaj (Temperament): Hot 3^{O}, Dry 3^{O}

Musleeh (Corrective): Unnab (Awan-1981)

Badal (Proximal substitute): No proximal substitute is identified**.**

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 5 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 3 %	Appendix 2.2.6
Water soluble extractive	Not less than 45 %	Appendix 2.2.7

(Anonymous-2007).

TLC behavior of chloroform extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Ethyl Acetate (5:1.5)	Dipped in Vanillin Sulphuric acid reagent and heated in air oven at $105^{O}$for 10 minutes.	2	0.42 0.51

Aa'maal-e-Adviya (Pharmacological action): Muqawwi-e-Qalb, Mufarreh, Mubahhi, Mughalliz, Muqawwi-e-Demagh

Mahall-e-Istemalat (Therapeutic use): Khafqan,, Zof-e-Qalb, Zof-e-Bah , Zof-e- Demagh

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): Not observed

Aaham Nukhsajat (Important formulations): Habb-e-Jadwar, Majoon Chobchini, Dawaul Misk Motadil, Khamira Gaozaban, Luboob-e- Kabeer.

CHANBELI

(Leaf)

The drug Chanbeli consists of dried leaves of a large climbing shurb that is used for the ailments of diseases in Unani and Ayurvedic system of medicine.

Other Names:

a. Botanical : *Jasminum officinale* Linn.
b. Family : Oleaceae
c. Bengali : Chameli
d. English : Common Jasmine, Jasminne

Tafseel (Description)) :

Aam (General): Chamelee is a vigorous, twining, bright, deciduous climber with sharply dark green and pinnate leaves and clusters of starry, pure white flowers in summer, which are the source of its heady scent. It is also cultivated as herbal medicine.

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

Khurd Beeni (Microscopic): Rachis- Rachis shows more or less convex outline with two lateral wings, epidermis single layered covered by thick cuticle; hairs mostly unicellular with pointed apex, glandular, hair rarely found only on the upper surface; collenchyma 2-5 layered; pericycle represented by slightly lignified small fibre groups; vascular bundles three, crescent-shaped, small accessory bundle present in each wing.

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

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

Powder- Yellowish-green; shows plaisade and spongy parenchyma, unicllular hairs, fibres and vesels with spiral thickening, polygonal epidermal cells and anomocytic sto-mata in surface view.

Juz-e-Mustamil (Part used): Roots, Leaves, flowers and buds.
Maskan (Habitat): Jasmines are native to tropical and subtropical regions of Eurasia, Australasia and Oceania, although only one of the 200 species is native to Europe. Their center of diversity is in South Asia and Southeast Asia. A number of jasmine species have become naturalized in Mediterranean Europe.

Jwoher'e Nabatati (Phytoconstituents): It has alkaloids, coumarins, flavonoids, tannins, terpenoids, glycosides, emodine, leucoanthcyanins, steroids, anthocyanins, phlobatinins, essential oil and saponins.

Mizaj (Temperament): Hot and Dry

Musleh (Correction): Oil, Ghee and fresh cheese.

Badal (Proximal substitute): *Jasminum sambac (*Arabian jasmine*), Jasminum polyanthum (*Pink jasmine*), jasminum nudiflorum(*Winter jasmine)

Shinakht, Khalisyat wa Quwwat/Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	: Not more than 2 per cent, Appendix 2.2.2
Total ash	: Not more than 6 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 18 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 25 per cent, Appendix 2.2.7
Volatile oil	: Not more than 1 per cent

TLC behaviour of chloroform extract:
T.L.C. of the alcoholic extract on Silica gel 'G' plate using tolune Ethylacetate (9:1) shows under UV (366 nm) three flurescent zones at Rf 0.44 (blue), 0.52 (light blue) and 0.91 (blue). On exposure to Iodine vapours ten spots appear at Rf. 0.08, 0.38, 0.44, .049, 0.53, 0.59, 0.67, 0.81 and 0.91 9all yellow). On spraying with Drgendroff reagent followed by 5% MEthanolic-Sulphuric acid reagent four spots appear at Rf 0.08, 0.18 (both orange), 0.4 and 0.91 (both light orange). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110^0 C many spots of brown, yellow, blue and violet colour appear from the point of application to the solvent front Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Musakkin-e-Waj-e-Dandan.

Mahall-e-Istemalat (Therapeutic uses): Qula

Meqdar-e-khorak (Dose): 3-5 gm

Muzir (Side-effects / adverse-effects): This oil can cause irritation in some people if used too frequently or in high concentrations. A major component of jasmine is benzyl acetate which is known to be absorbed through the skin and known to be an allergic sensitizer.Those who show allergies to spicy food, perfumes and cosmetics are most likely to react. However, the power of the scent is such that only tiny amounts are required. Jasmine is also an emmenagogue and therefore should not be used during pregnancy.

DARCHINI

(Bark)

Darchini is an evergreen tree, attaining the height of about 6-8 meter with thick, smooth, reddish brown bark. The branches of the trees are lopped and their bark removed; the dried inner bark constitutes the drug Cinnamon. The drug is used in diarrhoea, nausea, and vomiting.

Naam-e-Degar (Other names) :

a. **Botanical** **:** *Cinnamomum Zeylanicum*
b. **Family** **:** Lauraceae
c. **Bengali** **:** Darchini, Daruchini
d. **English** **:** Cinnamon bark, Chinese cassia

Tafseel (Description) :

Aam (General) : The bark of *Cinnamomum zeylanicum* is *thick, smooth, reddish brown in colour. Opposite or sub - opposite leaves are ovate or* ovate-Lanceolate, hard and coriaceous, glabrous and shining above, slightly pale beneath with 3-5 main nerves. 1/2 - 1-inch petiole flattened above. Many minute flowers in axillary or sub-terminal cymes or panicles. Fruit is ovate or oblong, about 1.5 - 2 cm long, minutely apiculate, dry or slightly fleshy and dark purple in colour with single seed and persistent perianth.

Klaa Beeni (Macroscopic) : Bark pieces about 0.5 mm thick brittle, occurs as single or double, closely packed compound guills, upto a metre or more in length about 1 cm in diameter, outer surface, dull yellowish-brown, marked with pale wavy longitudinal lines

with occasional small scars or holes; inner surface darker in coour, striated with longitudinally elongated reticulation; fracture, splintery, free from all but traces of cork;odour, fragrant; taste; sweet; aromatic with sensation of warmth.

Khurd Beeni (Microscopic) : Transverse section of bark (Devoid of cork and cortex) shows except at certain places pericyclic sclerenchyma, 3 or 4 rows of its diametric cells, sometimes tangentially elongated, inner and radial walls often being thicker than the outer, some containing starchgrains, small group of pericyclic fibres embedded at intervals in the sclerenchyma; phloem of tangential bands of sieve tissue alternating with parenchyma and containing axially elongated secreting cells containing volatile oil or mucilage; phloem fibres with very thick walls, upto 30 meter in diameter, isolated or in shorttangential rows;sieve tubes narrowwith transverse sieve plates, collapsed in outer periphery; medullary rays of isodiametric cells, mostly 2 cells wide; cortical parenchyma and medullary rays containing small starchgrains mostly below 10 meter in diameter;minute acicular crystals or calcium oxalate present.

Juz-e-Mustamil (Parts used) : Dried inner bark (Devoid of cork and cortex)

Maskan (Habitat): Cinnamomum zeylanicum is native to the Indian subcontinent, India, Nepal, Bhutan, Pakistan, Bangladesh, but most specifically Sri Lanka. Cinnamomum zeylanicum requires a subtropical to tropical area with full tropical sunshine and moist soil. Now, the tree is commercially grown in Brazil, the Caribbean and India. A great deal of cassia cinnamon comes from Indonesia, although the tree is also grown in Vietnam, China and Burma.

Jwoher'e Nabatati (Phytoconstituents): The oil extracted from leaves containing 70-80% of Eugenol, oil from bark contain cinnamon oil which is brown and viscid and the root oil has a strong camphoraceous smell with yellow colour and is lighter than water and also tannin and mucilage.

Mizaj (Temperament): 3rd Degree Hot & Dry

Musleh (Correction): Milk, Maul Aasal, Honey and Cold tempered substances.

Badal (Proximal substitute): Tojj(*Cinnamomum cassia*), Nar-Musk(*Abelmoschus moschatus***)**, Kontikari(*Solanum virginianum*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	: Not more than 2 per cent, Appendix 2.2.2
Total ash	: Not more than 3 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not more than 2 per cent, Appendix 2.2.6
Water- soluble extractive	: Not more than 3 per cent, Appendix 2.2.7
Volatile oil	: Not more than 1 per cent

Aa'mal-e-Advia (Pharmacological action): Mulattif, Kasir-e Riyah, Munaffis-e-Balgam, Muqawwi-e-Meda, Muqawwi-e-Kabid, Qabiz, Moharrik-e-Bah, Mudirr-e-Baul, Mudirr-e-Haiz.

Mahall-e-Istemalat (Therapeutic uses): Bakhr-ul Fam, Bahaq, Zof-e-Bah, Zeequn Nafas, Ehtebas-e-Baul.

Meqdar-e-khorak (Dose): 1 to 2 gm.

Muzir (Side-effects / adverse-effects): Hives, Itchy eyes, nausea, chest congestion, difficulty in swallowing.

Aaham Nukhsajat (Important formulations): Habb-e Amber Momyaee, Qurs-e-Mukhaddir, Dawa-ul-Misk Motadil Jawahar Wali, Dawa-ul-Misk Motadil Sada, Halwa-e-Baiza-e-Murgh, Halwa-e-Gazar, Jawarish-e-Bisbasa, Jawarish-e-Jalinoos, Jawarish-e-Kundor, Jawarish-e-Nar Mushk, Jawarish-e-Ood Shirin, Jawarish-e-Ood Tursh, Jawarish-e-Pudina, Zarooni Sada, Mazoon-e-Dabidul Ward, Mazoon-e-Falasifa, Mazoon-e-Fanjnosh, Mazoon-e-Ispand Sokhtani, Mazoon-e-Jalali, Mazoon-e-Jalinoos Lului, Mazoon-e-Khadar, Mazoon-e-Lana, Mazoon-e-Mughalliz, Mazoon-e-Muluki, Mazoon-e-Rahul Momineen, Mazoon-e-Suparipak, Mazoon-e-Ushba, Tiryaq-e-Samania, Raughan-e-Darchini, Arq-e-Amber, Arq-e-Chobchini, Iyarij-e-Faiqara, Sufoof-e Kisjneez, Sufoof-e-Qaranful.

FUNDUQ

(Fruit)

The drug Funduq consists of the fruit of *Corylusavellana* Linn. It is growing in Europe, Western Asia and Northern Africa as large shrubs or small trees about3.5–4.5 m high

Naam-e-Degar (Other names) :

a) Botanical name:	*Corylusavellana* Linn
b) Family:	Betulaceae
c) Bengali name:	Funduq
d) English name:	Hazel nut, European Hazel

Tafseel (Description) :

a) Aam (General): It is growing in Europe, Western Asia and Northern Africa as large shrubs or small trees about3.5–4.5 m high. The leaves are deciduous, rounded, 6–12 cm long,softly hairy on both surfaces, with a double-serrate margin. Theflowers are monoecious, with single-sex catkins, the male pale yellow and 5–12 cm long. The edible part of the hazelnut is theroughly spherical seed, which is covered by a dark brown perispermand protected by a hard, woody shell. The ripening nut is enclosedin a green fringed tube

b) KlaaBeeni (Macroscopic): Fruit is a nut, hemi-ellipsoid, with somewhat flat base, upto 2 cm in size, almond coloured, carrying a paler scar left by its attachment to bracteoles on the flat base; shell finely and longitudinally striated and at a few places characteristic elongated depressions are also seen; broken nut shows contains one seed, globose to pyramidal with rounded edges; seed coat orange-brown having striations; kernel is cream coloured and very mush oily: taste sweet and pleasant, no specific odour.

c) Khurd Beeni (Microscopic): The cross section of the nut shows a cuticle, followed by a single layer of epicarp composed of oval to rectangular and thick walled parenchymatous cells. Trichomes simple, unicellular, thin walled, non-glandular and varying in size present; mesocarp is composed of several layers of sclereids, the first few layers have smaller cells and middle portion consists of bigger cells while the lower portion generally has smaller cells; the sclereids are hexagonal to polygonal or oval, very thick lamellate walls with pits canals radiating through then, ranging from 9.0 to 76.0 µ in length and 6.0 to 36.0 µ in width. The vascular bundles prominently show the presence of vessels with associated parenchyma; innermost part of the mesocarp mainly consists of collapsed cells. Testa of the seed shows an outermost cuticle and 2 or 3 layers of parenchymatous cells which are compact, rectangular and thin walled, some containing oil; vascular strands surrounded by a layer of almost disorganised cells.
Transectional view of the cotyledon shows a single layered epidermis composed of oval to rectangular and slightly thick walled parenchymatous cells; rest of cotyledon consists of compact, thin walled, hexagonal to polygonal parenchyma and mostly filled with oil droplets. Small rosette crystals of calcium oxalate also present in these cells.
Powder: Powder of the crude drug is brown, coarse. free flowing; taste is slightly sweet and pleasant, no specific odour, cells from epicarp, testa, cotyledon present, sclereids and oil containing parenchyma seen; sclereids are abundant, hexagonal to polygonal, vary in size, highly thickened with broad lumen and conspicuous raidal striations. Vessel in less number, short, thick walled having spiral or scalariform thickening.

Juz-e-Mustamil (Part used): Fruit / kernel is mainly use as drugs purpose**.**

Maskan (Habitat): Native to Europe and Western Asia; common in gardens on hill-station in India. The Turkish Hazel Nuts are imported into India during the winter season.

Jwoher'eNabatati (Phytoconstituents): Myristic acid, Palmitic acid, stearic acid oleic acid, Linoleic acid

Mizaj (Temperament): Hot$2^{O,}$ Dry 2^{O}

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute is identified

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 3 %	Appendix 2.2.3
Acid insoluble ash	Not more than 2 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 6 %	Appendix 2.2.6
Water soluble extractive	Not less than 11 %	Appendix 2.2.7

TLC behavior ofEthanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Acetate : Acetic Acid (5:4:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	5	0.33 0.62 0.76 0.83 0.88

Aa'maal-e-Adviya (Pharmacological action): Muqawwi-e-Dimagh, Muqawwi-e-Bah, Muqawwi-e-Ama, Munaffis-e-Balgham, Muqawwi-e-Kerm e Mani, Mowalled-e-Kerm e Mani,

Mahall-e-Istemalat (Therapeutic use): Zof-e- Dimagh, Zof-e-Kabid, Suzak, Khafqan, ZeequnNafas, Qillat-e-Kerm e Mani, Zof-e- Kerm e Mani,

Meqdar-e-Khorak (Dose): 5-10 g

Muzir (Side-effects / adverse-effects): Like other tree nuts, hazelnuts can induce allergic reactions. The allergic responses dependstrongly on individual sensitivity, ranging from mild symptoms to severe, life-threateninganaphylactic forms.

AahamNukhsajat (Important formulations): Majoon Arad Khurma, Laboob-Sagheer, Laboob-e-Kabeer, Halwa-e-Gazar, Majoon-Falaksair, Raughan-e-Laboob-e-Saba, Qurs-e-Luboob.

HEEL KHURD

(Fruits)

Heel Khurd, commonly known as cardamom, is a pungent, aromatic, herbaceous, evergreen perennial of the ginger family. The seeds of the fruits are popular in South Asian dishes, particularly curries, and in Scandinavian pastries. Though the fruit is used as spice in many of the countries, but in Unani and Ayurvedic Formularies, it has been formulated for the treatment of different diseases.

Naam-e-Degar (Other names) :

a. **Botanical** **:** *Elettaria cardamomum*
b. **Family** **:** Zingibareceae
c. **Bengali** **:** Chiota Elachi
d. **English** **:** Cardamom

Tafseel (Description) :

Aam (General) : The herb is about 2-4 meter in height. It has alternate leaves in two rows, linear-lanceolate, 40-60 cm long, with a long pointed tip. The flowers are white to lilac or pale purple, produced in a loose end portion of 30-60 cm in length. Darchini consists of whole or ground dried fruits, or seeds. The seeds have a warm, slightly pungent, and highly aromatic flavour somewhat reminiscent of camphor. The fruit is a three-sided yellow-green pod, 1-2 cm long, containing between 15 and 20 black and brown seeds.

Klaa Beeni (Macroscopic) : Fruit: About 1-2 cm long, ovoid or oblong and more or less three sided with rounded angles, greenish to pale-buff or yellowish in colour, base rounded or with the remains of pedical; apex shortly beaked; surface almost smooth or with the longitudinalstriations,;small trilocular fruit each containing about 15-20 seedsin a row of doubles, adhering togrther to form compact mass.
Seed: Dark brown to black , about 4 mm long and 3 mm broad, irregularly angular, transversely wrinkled but not pitted; with a longitudinal channel containing raphe, enclosed in a colourless, membranous aril; odour strongly aromatic; taste characteristic.
Khurd Beeni (Microscopic) : Transverse section of seed shows flattened, aril, thin-walled parenchymatous cells; testa with outer epidermis of thick-walled, narrow, elongated cells, followed by layer collapsed parenchyma, becoming 2 or 3 layered in the region of raphe, composed of large, thin-walled rectangular cells containing volatile oil, a band of 2 or 3 layers of parenchyma and an inner epidermis of thin walled flattened cells; inner integument 2 layered an outer palisade sclerenchyma with yellow to reddish-brown beaker shaped cells; 20 meter long in radial direction and 12 meter wide, thickened on inner and anticlinal walls, each cell with small bowl skaped lumen containing a warty nodule of silica and an inner epidermis of flattened cells; perisperm cells thin-walled packedwith minute rounded poly hedral starch grains, about 1-2 to 4-6 meter in diameter and containing 1-7 small prismatic crystals of calcium oxalate, about 10-20 meter long; endosperm of thin-walled parenchyma containing protein as a granular hyaline mass in each cells; embryo, of small thin-walled cells containing aleurone grains; starch absent in endosperm and embryo; fibres sclerenchymatous; large vessels present in pericap.
Juz-e-Mustamil (Parts used) : Seeds of dried fruits.

Maskan (Habitat): Cardamom is one of the world's very ancient spices. It is native to the East originating in the forests of the western ghats in southern India, where it grows wild. Today it also grows in Sri Lanka, Guatemala, Indo China and Tanzania. It is distributed in Iran and Malaysia

Jwoher'e Nabatati (Phytoconstituents): Dried fruit of cardamom contains steam volatile oil, fixed (fatty) oil, pigments, proteins, cellulose, pentosans, sugars, starch, silica, calcium oxalate and minerals.

Mizaj (Temperament): 3rd Degree Hot & Dry

Musleh (Correction): Katira Gum(Gum tragakanth) & Tabasjir (*Bambusa arundinaceae*).

Badal (Proximal substitute): Heel Kalaee.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

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

Water- soluble extractive : Not less than 10 per cent, Appendix 2.2.7
Volatile oil : Not more than 4 per cent

Aa'mal-e-Advia (Pharmacological action): Muqawwi-e-Meda, Mutayyib-e-Dahan, Kasir-e-Riyah, Muffarrih, Musakkin, Muqawwi-e-Qalb.

Mahall-e-Istemalat (Therapeutic uses): Bakhr-ul-Fam, Zof-e-Hazm, Nafkh-e-Shikam, Zof-e-Qalb, Khafqan, Qai, Ghisyan.

Meqdar-e-khorak (Dose): 0.5-1 gm.

Muzir (Side-effects / adverse-effects): Cardamom seed can trigger gallstone colic.

Aaham Nukhsajat (Important formulations): Jawarish-e-Anarain, Jawarish-e-Jalinoos, Jawarish-e-Narmusk, Jawarish-e-Ood Tursh, Jawarish-e- Jawarish-e-Pudina, Jawarish-e-Shahi, Jawarish-e-Shahreyaran, Jawarish-e-Tamar Hindi, Jawarish-e-Zanjabeel, Jawarish-e-Zarishk, Majoon-e-Mughalliz, Majoon-e-Kuluki, Majoon-e-Muqil, Majoon-e-Supari Pak, Majoon-e- Mufarrih Barid, Majoon-e-Mufarrih Barid Jawahar Wali, MarhamRaskapoor, Raughan-e Babuna Qawi, Arq-e-Amber, Arq-e-Heel Khurd, Arq-e-Juzam, Sufoof-e-Hazim-Kalan, Sufoof-e-Qaranful, Sufoof-e-Satt-e-Gilo, Sufoof-e-Satt-e-Gilo Sartani, Sufoof-e-Suzak Qawi, Sufoof-e-Tabkhir, Sufoof-e-Missi, Zuroor-e-Qula Abyaz, Zuroor-e-Kath, Zuroor-e-Qula.

Hilteet

(Rhizome and Root)

Hilteet is herbaceous plant of the umbelliferae family. It is used as a digestive aid, in food as a condiment and in pickles. It is used in the treatment of hysteria, some nervous conditions, bronchitis, asthma and whooping cough. It was at one time employed in the treatment of infantile pneumonia and flatulent colic.

Naam-e-Degar (Other names) :

a. **Botanical** **:** *Ferula foetida*
b. **Family** **:** Umbelliferae
c. **Bengali** **:** Hing, Hingra
d. **English** **:** Asafoetida

Tafseel (Description) :

Aam (General) : It is a perennial plant and is about 2 meter in hight, with a circular mass of 30 to 40 cm leaves. Stem leaves have wide sheathing petioles. All parts of the plant have the distinctive fetid smell.

Klaa Beeni (Macroscopic) : Rounded flattened or mass of agglutinated tears, grayish-white to dull yellow, mostly 12-25 mm in diameter; freshly exposed surfaces, Yellowish and translucent of milky white, opaque slowlybecoming pink, red, finally reddish brown;odour, strong, characteristic and persistant; taste, bitter and acrid.

Juz-e-Mustamil (Parts used) : Oleo-gum-resin from rhizomes and roots

Maskan (Habitat): Heeng is native to central Asia, eastern Iran to Afghanistan, and today it is grown chiefly in Iran and Afghanistan, from where it is exported to the rest of the world. It is not native to India, but t it is also cultivated in India, mainly in the regions of Kashmir and some parts of Punjab.

Jwoher'e Nabatati (Phytoconstituents): Typical Heeng contains about 40–64% resin, 25% endogeneous gum, 10–17% volatile oil, and 1.5–10% ash. The resin portion is known to contain asaresinotannols 'A' and 'B', ferulic acid, umbelliferone and four unidentified compounds. The volatile oil component is rich in various organosulfide compounds, such as 2-butyl-propenyl-disulfide, diallyl sulfide, diallyl disulfide (also present in garlic) and dimethyl trisulfide, which is also responsible for the odor of cooked onions. The organosulfides are primarily responsible for the odor and flavor of asafoetida.

An analysis of Heeng shows it to consist of carbohydrates 67.8% per 100 gms, moisture 16.0%, protein 4.0%, fat 1.1%, minerals 7.0% and fiber 4.1%. Its mineral and vitamin contents include substantial calcium besides phosphorus, iron, carotene, riboflavin and niacin. Its calorific value is 297, contains 40-64% resinous material composed of ferulic acid, umbel-liferone, asaresinotannols, farnesiferols A, B, and C etc., about 25% gum composed of glucose, galactose, l-arabinose, rhamnose, and glucuronic acid[18] and volatile oil (3-17%) consisting of disulfides as its major components, notably 2-butyl propenyl disulfide (E- and Z-isomers), with monoterpenes (α- and β-pinene, etc.), free ferulic acid, valeric acid, and traces of vanillin (LAF). The disagreeable odor of the oil is reported to be due mainly to the disulphide C11H20S2.

Mizaj (Temperament): 4th Degree Hot & 3rd Degree Dry
Or 3rd Degree Hot & Dry

Musleh (Correction): Anar(*Punica granatum*), Anisun(*Pimpinella anisum*), Banafsa(*Viola odorata*), Nilufar(*Nymphaea alba*), Seb(*Malus domestica*). The drug may also be corrected by frying with Ghee.

Badal (Proximal substitute): Jaoshir and Sekenjabeen can be used as alternatives.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (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 3 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 50 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 50 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action): Moharrik-e-Asab, Hazim, Kasir-e-Riyah, Daf-e-Taffun, Muddir-e-Baul, Muddir-e-Haiz.

Mahall-e-Istemalat (Therapeutic uses): Nafkh-e-Shikam, Zof-e-Hazm, Zof-e-Meda, Nisyan, Qillat-e-Baul, Falij, Laqwa.

Meqdar-e-Khorak (Dose): 1 gm.

Muzir (Side-effects / adverse-effects): Large amount may cause stomach irritation, swelling of the lips, burping, intestinal gas, diarrhea, headache, convulsions and blood disorders.

Aaham Nukhsajat (Important formulations): Majoon-e-Antaki, Habb-e-Hilteet, Tila-e-Jund, Zimad-e-Khanazeer.

HUMMAZ
(Seed)

The drug Hummaz consists of dry seeds of *Rumexvesicarius* Linn, also known as Ruby dock, or bladder dock, is a species of perennial flowering plant in the family Polygonaceae. Leaves are eaten as vegetable, and are also added to other curies for its sour taste.

Naam-e-Degar (Other names) :

a) Botanical name: *Rumex vesicarius* Linn
b) Family: Polygonaceae
c) Bengali name: *Tokpalongbeej,Chukapalong, Amlabetom, Chuk,Chukpal*

d) English name: *Rosy Dock, Dock Sorrel, Bladder Dock*

Tafseel (Description) :

a) Aam (General): It is an erect, a small, 15 to 30 cm high,, succulent annual herb which grows to up about 60 cm high, and has triangular to ovate leaves which are truncate or cordate at the base and about 5–10 cm long, with entire margins. The stipules form an almost complete sheath around the stem which disintegrates. The flowers are green with a red tinge, and have six perianth segments with the inner three becoming enlarged and papery when fruiting. The hard, red and reticulately veined fruit persist, giving rise to spectacular displays.


b) KlaaBeeni (Macroscopic): Seeds triangular small, about 1.5 mm long and 1 mm wide, dark brown, shining, albuminous, embryo eccentric, nearly straight, cotyledons linear, taste acrid, odour not specific.
c) KhurdBeeni (Microscopic): Cross section of seed triangular, testasclerified, cells elongated radially like palisade, thick walled cells, lumen narrow; tegmen almost crushed, endosperm starchy, embryo parenchymatous with cells containing crystals of calcium oxalate, oil globules and aleurone grains.
Powder: Deep brown, coarse, consisting of small fragments of testa with sclerified epidermal cells showing narrow lumen, starch grains and a few small cotyledonary parenchymatous cells; aleurone grains and prismatic crystals present in endosperm cells.

Juz-e-Mustamil (Part used): Leave, seed, root are used as drugs purpose.

Maskan (Habitat): Hummaz (*Rumexvesicarius)* is native to tropical and temperate Asia, Africa, and Western Australia. It is found in Bangladesh specially Chittagong. In India it is available in Western Punjab and cultivated in Tripura, West Bengal and Bihar.

Jwoher'eNabatati (Phytoconstituents):
Cystine, glutamic acid, proline, phenylalanine and histidine.

Mizaj (Temperament): Cold 1^{O} - $Dry1^{O}$

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute is identified

Shinakht, KhalisyatwaQuwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 3 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 1 %	Appendix 2.2.6
Water soluble extractive	Not less than 6 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80°) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Ethyl Acetate : (9:1)	On spraying plate with 2% Ethanolic conc. H_2SO_4andheated for 5 minutes at 105° C	5	0.14 0.28 0.42 0.50 0.57

Aa'maal-e-Adviya (Pharmacological action): Habis-e-Dam, Qabiz, Musakkin ,Daf-e-Humma.

Mahall-e-Istemalat (Therapeutic use): Ishal, Qurooh-e-Ama, Ghasayan, Qai, Atash-e-Mufrit, Taqteer-e-Baul, Humma

Meqdar-e-Khorak (Dose): 3-5 g.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed

AahamNukhsajat (Important formulations): Majoon-e-MasikulBaul, Qurs-e-Kahruba,

Jauzbuwa
(Seeds)

Jauzbuwa is an evergreen tree and is important as the main source of the spices nutmeg and mace. It is incorporated in the formulations of Unani and Ayurvedic Formularies for the treatment of different diseases.

Naam-e-Degar (Other names) :

a. **Botanical** **:** *Myristica fragrans*
b. **Family** **:** Myristicaceae
c. **Bengali** **:** Jaypala
d. **English** **:** Nutmeg

Tafseel (Description) :

Aam (General) : The evergreen tree is usually 5 to 15 meter in height, but occasionally reaching 20 meter or even 30 meter on Tidore. The alternately arranged leaves are dark green, 5 to 15 cm long by 2 to 7 cm wide with petioles about 1 cm long. The species is dioecious, i.e. "male" or staminate flowers and "female" or carpellate flowers are borne on different plants, although occasional individuals produce both kinds of flower. The flowers are bell-shaped, pale yellow and somewhat waxy and fleshy. Staminate flowers are arranged in groups of one to ten.

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

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

Juz-e-Mustamil (Parts used) : Endosperm of dried seeds(Kernel of fruits)

Maskan (Habitat): Myristica fragrans is indigenous to the Moluccas or the Spice Islands of Indonesia. It is widely grown across the tropics including Guangdong and Yunnan in China, Taiwan, Indonesia, Malaysia, Grenada in the Caribbean, Kerala in India, Sri Lanka and South America.

Jwoher'e Nabatati (Phytoconstituents): Alkyl benzene derivatives (Myristicin, elemicin, safrole) myristic acid, alpha-pinene, terpenes, beta-pinene and trimyristin and also essential oil and fixed oil.

Mizaj (Temperament): 2nd Degree Hot & Dry

Musleh (Correction): Gul-e-Banafsa(*Viola odorata*), Kashnij Khusk, Honey

Badal (Proximal substitute): Basbasa/Joitri(Myristica fragrance), Akarkarah, Filfil Daraj(*Piper longum*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	: Not more than 1 per cent, Appendix 2.2.2
Total ash	: Not more than 3 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 11 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 7 per cent, Appendix 2.2.7

Ether- soluble extractive : Not less than 25 per cent v/w
Volatile oil : Not more than per cent v/w

Aa'mal-e-Advia (Pharmacological action): Mofarrih, Muqawwi-e-Bah, Mutayyib-e-Dahan, Muqawwi-e-Meda, Qabiz, Kasir-e-Riyah, Mukhaddir.

Mahall-e-Istemalat (Therapeutic uses): Zof-e-Bah, Qula, Falij, Laqwa, Zof-e-Bsarat, Nafkh-e-Shikam

Meqdar-e-khorak (Dose): 1-2 gm.

Muzir (Side-effects / adverse-effects): Nausea, dry mouth, dizziness, irregular heartbeat, agitation and hallucinations and even death.

Aaham Nukhsajat (Important formulations): Laboob-e-Kabir, Jawarish-e-Ood Shireen, Habb-e-Mumsik Waqi.

KABABCHINI
(Fruits)

Kababchini comes from Arabic *kabāba* by way of Old French *quibibes*. Cubeb is mentioned in alchemical writings by its Arabic name. It has been reported for various pharmacological actions.

Naam-e-Degar (Other names) :

a. **Botanical :** *Piper cubeba* Linn
b. **Family :** Piperaceae
c. **Bengali :** Kababchini
d. **English :** Cubebs, Tailed pepper

Tafseel (Description) :

Aam (General) : Kabab Chini is a perennial woody climber with ash grey climbing stems and branches, rooted at joints. Cubebs or tailed pepper are the dried, full grown fruits of the Piper cubeba. The spikes of cubebs bear more fruits and become falsely stalked as they mature, owing to an abnormal development of the base of the pericarp. The upper part of cubeb fruit is globular, 3-6 mm diameter and covered with a grayish brown, reticulated pericarp, which is prolonged at the base in to a straight stalk.

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

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

Juz-e-Mustamil (Parts used) : Mature, dried fruits.

Maskan (Habitat): The cubeb plant originally belongs to Indonesia. Cubeb came to Europe via India through the trade with the Arabs. It is now grown in many parts of Asia too.

Jwoher'e Nabatati (Phytoconstituents): The dried cubeb berries contain essential oil comprising monoterpenes (sabinene 50%, α-thujene, and carene) and sesquiterpenes (caryophyllene, copaene, α- and β-cubebene, δ-cadinene, germacrene), the oxides 1, 4- and 1,8-cineole and the alcohol cubebol.

About 15% of a volatile oil is obtained by distilling cubeb with water. Cubebene, the liquid portion, has the formula $C_{15}H_{24}$ and comes in two forms, α- and β-. They differ only in the position of the alkene moiety, with the double-bond being endocyclic (part of the five-membered ring) in α-cubebene, as shown, but exocyclic in β-cubebene. It is a pale green or blue-yellow viscous liquid with a warm woody, slightly camphoraceous odor. After rectification with water, or on keeping, this deposits rhombic crystals of camphor of cubeb.

Cubebin ($C_{20}H_{20}O_6$) is a crystalline substance existing in cubeb, discovered by Eugène Soubeiran and Capitaine in 1839. It may be prepared from cubebene, or from the pulp left after the distillation of the oil. The drug, along with gum, fatty oils, and malates of magnesium and calcium, contains also about 1% of cubebic acid, and about 6% of a resin.

Mizaj (Temperament): 2nd Degree Hot & Dry

Musleh (Correction): Chandan Sufaid(*Santalum album*), A'ab-e-Gulab(*Rosa damascene*), Mustagi(*Pistacia lentiscus)*, Ispaghula(*Plantago ovate*), Katan(*Linum usitatissimum*).

Badal (Proximal substitute): Aak (*Calotropis procera),* Filfilsiyah(Piper nigrum), Darchini(*Cinnamomum zeylanicum),* Elachi(*Elettaria cardamomum*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):
Foreign matter : Not more than 2 per cent, Appendix 2.2.2

Total ash	: Not more than 8 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 14 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 11 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action): Mulattif, Mufatteh-Sudad, Mutayyib-e-Dahan, Mohallil-e-Waram, Mudirr-e-Boul, Mudirr-e-Haiz.

Mahall-e-Istemalat (Therapeutic uses): Sual, Qurooh, Ehtebas-e-Boul.

Meqdar-e-khorak (Dose): 1-3 gm

Muzir (Side-effects / adverse-effects): Lower blood pressure and heart rate, too much sleepiness if combined with medications used during and after surgery.

Aaham Nukhsajat (Important formulations): Majoon-e-Antaqi, Laboob-e-Sagheer, Sufoof-e-Indrijulab, Sunoon-e-Mujalli, Zuroor-e-Qula Abyaz, Zuroor-e-Kath.

KALONJI
(Seeds)

Kalonji is an annual flowering plant, native to South and Southwest Asia. The seeds of this plant, commonly known as black seed or black cumin. In biblical times, the black eed was often used to spice breads and cakes, and throughout Europe over the centuries baked goods were spiced with black seeds in combination with cumin or coriander. In Unani and Ayurvedic system of medicine, the seeds are used for the treatment and prevention of many diseases.

Naam-e-Degar (Other names) :

a. **Botanical :** *Nigella savita* linn
b. **Family :** Ranuculanceae
c. **Bengali :** Kalazira
d. **English :** Nigella seed, Black cumin

Tafseel (Description) :

Aam (General) : Drug Kalonji consists of seeds of *Nigella savita* linn. Drug yielding plant is small herb. 45-60 cm high and its seeds are used as medicine from time immemorial.

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

Khurd Beeni (Microscopic): Transverse section of seed shows single layer of epidermis consisting of elliptical, thick-walled cells covered externally a papillose cuticle filled with reddish-brown content epidermois follwed by 2-3 layers of thick walled, tangentically elongated, parenchyma composed of thick walled rectangular, radially elongated cells,

present in a layer. endosprem consists of moderately thick-walled rectangular to polygonal cells, a few filled with oil blobules embryo embedded in endosperm.

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

Juz-e-Mustamil (Parts used) : Seeds

Maskan (Habitat): The Black Seed is believed to be native to the Mediterranean region**.** It has spread over the years throughout northern Africa, eastern Asia, and southern Europe. In the past few decades, Black Seed found its way into Eastern Europe and North America. The plant is cultivated worldwide for medicinal and culinary uses. The Black Seed is sensitive to climate and soil condition so its production thrives primarily throughout the Middle East and the Mediterranean Basin which includes India, Bangladesh, Egypt, Sudan, Turkey, Iraq, Iran, and Pakistan.

Jwoher'e Nabatati (Phytoconstituents) : Major component of *Nigella sative* consists of; linoleic acid, oleic acid, palmitic acid, and trans-anethole, and other minor constituents, such as nigellicine, nigellidine, nigellimine, and nigellimine N-oxide. Aromatics include thymoquinone, dihydrothymoquinone, p-cymene, carvacrol, α-thujene, thymol, α-pinene, β-pinene and trans-anethole.

Mizaj (Temperament) : 3rd Degree Hot & Dry

Musleh (Correction) : Thankuni(*Centella asiatica*), Katira Gum(Gum tragakanth), Amrul(*Oxalis corniculata***)**, Sirka.

Badal (Proximal substitute) : Anisun(*Pimpinella anisum*), Sulfa, Jatamansi(*Nardostachys Jatamansi***).**

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

Foreign matter	: Not more than 2 per cent, Appendix 2.2.2
Total ash	: Not more than 6 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 0.2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 20 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 15 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action) : Jali, Munaffis-e-Balgham, Muqawwi-e-Meda, Qatil-e-Deedan-e-A'ama, Mudirr-e-Haiz, Musakkin, Mohallil-e-Waram.

Mahall-e-Istemalat (Therapeutic uses) : Bahaq, Bars, Quba, Shaqeeqa, Zeequn Nafas, Zof-e-Meda, Nafkh-e-Shikam, Qulanj, Yarqan, Waj-ul-Mafasil, Waj-ul-Qutn, Falij, Laqwa.
Meqdar-e-khorak (Dose) : 1-2 gm.

Muzir (Side-effects / adverse-effects) : Allergic rashes, stomach upset, vomiting, or constipation. It might increase the risk of seizures.

Aaham Nukhsajat (Important formulations): Majoon-e-Kalkalanj, Majoon-e-Fanjnosh, Majoon-e-Kundur.

KAMILA
(Fruit)

Drug yielding plant is very common perennial shurb or small tree that consists of glands and hairs of fruit. The plant is found outer Himalayas ascending to 1500 meter. The mature fruits are collected in February-March. The reddish brown powder is collected in cloth by shaking and rubbing the fruits with hand for medicinal purpose.

Naam-e-Degar (Other names) :

a. Botanical : *Mallotus philippinensis* Muell
b. Family : Euphorbiaceae
c. Bengali : Kamalagundi, Kamala
d. English : Indiankamala, Rottlera.

Tafseel (Description) :

Aam (General) : *Mallotus philippensis* is a plant that is also known as the kamala tree or red kamala or kumkum tree, due to the fruit covering, which produces a red dye. It has also many other local names. This kamala often appears in rainforest margins or in disturbed areas free from fire, in moderate to high rainfall areas.

The plant is a bush to small or medium-sized tree, up to 25 metres tall and a trunk diameter of 40 cm. The trunk is fluted and irregular at the base. The grey bark is smooth, or with occasional wrinkles or corky bumps. Small branches are greyish brown in colour, with rusty covered small hairs towards the end. Leaves are opposite on the stem, ovate to oblong in shape. 4 to 12 cm long, 2 to 7 cm wide with a long pointed tip. The upper surface is green without hairs, the underside pale grey in colour. With a magnifying glass, small red glands may be visible. Leaf stems 2 to 5 cm long, somewhat thickened at both ends. The first leaf vein on either side of the mid rib extends from the leaf base, to over half the length of the leaf. Veins raised and evident under the leaf.

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

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

Juz-e-Mustamil (Parts used) : Glands and hairs of fruit

Maskan (Habitat) : Kamila plants are widely distributed small tree in tropical and subtropical region in outer Himalayas regions with an altitude below 1,000 meer.It has a widespread natural distribution, from the western Himalayas, through India, Sri Lanka, to southern China, and throughout Malesia to Australia. Sometimes it is gregarious but more usually mixed with other species, both in forests and open scrubland. Kamala tree is common in evergreen forest, especially in secondary forest, and sometimes even dominant in the undergrowth. Kamala tree withstands considerable shade; it is frost-hardy and resistant to drought.

Jwoher'e Nabatati (Phytoconstituents) : Phenols, diterpenoids, steroids, flavonoids, cardenolides, triterpenoids, coumarins, isocoumarins, resinous colouring matter(Rottlerin) and many more.

Mizaj (Temperament) : 2nd Degree Hot & Dry

Musleh (Correction) : Katira Gum(Gum tragakanth).

Badal (Proximal substitute) : Baobarang(*Embelia ribes).*

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

Foreign matter	: Not more than 2 per cent, Appendix 2.2.2
Total ash	: Not more than 6 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 4 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 50 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 1 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action) : Qatil-e-Deedan-e-A'ama, Mushil, Mujaffif, Daf-e-Tafun.

Mahall-e-Istemalat (Therapeutic uses) : Bussor, Jarab, Hikka, Deedan-e-A'ama

Meqdar-e-khorak (Dose) : Sufficient information is not available regarding dose.

Muzir (Side-effects / adverse-effects) : Nausea

Aaham Nukhsajat (Important formulations) : Itrifal-e-Deedan, Marham-e-Gulabi, Qurs Deedan.

KANER
(Leaves)

Drug yielding plant is a large evergreen woody shrub with milk juice. It has been reputed as therapeutic agents due to its biological activities including heart failure, cancer, anti-neoplastic, anti-inflammatory, sedation, anti-bacterial and anthelminthic effects.

Naam-e-Degar (Other names) :

a. Botanical : *Nerium indicum* Mill.
b. Family : Apocynaceae
c. Bengali : Karavi, Karabi.
d. English : Oleander

Tafseel (Description) :

Aam (General): *Nerium indicum* is evergreen shrub or small tree that grows up to 5 meter in height. The leaves are long, simple and narrowly elliptic to linear entire. The flowers grow in clusters at the end of each branch. The flowers have both male and female organs, soft sweet-scented, single or double cymes with attractive color that varies from white, pink or red, sweet smelled and 4-5 cm in diameter. Fruit of Nerium is long about 15-20 cm, cylindrical, deep longitudinal, narrow parallel lines or ridges and paired growing with the stem. The seeds usually are flat and winged or have a tuft of fine. Seeds contained in fruit are numerous, compressed and white and grayish in color having smooth hairs.

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

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

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

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

Juz-e-Mustamil (Parts used) : Dried leaves

Maskan (Habitat) : Nerium oleander is either native or naturalized to a broad area from Mauritania, Morocco, and Portugal eastward through the Mediterranean region and the Sahara (where it is only found sporadically), to the Arabian peninsula, southern Asia, and as far east as Yunnan in southern parts of China.*Now it* is distributed all over the Philippines

and found throughout the year in upper Gangetic plains, Himalayas from Nepal to Kashmir upto 2000 meter. It is also cultivated near temples and gardens.

Jwoher'e Nabatati (Phytoconstituents) : The drug consists of; neriumogenin, digitaloside, proceragenin, neridienone A and cardiace glucoside(Oleandrin).

Mizaj (Temperament) : 3rd Degree Hot & Dry

Musleh (Correction) : Oil, Ghee and fresh cheese. Or boil the drug with milk in light flame for 3 hours. At this the toxicity of the plant will be removed and then may be used.

Badal (Proximal substitute) : Digitalis(*Digitalis purpurea*), Nerium odorum.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (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 20 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 20 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action) : Muqawwi-e-Bah, Musaffi-e-Dam, Jali, Mujaffif, Muhallil-e-Waram.

Mahall-e-Istemalat (Therapeutic uses) : Juzam, Bars, Aatishak, Suzak, Qurooh, Zof-e-Bah, Fasad-ud-Dam.

Meqdar-e-khorak (Dose) : 1-1.5 gm.

Muzir (Side-effects / adverse-effects) : Skin irritations, severe eye inflammation and irritation, and allergic reactions characterized by dermatitis.

Aaham Nukhsajat (Important formulations) : Tila-e-Mumsik.

KHAR-E-KHASAK KHURD
(Fruits)

Drug Khar-E-Khasak consists of dried entire fruits. The plant is an annual rarely perennial common weed of the pasture lands road sides and other waste places chiefly in hot dry and sandy regions. It is used to treat different diseases of Nizam-e-Boul in Unani system of Medicine.

Naam-e-Degar (Other names) :

a. Botanical : *Tribulus terrestris* Linn
b. Family : Zygopyllaceae
c. Bengali : Gokshura, Gokhri
d. English : Caltrops, Caltrops fruits, Small caltrops

Tafseel (Description) :

Aam (General) : Tribulus terrestris is an annual plant in the caltrop family . It is widely distributed around the world and is adapted to grow in dry climate locations in which few other plants can survive. It is native to warm temperate and tropical regions.

Klaa Beeni (Macroscopic): Fruit stalked light or greenish yellow, five ribbed or angled more or less spherical in structure and covered with short stiff or pubescent hairs, 1 cm in diameter with five pairs of prominent short stiff spines pointed downwards about 0.5 cm in

length tips of spines almost meet in pairs, whole together forming pentagonal framework around fruit ripe fruit separated into five segments of each cocci and each appears as single fruit, each coccus semi-lunar or plano-convex in structure, one chambered, armed with a pair of spines starting from its middle, containing four or more seeds, taste slightly astringent.

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

Juz-e-Mustamil (Parts used) : Fruits

Maskan (Habitat) : The plant is native to the Mediterranean region. *It* is widespread throughout the world from latitudes 35°S to 47°N. It is distributed across warm temperate and tropical regions of southern Europe, southern Asia, throughout Africa, New Zealand, and Australia. It is present across the United States and in Central and South America. Over the 20th century, the vine appeared in California and became distributed northward, eventually appearing in the Okanagan Valley of south-central British Columbia, Canada where it is classified as a noxious weed.

Jwoher'e Nabatati (Phytoconstituents) : Potassium Nitrate sterols, Sapogenin with pyroketone ring (Diosgenin), furostanol saponins, protodioscin, beta carboline alkaloids, harman (harmane) and norharman, gitogenin, hecogenins flavonoids, flavonol glycosides, steroidal saponins, steroidal glycosides, furosteroidal saponins, furostanol etc.

Mizaj (Temperament) : 1st Degree Hot & Dry

Musleh (Correction) : No sufficient information is available regarding correction.

Badal (Proximal substitute) : Other sepsis of the plant.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

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

Aa'mal-e-Advia (Pharmacological action) : Mudirr-e-Boul, Mudirr-e-Haiz, Mufattit-t-Hasat.

Mahall-e-Istemalat (Therapeutic uses) : Hasat-e-Masana, Hirqat-ul-Boul, Ehtabas-e-Haiz, Surat-e-Inzal, Jiryan.

Meqdar-e-khorak (Dose) : 5-7 gm.

Muzir (Side-effects / adverse-effects) : Stomach pain, cramping, diarrhea, nausea, vomiting, constipation, excitation, difficulty sleeping, or heavy menstrual bleeding, rarely kidney damage.

Aaham Nukhsajat (Important formulations) : Sharbat-e-Buzoori Motadil, Sufoof-e-Ziabetus Qawi.

KHIYAR SHAMBER
(Fruits)

Drug Khiyar Shamber consists of pulp obtained from fruits (Devoid of seeds, septa and pieces of pericarp). It is commonly known as Sonali or Bandarlati and has been used in different traditional system of medicines for various ailments since ancient times. Drug yielding plant is moderate sized deciduous tree and found many of the countries of the world as wild or cultivated plant. Fruits of the plant are collected for medicine when ripe.

Naam-e-Degar (Other names) :

a. Botanical : *Cassia fistula* Linn
b. Family : Leguminosae
c. Bengali : Sonalu, Bandarlathi
d. English : Purging Cassia, Cassia

Tafseel (Description) :

Aam (General) : *Cassia fistula* is a moderate sized deciduous tree 10 meter tall, flowers yellow, leaves alternate, pinnate, 30-40 cm long, with 4-8 pairs of ovate leaflets, 7.5-15 cm long, 2-5 cm broad. Fruits pendulous, cylindrical, brown, septate, 25-50 cm long, 1.5-3 cm in diameter, with 25-100 seeds. Seeds lenticular, light brown, lustrous.

Klaa Beeni (Macroscopic): Fruit a many called indihiscent pod, 35-60 cm long and 18-25 mm in diameter, nearly straight and subcylindrical, chocolate-brown to almost black in

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

Khurd Beeni (Microscopic): The Transverse Section of leaf is dorsiventral consists of Midrib and Lamina. Transverse section of the stem shows a single layered epidermis composed of thin- walled cells covered externally by a thin cuticle. The cortex is composed of 8 to 14 layers of collenchymatous cells followed by 2 to 6 layers of parenchymatous cells. Endodermis is single layered, parenchymatous and found encircling the pericycle. Prismatic as well as rosette crystals of calcium oxalate are present in many cortical cells including endodermis, which shows the presence of only prismatic crystals. Each vascular bundle is capped by pericycle, which is represented in early stages by parenchymatous cells. Later many of these cells become thick walled and lignified and give rise to fibers and stone cells.

Leaf: The leaflet is dorsiventral in structure, the mesophyll being differentiated into palisade and spongy tissue. The upper epidermis is covered externally with moderately thick cuticle having horn like unicellular trichomes. The cells of the lower epidermis are somewhat rectangular in shape and arched outside and smaller than those of the upper epidermis. Stomata of paracytic type are present on both surfaces, but they are less abundant on the upper surface than the lower one. Chloroplasts are presentin abundance in the mesophyll cells. Stem; Transverse section of the stem shows a single layered epidermis composed of thin- walled cells covered externally by a thin cuticle. The cortex is composed of 8 to 14 layers of collenchymatous cells followed by 2 to 6 layers of parenchymatous cells. Endodermis is single layered, parenchymatous and found encircling the pericycle. Prismatic as well as rosette crystals of calcium oxalate are present in many cortical cells including endodermis, which shows the presence of only prismatic crystals. Each vascular bundle is capped by pericycle, which is represented in early stages by parenchymatous cells. Later many of these cells become thick walled and lignified and give rise to fibers and stone cells.

Midrib: It consist of single layered epidermis, on either side, upper epidermis composed of single layer closely arranged elongated cells externally covered with striated cuticle. Leaf surface contains simple, multicellular covering trichomes and anomocytic type of stomata. Below the upper epidermis 3-4 layers of well developed more or less isodiametric collenchymatous tissue were observed. Midrib contains centrally located vascular bundle which is collateral surrounded by some parenchymatous cells filled with dark content. Xylem is well developed and the phloem consists of strands of sieve tubes and

small celled parenchyma. Lower epidermis consisted of single layer elongated cells with cuticle and just above the lower epidermis 2-3 layers of parenchymatous cells followed by the layers of collenchymatous cells were present. Calcium-oxalate crystals were found in spongy parenchyma. Lower epidermis contains more number of covering trichomes as compared to upper epidermis.

Lamina: Dorsi-ventral structure with single layered upper and lower epidermis with a layer of elongated closely arranged cells externally covered with cuticle. Epidermal cells show anomocytic stomata in surface view; below upper epidermis single layered palisade cells followed by 5-7 layers of masophyll parenchyma which are rounded in shape and are devoid of intracellular spaces.

Juz-e-Mustamil (Parts used) : Pulp of fruits

Maskan (Habitat) : *Cassia fistula* grows throughout in Bangladesh and in many other Asian countries and is used as a traditional herbal medicine in India, China, Hong Kong, the Philippines, Malaysia, Indonesia, and Thailand.

Jwoher'e Nabatati (Phytoconstituents): The plant is rich in phenolic antioxidants such as anthraquinones, flavonoids and flavan- 3-ol derivatives. Alkaloids, terpenoids, reducing sugars, saponins, tannins, carbonyl, phlobatanin, and steroids. Two flanol glycosides and a xanthone glycosides. The plant also contain fistulic acid, rhein, rheinglucoside, galactomannan, sennosides A and B, tannin, phlobaphenes, oxyanthraquinone substances, emodin, chrysophanic acid, fistuacacidin, barbaloin, lupeol, beta-sitosterol, and hexacosanol mucilage, pectin and anthraquinone

Mizaj (Temperament) : 1st Degree Hot & Moist

Musleh (Correction): Mustagi rumi (PistaciaLentiscus), Rowghn-e-Badam & Tamarhindi (Tamarindus indica), Anisun (Pimpinella anisum).

Badal (Proximal substitute) : Teuri Root(Teuri Mool), Easily available. So, No need of alternative).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

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

Chromatographic Studies: Thin Layer Chromatography studies were carried out for extracts to confirm the presence of different phytoconstituents. TLC is a mode of liquid chromatography, in which the extract is applied as a small spot at the origin of thin sorbent layer supported on a glass plate. The mobile phase migrates through the stationary phase by

capillary action. The separation of solutes takes place due to their differential absorption/ partition coefficient with respect to both mobile and stationary phases. Each separated component has same migration time but different migration distance. The mobile phase consists of a single solvent or a mixture of solvents. Although, a number of sorbent like silica gel, cellulose, polyamide, alumina, chemically modified silica gel etc. are used, silica gel (type 60) is most commonly used sorbent. Handmade plates are prepared by using techniques like pouring. The retardation factor (R_f) is calculated using following formula,

$$R_f = \frac{\text{Distance traveled by sample from base line}}{\text{Distance traveled by solvent from base line}}$$

Chromatographic study of the extracts was carried out. Where Thin layer chromatography were carried out by using mobile phase Toulene: Ethyl acetate: Formic Acid (8.5:1:0.5) which shows R_f value 0.44 and 0.34 for steroids for Ethanolic and Aqueous extract respectively.

Aa'mal-e-Advia (Pharmacological action) : Mushil, Mulaiyin, Mohallil-e-Waram, Mudirr-e-Haiz.

Mahall-e-Istemalat (Therapeutic uses) : Qabz, Sual, Waram-e-Lauzatain.

Meqdar-e-khorak (Dose) : 20-40 gm.

Muzir (Side-effects / adverse-effects) : Vomiting, nausea, abdominal pain and cramps.
Avoid using it during pregnancy and lactation.

Aaham Nukhsajat (Important formulations) : Laooq-e-Khiyar Shambar.

KHIYARZAH
(Seed)

The drug Khiyarzah seed consists of dried seeds of *Cucumis melo.* It is an annual climbing or creeping herb with angular, scabrous stem, simple soft hairy orbicular-reniform leaves and bears tendrils, by which it is readily trained over trellises. Flowers are unisexual and yellow. Khiyarzah (*Cucumis melo)* is extensively cultivated for its fruits, eaten as a vegetable in many tropical countries.

Naam-e-Degar (Other names):

a) Botanical name:	*Cucumis melo*
b) Family:	Cucurbitaceae
c) Bengali name:	Kakurbeej
d) English name:	Long melon

Tafseel (Description):

Aam (General): This is an annual climbing herb with angular and scabrous stem. Leaves are about 7.5 cm, orbicular-reniform in outline, 5 angled or lobed, scabrous on both surfaces and also often with soft hairs, lobes neither deep nor acute and 5 cm long petiole. Fruits are spherical ovoid elongate or contorted, glabrous or somewhat hairy, neither spinous nor tuberculateand 5 cm long and 4 cm in diameter, yellow with age with green stripes when young. Seeds are obovoid and rounded at apex. Give fruits in August and September.Flowers are small, yellow, unisexual flowers contain bells shaped corollas, male flowers borne in small clusters and female solitary. Male flowers have three stamens, whereas the female flowers have the ovary and three cells.

KlaaBeeni (Macroscopic): Seeds exalbuminous, smooth, elongated but laterally flattened, about 7 to 10 mm long and 2 to 3 mm wide, tapering at one end, cream coloured; taste sweet but no specific odour.

KhurdBeeni (Microscopic): Testa composed of thick walled radially elongated cells, upto 150 µ long, followed first by several layers of pitted stone cells thereafter by many layers of thin walled parenchyma; nucellus consists of just 2 or 3 layers of small cells; cotyledonary parenchymatous cells rich in aleurone grains and oil globules.
Powder: Powder creamy yellow coloured, sticky; taste sweet, odourless; consists of abundance of pitted stone cells. thin walled parenchyma cells, oil globules and aleurone grains, 5 to 10 µ; stone cells elongated with thick lignified walls and thick walled cells of testa;

Juz-e-Mustamil (Part used): Fruit pulp, root, seeds and seed oilare used as drugs purpose.

Maskan (Habitat): *Cucumis melo* is extensively cultivated in gardens as well as in the sandy basins of rivers. Its centre of origin is supposed to be Africa. It is mentioned in some books as native of South Asia, which has come from the foot of the Himalayas to Cape Comorin, where it grows wild but it's cultivated in the temperate and warm region of the whole world.

Jwoher'eNabatati (Phytoconstituents): Linoleic acid, amyrins, taraxerol, lupeol, dehydroporifer-astarol, avenasterol, clerosterol, isofucosterol, stigmasterol.

Mizaj (Temperament): Cold 2^{O}- Moist 2^{O}

Musleeh (Corrective): Not require.

Badal (Proximal substitute): Tukhm-e-Kheyareen

Shinakht, KhalisyatwaQuwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 4 %	Appendix 2.2.3
Acid insoluble ash	Not more than 3 %	Appendix 2.2.4
Alcohol soluble extractive(s)	Not less than 6 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 1 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behaviour of petroleum ether (60-80°) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Ethyl Acetate : (9:1)	On spraying plate with 2% Ethanolic conc. H_2SO_4 andheated for 5 minutes at 105° C	3	0.14 0.26 0.33

Aa'maal-e-Adviya (Pharmacological action): Mubarrid. Muddirr-e-Baul, Daf-e-Atash

Mahall-e-Istemalat (Therapeutic use): Hurqat-e-Baul, Ehtebas-e-Tams, AtashMufrit

Meqdar-e-Khorak (Dose): 5-10 gm.

Muzir (Side-effects/ adverse-effects): No significant side effects/ adverse effects have been observed.

AahamNukhsajat (Important formulations): Sharbat-e-BuzooriMotadil, Sharbat-e-Deenar

KHUBBAZI

(Fruit)

The drug Khubbazi fruit is the dried fruits of *Malvasylvestris* Linn.(Malvaceae) plant. Khubbazi is an annual plant with shallowlylobed leaves and purple flowers which bloom in late spring. This plant is native to Europe,North Africa and South-west Asia. The plant prefers damp areas, such as the ocean, saltmarshes, meadows, sides of ditches and banksof tidal rivers.Found throughout the plains of India.

Naam-e-Degar (Other names) :

a) Botanical name: *Malva sylvestris* Linn.
b) Family: Malvaceae
c) Bengali name: Khubazifol
d) English name: Comman mallow, Mallow, Marsh mallow, Cheese cake

Tafseel (Description) :

a) Aam (General):Khubbazi (Malvasylvestris) is an erect, branched, nearly glabrous, a biennial or perennial plant from Malva family. It has a stem with a height of 30 to 120 cm and fleshy white roots. Its leaves have 5 to 7 lobes and are serrated. Flowers are rose-violet colored with purple lines. Distributed mainly in Europe, North Africa, and South-WestAsia, andits traditional use has been documented since a long-time ago.The plant generally grows in moist areas such as near marshes,ditches, river banks, oceans, and meadows.

Native to Europe, Asia and North Africa.The flowers of *M. sylvestris*are almost odourless and have amucilaginous taste when chewed. They are 3–5 cm wide andhave an epicalyx; the rest of the stalk does not exceed 20 mmin lengthThe flower consists of an epicalyx with threeoblong or elliptical-lanceolate parts that are shorter thanthose of the calyx and are situated immediately below it; thecalyx has five pubescent triangular lobes, and gamosepalousat the bases.A corolla three to four times longer than the calyxwith five wedge-shaped, notched petals is fused to the stamentube at their base.Numerous stamens, the filaments of whichfuse into a stamina tube covered by small star-shaped trichomesand occasional simple trichomesare visible undermagnification, and numerous wrinkled carpels, glabrous orsometimes pubescent, enclosed in the stamen tube arearranged into a circle around a central style that ends withnumerous filiform stigmas. In cultivated varieties, the epicalyis three to seven partite, the calyx is five to eight partite,and the corolla is five to 10 partite.

The leaves are simple, membranous, pubescent and velveyon both sides. They are green even when dry, have long petiolesand are orbicular to reniform, palminervous and lobed,with three, five, seven or nine shallow lobes. They haverounded or acute apexes, with a truncated subcordiform,dentate-crenate and measure 7–15 cm in diameter. Venationis actinodromous. First-order veins are prominent andstraight; second-order veins show acute divergence angles;and third-order veins are cross-linked. The last, marginal,venation is

incomplete, with simple venules and curves.The nipples show outright development and are large andpolygonal in shape.

b) KlaaBeeni (Macroscopic): Fruit is a schizocarp 3.0 to 6.0 mm in diameter and 1.5 to 2.5 mm in thickness, stalk mostly 4.0 to 7.0 mm long, attached; fruit separable into 8 or 10 carpels with a depression on the top and each containing a single seed; seeds reniform to rounded, olive - brown to chocolate-brown, 1.0 to 1.8 mm across, enclosing a curved embroy. mucilagenous on chewing and slighly bitter.

c) KhurdBeeni (Microscopic): In Transverse section fruit wall shows a pericarp consisting of an epidermis with tangentially elongated, large, rectangular, thick walled parenchymatous cells; cuticle present: trichomes abundant large, stellate with 3 to 8 branches; a few unbranched unicellular trichomes also present; stomata anomocytic; a few layers of large, rectangular to oval parenchymaotus cells present in the mesocarp: rosette crystals of calcium oxalate of 9.0 to 13.0 p in diameter present in the lower most layer of mesocarp, followed by the inner epidermis; vascular strands consisting of xylem and pholem elements.

Mericarp: Transverse section shows cuticle: epidermis a single layer of slightly thick walled, rectangular or almost barrel shaped parenchymatous cells: mesocarp of several layer of large simple, thin walled, polygonal to oval and compact parenchymatous cells with straight walls: mucilagenous cavities present in this region; conical patches of smaller

sclerenchymatous cells present adjacent to the innermost layer of mesocarp which is sclerenchymatous.

Seed: Testa shows a layer of rectangular to sqaure, slightly thick walled parenchymatous cells; a sub-epidermal palisade consisting of mostly a single layer, compact, radially elongated straight and thin walled containing a yellowish-brown substance; below this is another layer of simple, colourless, rectangular to polygonal, thin walled parenchymatous cells with yellowish brown contents which may become 2 to 3 layers at places; a cuticularised, single layer of thin walled, rectangular to square cells form the outer layer of the endosperm followed by a multiseriate zone of comparatively larger parenchymatous cells, slightly thick walled compact, polygonal to oval or rectangular, all the cells completely filled with small oval to round aleurone grains, 2.0 to 4.0 11 in diameter; cotyledon reveals a single layer of epidermis composed of slightly radially elongated, thin walled parenchymatous cells; cuticle present; two layers of radially elongated, thin walled, palisade cells present; below this region there are 3 or 4 layers of compact, polygonal, thin walled parenchymatous cells; the cells of lower epidermis are almost similar to those of upper epidermis; all cells of cotyledon are packed with small, oval to round aleurone grains.

Powder: Powder yellowish - brown, revealing fragments of fruit wall to testa, endosperm, palisade cells along with epidermis with stomata, abundant stellate and ordinary unbrabchedtrichomes; abundant aleurone grains intact in cell tissue from fruit wall; vessels, tracheids and fibres; in surface view the parenchymatous cells are simple, large, undulate thin walled, polygonaql to oval with aleurone grains; sub-epidermal palisade of testa usually seen isolated; thin walled with yellowish - brown contents; endospermic cells frequent in surface view, cells comparatively larger slightly thick walled, somewhat undulating and usually contain aleurone grains; a parenchymatous layer with each cell containing cluster of calcium oxalate crystals from the innermost wall of the fruit mesocarp present, a few groups of sclerenchymatous cells also seen, thick walled with broader lumen; frаments of fruit tissues in surface view show epidermal layer with frequent stomata and trichomes.

Juz-e-Mustamil (Part used): The fruits, leave, seeds, flower of Khubbaziplant are used as drugs purpose.

Maskan (Habitat): This plant is native to Europe,North Africa and South-west Asia. The plant prefers damp areas, such as the ocean, saltmarshes, meadows, sides of ditches and banksof tidal rivers.

Jwoher'eNabatati (Phytoconstituents):
Palmitic, myristic, stearic, oleic and lauric acids, β-sitosterol and stigmasterol found in lipid fractions of seeds.

Mizaj (Temperament): Cold 1^{O}, Moist 1^{O}

Musleeh (Corrective): Not required.

Badal (Proximal substitute): No proximal substitute is identified

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 12 %	Appendix 2.2.3
Acid insoluble ash	Not more than 7%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 12 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 14 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behaviour of Petroleumether (60-80^{O}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet. Ether : Diehtyl Ether (9:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	2	0.18 0.50

Aa'maal-e-Adviya (Pharmacological action): Munzij, Mulaiyin, Radey, Muddir-e-baul, Muzliq, Muqawwi-e-Ama, Munaffis-e-Balgham.

Mahall-e-Istemalat (Therapeutic use): Amraz-e-Riya, Sahaj-e-Ama, Qurooh-e-Meda, Qurooh-e-Ama, Sozish-e-Kulya, SozishMasana, Suda, Zaheer, Waj-ul-Kabid.

Meqdar-e-Khorak (Dose): 5-7 gm.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed

AahamNukhsajat (Important formulations): Laooq-e-Sapistan, Habb-e-Sil, Sharbat-e-Ejaz,

KISHMISH
(Fruit)

The drug Kishmish is a dried fruits of seedless variety of *Vitis vinifera L*. (Vitaceae), ripe fruit is known as Angur (Graps).The plant is well-known as grape vine. The name vine is derived from Viere (to twist), referring to the twisting habits of the plant. Vitis, is the latin name of Celtic origin. Plant is famous for its fruiting berries, grape grows in clusters.

Naam-e-Degar (Other names) :

a) Botanical name:	*Vitis vinifera* Linn.
b) Family:	Vitaceae
c) Bengali name:	Kishmish
d) English name:	Raisins, Dry grapes

Tafseel (Description):

a) Aam (General): It is a shrub or more rarely a tree with a thick trunk and numerous long, tortuous, irregular straggling branches, somewhat thickened at nodes, dark brown. flowers are green, fragrant and grows in cluster; leaves are orbicular 3-5 lobed, fruit a berry, sticky and pulpy, dark brown to black; oblong or oval, sometimes spherical; 1.5-2.5 cm long and 0.5-2.5 cm wide; outer skin irregularly wrinkled forming ridges and furrows; usually contain 1-4 seeds, 4-7 mm long, ovoid rounded to triangular or simply ovoid, brown to black, odour, sweetish and pleasant; taste, sweet.

b) Klaa Beeni (Macroscopic): Fruits ovoid, dark brown; 1 cm long, 0.5 cm wide soft and pulpy showing longitudinal wrinkles; taste sweet.

c) Khurd Beeni (Microscopic): Fruit comprises of an outer epicarp which consists of a single thin epidermis followed by 3 or 4 layers of thick walled cells, which are tangentially oblong and compact; mesocarp tissue parenchymatous, homogenous, thin walled, large, less compact; scattered in the mesocarp are numerous small collateral vascular bundles, with a few xylem elements and small mass of phloem; in the central part of the fruit are two large wedge shaped collateral vascular bundles, placed just opposed with phloem abutting on each other; each bundle has a dense prominent xylem tissue with thick walled tracheary elements arranged in radial rows; phloem is also prominent consisting of tube members, companion cells and parenchyma cells; tannin filled cells abundant especially around the central vascular strands.

Juz-e-Mustamil (Part used): Fruit, ripe, unripe and partly dried ones (raisins), leaves, dry fruit and flowers.

Maskan (Habitat):

It is cultivated extensively in north western India,and peninsula specially Bengal, Himachal, Kashmir,Maharashtra and Andhra Pradesh. It is found wild in north- western Himalaya,Baluchistan and Afghanistan.

Jwoher'e Nabatati (Phytoconstituents): Grape vine contains flavonoids, tannins, tartrates, inositol, carotenes, choline and sugars. The fruit contains tartaric and malic acids, sugars, pectin, tannin, flavone glycosides, vitamins A, B_1, B_2, C and minerals. The leaves contain thiamine, niacin, biotin, tocopherol, hulme, hexokinase, catalase and polyphenyl oxidase and s**eeds contain** Procyanidins B_1 and B_2; oleanolic acid and beta-sitosterol glucoside.

Mizaj (Temperament): Hot 1^O, Moist 1^O

Musleeh (Corrective): Kateera, Zarishk,,injeer, anisun, kasir riyah advia.

Badal (Proximal substitute): Kham angoor- Rebas, Munaqqa

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 3 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 60 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 64 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior ofChloroformextract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*

Toluene : Ethyl Acetate (5:1:5)	Dipped in Vanillin Sulphuric acid reagent and heated it in air oven at 105^{o} for 10 minutes.	5	0. 28 0.41 0.51 0.58 0.87

Aa'maal-e-Adviya (Pharmacological action): Mohallil, Mufatteh, Mubhi,Mufarreh, Mulattif, Muqawwi-e-Bah, Muqawwi-e-Badan, Muqawwi-e-Aza-e-Raisa, Mulayyan, Munaffis.

Mahall-e-Istemalat (Therapeutic use): Qabz, Zof-e-Aam, Zof-e-Dimagh, Zof-e-Qalb, Khafqan, Sual-e-ratab

Meqdar-e-Khorak (Dose): Dried mature fruits: 12 gm.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed.Raisins are 100% natural and they do not have any side effects. However, over-consumption (above 30 gm) in a day increase weight and blood sugar levels. People suffering from high blood pressure should keep their consumption in check.

Aaham Nukhsajat (Important formulations): Itrifal Kishnizi, Majoon Zabeeb

KULTHI

(Seeds)

Drug Kulthi consists of dry seeds that are an annual branched, sub-erect of twining, downy or glabrescent, herbs. It is used to treat different diseases of Nizam-e-Boul and Nizam-e-Toulidee in Unani system of medicine.

Naam-e-Degar (Other names) :

a. Botanical : *Vigna unquiculata*
b. Family : Leguminosae
c. Bengali : Kulthi Kalai, Kulattha
d. English : Horse gram

Tafseel (Description) :

Aam (General): The cowpea (*Vigna unguiculata*) is an annual herbaceous legume from the genus *Vigna*. Due to its tolerance for sandy soil and low rainfall, it is an important crop in the semiarid regions across Africa and Asia. It requires very few inputs, as the plant's root nodules are able to fix atmospheric nitrogen, making it a valuable crop for resource-poor farmers and well-suited to intercropping with other crops.

Cowpeas can either be short and bushy or act like a vine by climbing supports or trailing along the ground. The taproot can penetrate to a depth of 2.4 meter after eight weeks.

The size and shape of the leaves vary greatly, making this an important feature for classifying and distinguishing cowpea varieties. Another distinguishing feature of cowpeas is the long 20–50 cm peduncles, which hold the flowers and seed pods. One peduncle can support four or more seed pods. Flower colour varies through different shades of purple, pink, yellow, and white and blue.

Seeds and seed pods from wild cowpeas are very small while cultivated varieties can have pods between 10 and 110 cm long. A pod can contain six to 13 seeds that are usually kidney-shaped, although the seeds become more spherical the more restricted they are within the pod. Their texture and colour are very diverse. They can have a smooth or rough coat and be speckled, mottled, or blotchy. Colours include white, cream, green, red, brown, and black, or various combinations.

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

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

Juz-e-Mustamil (Parts used) : Dry seeds

Maskan (Habitat) : Vigna unguiculata sesquipedalis is often cultivated for its edible seed in warm temperate and tropical zones. An abundant cropper, it can produce a harvest all year round in the Tropics, especially if new sowings are made every few months. It is found in open Maskan (Habitat)s, abandoned fields, and roadsides in this sub-continent.

Jwoher'e Nabatati (Phytoconstituents) : 24.5 protein, 51.4 carbohydrates, 16.6 insoluble fiber and 2.7 soluble fiber, 2.6 ash; iron - 6.8, zinc - 4.1, manganese - 1.5, phosphorus - 510.0 and potassium - 1430.0 and an enzyme(Urease) and oil.

Mizaj (Temperament) : 2nd Degree Hot and Dry

Or, 2nd Degree Cold and 1st Degree Moist

Musleh (Correction) : Zanzabil Khusshk(Zinziber officinale**)**

Badal (Proximal substitute): Jhar shim(*Cyamopsis tetragonoloba)*

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

Foreign matter	: Not more than 2 per cent, Appendix 2.2.2
Total ash	: Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 3 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 12 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action) : Mufattit-e-Hasat, Mudirr-e-Boul, Mudirr-e-Haiz, Jali, Mufatteh Sudad, Mulaiyin.

Mahall-e-Istemalat (Therapeutic uses) : Hasat-e-Kulaiya, Hasat-e-Masana, Ehtabas-e-Baul, Ehtabas-e-Haiz.

Meqdar-e-khorak (Dose) : 3-5 gm.

Muzir (Side-effects / adverse-effects) : ındigestion, vomiting, diarrhoea, increased belching, bad breath, offensive stool, flatulence, constipation, mild abdominal discomfort and sleepiness.

Aaham Nukhsajat (Important formulations) : Kushta-e-Hazrul Yahood.

LODH PATHANI
(Bark)

Drug Lodh pathani consists of dried stem bark. The plant is an evergreen tree, 6-8.5 meter tall and found abundantly in plains and lower hills throughout the tropical and sub-tropical countries. The drug is used to treat different diseases in Unani system of medicine.

Naam-e-Degar (Other names) :

a. Botanical : *Symplocos racemosa* Roxb.
b. Family : Symplocaceae
c. Bengali : Lodha, Lochra
d. English : Sypmlocos bark, Lodh tree

Tafseel (Description) :

Aam (General) : Symplocos racemosa is an evergreen tree and its bark is marked with white patches. Leaves are elliptic-oblong or elliptic-lanceolate. It is narrow at base, glandular-serrate, acute or acuminate at apex, crenate or subentire, glabrous on both side curves and polished and shining above the nerve pair. Flowers are 8-18 cm long, fragrant and white which is followed by a fruit. Fruit is a drupe which is ellipsoid to ovoid or oblong measuring 1-1.5 x 0.6 cm which encompasses 1 to 3 seeds. Seeds are oblong and hard.

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

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

Juz-e-Mustamil (Parts used) : Dried stem bark

Maskan (Habitat): Symplocos racemosa plant with broad crown and stems that grows to the height of 6 meters. It belongs to Symplocaceae family which comprises of one genus Symlocos and is distributed in tropical and subtropical regions of Asia, Australia, America and Malaysia. It is also found in north and east India throughout Himalayas.

Jwoher'e Nabatati (Phytoconstituents): Oleanolic acid, Ellagic acid, Betulinic acid, Beta-amyrin, Beta sitosterol, Salireposide, Acetyloleonolic acid and also Alkapoids (Loturine and collaturine) and red colouring matter.

Mizaj (Temperament) : 2nd Degree Hot and Dry.

Musleh (Correction) : No sufficient information available regarding correction.

Badal (Proximal substitute) : Other parts of this plant may be used as substitute.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

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

Aa'mal-e-Advia (Pharmacological action) : Mughalliz-e-Mani, Habis.

Mahall-e-Istemalat (Therapeutic uses) : Ramad, Kasrat-e-Tams, Ishal, Bawaseer, Sailan-ur-Rahem, Jiryan, Zof-e-Bah, Zof-e-Rahem, Taqteer-u-Boul.

Meqdar-e-khorak (Dose) : 1-3 gm.

Muzir (Side-effects / adverse-effects) : It decreases testosterone and cholesterol levels and increases estrogen and progesterone levels. It has anti-androgen effect and reduces male sex hormones such as testosterone. In empty stomach, it can cause abdominal heaviness, nausea & constipation in individuals prone to gastrointestinal upsets. No adverse effect of Lodhra powder is reported when taken in recommended doses. It is safe to take Lodhra during breastfeeding.

Aaham Nukhsajat (Important formulations) : Zimad-e-Asfar.

MAINPHAL
(Fruit)

Drug Mainphal consists of dried fruit which is a deciduous thorny shrub or a small tree, reaching a height upto 9 meter and girth about a metre. Its stem, bark and fruits are popular to the physicians of Traditional medicine for the treatment of different diseases. It is also known as mountain pomegranate. The herb yields alexiteric, aphrodisiac, emetic, carminative, antipyretic, purgative, anodyne and also anthelmintic and abortifacient effect.

Naam-e-Degar (Other names) :

a. Botanical : *Xeromphis spinosa*
b. Family : Rubiaceae
c. Bengali : Maynaphal, Menaphal
d. English : Emetic nut

Tafseel (Description) :

Aam (General) : It is a medium sized deciduous tree, bark smooth. Leaves opposite, ovate, 10-15 cm, coriaceous. Flowers sessile, solitary, terminal, 10 cm. Flowers are pure white and extremely fragrant as they open at night. The very next day they turn golden yellow, lose fragrance and attract diurnal pollinators like bees. Flowers are extremely fragrant when they bloom at night but not so on the next daytime when they turn golden yellow. Fruits are 3-5 cm, globose and hard, not of any edible value.

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

Khurd Beeni (Microscopic): Fruit: Transverse section shows epicarp consisting of single layered epidermis, sometimes obliterated in surface view; epidermal cells thin-walled and polygonal; mesocarp, broad zone consisting of thin-walled, parenchymatous cells, some cells contain reddish brown content, a number of vascular bundles found embedded in this zone, endocarp stony consisting of light yellow polygonal, sclerenchymatous cells variable shape and size.
Seed: Transverse section shows a seed coat, consisting of single layered, rounded to oval epidermal cells. a few layers of yellowish-brown pigmented cells, endosperm forms bulk of seed consisting of large oval and irregular shaped parenchymatous cells, albumen horny, translucent, cells of outermost layer smaller in size.
Powder: Reddish-brown; under microscope shows numerous, large, irregular, reddish brown cells sclereids of variable shape and size; pieces of xylem vessels with reticulate thickenings; thin-walled, crushed parenchymatous cells and yellow-orange pieces of seed coat.

Juz-e-Mustamil (Parts used) : Dried fruit

Maskan (Habitat): The mountain pomegranate is found in India, Srilnka, and South-East Asia. It is also found in the Himalayas, up till altitudes of 1600 meter.

Jwoher'e Nabatati (Phytoconstituents): Mannitol and six saponins, dumetoronins A, B, C, D, E and F, oleanolic acid as aglycone, essential oil, saponin,tannin, and resin.

Mizaj (Temperament) : 2nd Degree Hot & Dry.

Musleh (Correction) : No sufficient information available regarding correction.

Badal (Proximal substitute): Maniphal*(Randia spinosa)*, Mon-kanta *(Catunaregam spinosa*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

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

Aa'mal-e-Advia (Pharmacological action) : Mohallil-e-Waram, Munaffis-e-Balgam.

Mahall-e-Istemalat (Therapeutic uses) : Falij, Laqwa, Sual, Zequn Nafas, Busoor, Nafkh-e-Shikam.

Meqdar-e-khorak (Dose) : 3-6 gm.

Muzir (Side-effects / adverse-effects) : Excess, it may cause excess of vomiting, indigestion and anorexia.

Aaham Nukhsajat (Important formulations) : Roughan-e-Baladur.

MAUZ
(Fresh Unripe Fruit)

Mauz consists of fresh unripe fruits of Musa paradisiaca Linn.commonly known as Banana. Banana is a familiar tropical fruit. From its native Southwestern Pacific home, the bananaplant spread to India by about 600 BC and later on it spread all over the tropical world.

Naam-e-Degar (Other names) :

a) Botanical name:	Musa paradisiaca Linn
b) Family:	Musaceae
c) Bengali name:	Kacha Kola
d) English name:	Banana

Tafseel (Description) :

a) Aam (General): Musa paradisiaca is a herbaceous plant (up to 9 m long) with a robust treelike pseudostem, a crown of large elongated oval deep-green leaves (up to 365 cm in length and 61 cm in width), with a prominent midrib, each plant produces a single inflorescence like drooping spike, and large bracts opening in succession, ovate, 15-20 cm long, concave, dark red in color and somewhat fleshy. Fruits are oblong, fleshy, 5-7cm long in wild form and longer in the cultivated varieties.

b) Klaa Beeni (Macroscopic): Occurs in hunches, each bunch containing 10 to 15 hands and each hand bearing 2 to 3 dozens of fruits; each fruit dull green in colour with characteristic odour and astringent taste; outer surface smooth, stout, 3 to 5 ridged, about 15 to 18 cm in length, 3 to 5 cm in diameter, curved to sub-cylindrical, tapering towards ends; fleshy, indehiscent, seedless berry: peel attached firmly to mesocarp, taste of flesh starchy and astringent.

c) Khurd Beeni (Microscopic):
Microscopic AnalysisMethod:Unripe banana fruits were cut into small pieces, shade dried, and powdered. Powdered material was used to carry out powder microscopy. Dried unripe banana fruits were soaked in 70% alcohol for 24 hours, and free hand sections were taken, cleared with chloral hydrate solution and water, and stained with safranin according to the standard prescribed methods.17 Photomicrographs were captured with Catcam camera. Powder and maceration studies were also carried out following the standard methods.
Microscopical Characters: Transverse section of unripe fruit showed different spe-cific characters. The outer layer epicarp, consisting of a single layer of epidermis made up of rectangular-shaped parenchyma cells covered by a thin cuticle, papillae-like outer protrusion from each epidermal cell, was also observed. Followed by epidermis, thick-walled irregular-shaped parenchyma cells were present, where these cells are compactly arranged and heavily loaded with abun-dant, oval-shaped starch grains. Sclerenchymatous cells were found in groups, encircled by thin-walled parenchy-matous cells, tannin cells, and vascular bundles scattered in this region. Presence of 10 to 14 layers of compactly arranged parenchymatous cells, without air spaces and longitudinally extended, was found. Mesocarp showed loosely arranged tangentially elongated parenchymatous cells consisting of abundant oval starch grains, raphide bundles with needle-like crystals, and few longitudi-nally extended parenchymatous cells containing tannin. (Figs 2A and B).

Powder Microscopy: Powder is light brown to ash in color, rough to touch; smell agreeable with sweet taste. When observed under the microscope, different fragments of tissues were observed. Fragments of epidermal cells with papillae, different shape of parenchyma cells, sclerenchyma cells, reticulate helical vessels in groups, xylem cells in surface view, tannin-containing cells, and abundant starch grains in groups were found as shown in Figs 3A to H.

Juz-e-Mustamil (Part used): Unripe and ripe fruit, Leave, Root and other parts of Banana plant used as medicinal purposes.

Maskan (Habitat): Cultivated all over Bangladesh

Jwoher'e Nabatati (Phytoconstituents): Tannin, Chlorophyll, Carotene, Xanthophylls, Malic acid, Serotonin, Nor epinephrine.

Mizaj (Temperament): Cold, Moist

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute identified

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash on dry wt. basis	Not more than 5 %	Appendix 2.2.3
Acid insoluble ash on dry wt. basis	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive value on dry wt. basis.	Not less than 1 %	Appendix 2.2.6
Water soluble extractive value on dry wt. basis	Not less than 3 %	Appendix 2.2.7
Moisture content	Not less than 57 %	Appendix 2.2.9

TLC (Thin-layer Chromatography) behavior of Ethanolic extract:

Solvent system	Spray/reagent treatment	No. of spots	Rf value
Toluene : Dichloromethane (7:3)	: On spraying plate with 10% H2SO4 and heated for 30 minutes at 1100 ^{C}	4	0. 14 0.20 0.48 0.96

Aa'maal-e-Adviya (Pharmacological action): Mughazzi, Musammin, Mufarreh, Qabiz, Naffakh, Muqawwi Bah, Munaffis Balgham.

Mahall-e-Istemalat (Therapeutic use): Zof, Laghari-e-Badan, Soal-e-Yabis, Khashoonat Halq, Ishal, Awarayzat-e-meda

Meqdar-e-Khorak (Dose): As required.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed

MAZOO
(Excrescence)

The drug Mazoo consists of dried galls, which are excrescences formed as a result of stimulus produced by the larva of the gall wasp, and found on twigs of *tree Quercus injectoria* Olive.
It is asmall tree found in Greece, Asia Minor andIran. The galls arise on young branches of thistree as a result of attack by the gall-wasp*Adleriagallae-tinctoria*.

a) Botanical name: *Quercus infectoria* Olive
b) Family: Fagaceae
c) Bengali name: Majuphal
d) English name: Dyer's Oak, Gall, Oak gall

Tafseel (Description):
Aam (General): Oak galls (Turkish galls; Mazu) are an out growthsformed on the young twigs of the dyer's oak,as a result ofthe deposition of the eggs of the gall wasp*Adleriagallae-tinctoriae*. The female fly punctures the barkof young twigs and lays the eggs on or in thecambium of a young shoot. The egg develops into alarva and gets surrounded by the tissues of the developing gall.
Abnormal development of vegetable tissue roundthe larva is due to an enzyme-containing secretion,produced by the young insect after it has emergedfrom the egg, which by the rapid conversion of starchinto sugar stimulates cell division. As starchdisappears from the neighbourhood of the insect,shrinkage occurs and a central cavity is formed inwhich the insect passed through the larval and pupalstages.

The growth of gall continues only as long as the eggor larva lives or reaches maturity and passes into a chrysalis. Finally, if the galls are not previouslycollected and dried, the mature insect or imagobores its way out of the Gall and escape. Duringthese changes the colour of the gall passes from a bluish-grey through olive-green to almost white.
Quercus infectoria Olive is a small tree or shrub about 2 m high, with many spreading branches. The bark is slightly grey in colour.

Leaves: The leaves are 4-6 cm long, very rigid, oftenglabrescent with spinous teeth, short petiole,elongate and sinuate.

Flowers: The flowers are unisexual. The maleflowers are tangled into hanging, axillary catkins,
with a 6-8 tepaledperigone and 6-10 stamens. Thefemale sessile flowers are single or in small groups inthe leaf axils of dropping stipules. The perigone is tipped with an inferior 3 chambered ovarysurrounded by an initially inconspicuous and then later cup shaped cupula.

Fruits: The fruit is up to 4 cm long, cylindrical, shinybrown and is 3 times longer than the cupula, which iscovered with narrow scales.

Galls: The galls are globular in shape and from 10 to25 mm in diameter. They have a short, basal stalkand numerous rounded projections on the surface.The galls are hard and heavy, usually sinking inwater. The so called 'blue' variety is actually of a grey or brownish-grey colour. These and to a lesser extentthe olive-green 'green' galls, are preferred to the'white'

variety, in which the tannin is said to havebeen partly decomposed. White galls also differfrom the other grades in having a circular tunnelthrough which the insect has emerged. The gallswithout the opening have insect remains in the smallcentral cavity. Galls have a very astringent taste.Sections through a gall show a very large outer zoneof thin walled parenchyma, a ring ofsclerenchymatous cells, and a small, inner zone ofrather thick-walled parenchyma surrounding thecentral cavity. The parenchymatous tissues containabundant starch, masses of tannin, rosettes andprisms of calcium oxalate, and the rounded so-called'Lignin bodies', which give a red colour with phloroglucinol and hydrochloric acid.
The galls are collected for medicinal use before the escape of the insect and well dried. The surface ofmature dry gall may be smooth and shining, asthough varnished and chestnut brown, but moreusually it is rough and of a greyish brown in colour.When the galls are gathered at the correct stage, i.e.before the insect emerges, the inner tissue is soft, of adeep greenish yellow colour, with a very astringent taste and slightly sweet aftertaste.

KlaaBeeni (Macroscopic):Galls globular in shape, 1 to 2.5 cm in diameter, bluish grey in colour, pale buff within, tough and heavy; the surface of the upper half shows 8 to 12 small blunt projections; but the lower half smooth, bearing a basal stalk; a hole of about a mm. may occasionally be present in the middle, showing that the insect has emerged; when cut in two halves gall shows a central cavity, and in those with holes, a channel from the cavity to the periphery in the region of the hole; average weight of 50 galls picked at random, should not be less than 2.5 g.; odour not specific; taste bitter and astringent.

KhurdBeeni (Microscopic): Gall shows the outermost 2 or 3 layers of suberized cells; followed by a broad parenchymatous zone of thin walled cells which are smaller towards periphery but radially elongated towards interior; cells contain thin colourless angular fragments of tannin, starch grains of 19 to 28 µ as well as prismatic and clustered crystals of calcium oxalate; small vascular strands found in the broad parenchymatous zone with tracheids having spiral thickening; a sclerenchymatous zone of 3 to 5 layers of lignified sclereids 35 to 260µ long. Within the sclerenchymatous zone a few parenchymatous cells containing starch grains with stellate hilum also present; galls bearing hole show a large central cavity filled with insects debris.

Powder: Powder coarse, creamy yellow coloured, having a bitter taste but no odour; consists of abundance of thin walled parenchyma, lignified stone cells, few tracheids with spiral thickening fragments of tannins, prismatic and clustered crystals; starch grains, some insect debris may be present; tissue debris with thick walled, closely packed, somewhat rounded cells, with striations seen in surface view.

Juz-e-Mustamil (Part used): Excrescence

Maskan (Habitat): Found in Turkey, Syria, Persia, Cyprus andGreece. It is a tree of subtropical climates, found in mid Mediterranean, Balkans, Anatoliaand Iran. It is more common in areas with Mediterranean climate, in term of annualtemperature; areas with 12-16°C temp are the optimum growth areas.

Jwoher'eNabatati (Phytoconstituents): The galls contain 50-70% of the tannin known asgallotannic acid. The gallsalso contain gallic acid (about 2-4%), ellagic acid,sitosterol, methyl betulate, methyloleanolate, starch and calcium oxalate. Nyctanthic, roburic and syringicacids have more recently been identified as the CNS active component of the methanolic extract of galls.

Mizaj (Temperament): Cold 2^{O}, Dry 2^{O}

Musleeh (Corrective): Katira, samagharabi, zardi baize neembrasht.

Badal (Proximal substitute): Maaei, Juftbaloot, Post anar,Halilazard, Samrauturfa.

Shinakht, KhalisyatwaQuwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 2 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 65 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 55 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior ofAcetone extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Chloroform: Methonol : (1: I)	Exposed to 1% Ethanolic ferric chloride spray.	4	0.33 0.50 0.66 0.83

Aa'maal-e-Adviya (Pharmacological action): Habis, Qabiz, Mughazzi, Qabiz, Habis-e-haiz,Mane ruaf,Habis-ud-dam,Dafa-e-Taffun,Mujaffif,Muqawwie dandanwa lissa,Mumsik, Muhallil,Naafe nutue rehm, Musakkin-e-dard, Qatel-e-jaraseem, Many-e-qashab, Many-e-phaphundi, Muhallil-e-auram, Mundamel.

Mahall-e-Istemalat (Therapeutic use): Ishal, Zaheer, BawaseerDamvi, Quruh**,** Jeryan, Eltahab, Amraz-e-qashab, Sailanurreham, Kasrat-e-haiz, Jeryan-e-khunbatni, Nimla, Qooba,

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): Chest/ throat diseases.

AahamNukhsajat (Important formulations): Majoonmuqawwi rehm, Sufoofehabis, Sufoofemuallif, Sunoonezarad, Sunoone, muqawwie dandan, Qursebandishekhoon, Qursepechish.

MULSARI
(Fruit)

The drug Mulsari fruit is dried ripe fruits of *Mimusops elengi* Linn. of a small to large evergreen tree.

Naam-e-Degar (Other names):

a) Botanical name: *Mimusops elengi* Linn.
b) Family: Sapotaceae
c) Bengali name: Bokulfol, Bakal,Bakul,Bohl, Bukal
d) English name: Bullet wood, Spanish cherry

Tafseel (Description):

a) Aam (General): A small to large evergreen tree, grows up to 15 mhigh. Generally characterized by a short, dark and very rough trunk and wide spreading, the ends of which tend to rise and forms a thick globular head to the tree. The bark is dark grey,occurs in pieces of 15-25 cm long and 10 -15 cmbroad. Externally rough due to the presence of vertical lenticels, cracks and longitudinal fissures.The dried bark is thin and occurs in quills.Berry is ovoid, 2.5 cm long with. It turns yellowand it tastes astringent and sweet. Fruition occursin rainy season, when ripe containing 1, rarely 2seeds. Seeds are grayish brown, solitary, ovoid,compressed, shining. The leaves are glossyand are dark green when old with 6.3-10 cm inlong and 3.2-5 cm in wide. The new leavesmostly appear in February when the trees often appear bright vivid green. Leaves are variable, elliptic, oblong or oblanceolae, short or longacuminate, margin undulate, closely but faintly veined. Petioles 1.2 - 2.5 cm long.

b) KlaaBeeni (Macroscopic):

Fruit: A berry, pedunculate, 3.0 cm long and upto 1.5 cm mid-width, ovoid, containing one seed; young fruits light green to yellow; Pinkish brown or orange when ripe; often with a thin leathery to bony outer surface; mesocarp fleshy and endocarp stony; seeds with fleshy endosperm, obliquely ovate and slightly compressed; testa shining; hilum is either and basal or elongate and lateral; slightly aromatic odour; sweet, acrid taste.

c) KhurdBeeni (Microscopic):

Pericarp: Transverse section of the pericarp shows a thick cuticle, and a layer of tangentially elongated cells of epicarp; mesocarp made up of thin walled polygonal parenchymatous cells, with patches of sclereids at its periphery; conjoint type of vascular bundles present in mesocarp; 5 or 6 layers of cells with latex or similar secretory substance in thin walled polygonal parenchymatous cells, are present in mesocarp.

Seed: Transverse section of the seed showing thick testadistringuished into five concentric regions, outermost composed of 12 tol 3 layers of thick walled polygonal isodiametric, sclerenchymatous cells; the second and third region consisting of—thin walled parenchymatous cells; deep reddish contents comprise the fourth region, conjoint vascular bundles of testa lie in this layer; the fifth region is composed of a few layers of round to oval brushed cells, devoid of cellular contents. The cells of the endosperm are thin walled, parenchymatous, polygonal, smaller at the periphery and larger towards the centre, containing oil globules and aleurone grains. The epidermal cells of the cotyledons are rectangular or laterally elongated. A number of vascular strands with poorly developed elements are seen in the cotyledons.

Powder: Light brown; round and elongated sclereids of mesocarp 28 to 60 µ in diameter, 150 to 250 µin length, 40 to 60 µ in width; reticulate and scalariform vessels, latex cells, fragments of endosperm with aleurone grains and oil globules.

Juz-e-Mustamil (Part used): Stem, bark, leaves, flowers, fruit, seed and gum of Mulsari tree have been used.

Maskan (Habitat): It is cultivated mainly in North and Peninsular India, and inAndaman Islands.and also grows in Bangladesh.

Jwoher'eNabatati (Phytoconstituents): Fruit and seed of Mulsari showed presence of Quercitol, ursolic acid, dihydro quercetin, quercetin, β - d glycosides of β sitosterol, alphaspinasterol after Saponification.

Mizaj (Temperament): Cold and Dry

Musleeh (Corrective): Shahadkhalis, Ghee, Use along with Advia –e- harwaratab)

Badal (Proximal substitute): Bhon phalli,Post waSamer-e-Babool

Shinakht, KhalisyatwaQuwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	***Not more than 1 %***	***Appendix 2.2.2***
Total ash	Not more than 5 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 3 %	Appendix 2.2.6
Water soluble extractive	Not less than 2 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior of Ethanolic extract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Cyclohexane: Ethyl Acetate : (4:1)	On spraying plate with Ethanoloc H_2SO_4 and heated for 5 minutes at 105^O	4	0.20 0.27 0.60 0.70

Aa'maal-e-Adviya (Pharmacological action): Mughal1iz-e-Mani, Muwallid-e- Mani, Muqawwi-e-Bah, Qabiz, Muqawwimeda, qalb -wa- jigar.

Mahall-e-Istemalat (Therapeutic use): Surat-e-Inzal, Zaf-e-Bah, Kasrat-e-Ehtelam, Ashal, Admm-e-kirm'emani.

Meqdar-e-Khorak (Dose): 5-10 gm.

Muzir (Side-effects / adverse-effects): Naffakh, Qabiz.

AahamNukhsajat (Important formulations): Sufoof-e-sailan.

MUQIL
(Exudate)

Drug Muqil consists of exudates which are used as remedies of different diseases in Unani system of medicine. Guggul is also used in Ayurveda remedies and is mentioned in Ayurvedic texts dating back to 600 BC. It is often sold as an herbal supplement. The exudate is collected during winter season by making incisions in the bark or in summer falling from the bark itself.

Naam-e-Degar (Other names) :

a. Botanical : *Commiphora wightii*
b. Family : Burseraceae
c. Bengali : Guggul, Mukul
d. English : Gum guga, Indian Bedlellium

Tafseel (Description) :

Aam (General): Drug yielding plant is a small perennial tree or shurb upto 1.2 to 1.8 meter high. It is a slow growing, highly branched, spiny shrub or a small tree with crooked and knotty branches ending in sharp spines. The stem is covered with silvery white, papery bark that peels off as flakes from the older parts of the stem, whereas, the younger branches are pubescent and glandular. Leaves are trifoliate; leaflets rhomboid, ovate, and entire at the base and serrate at the apex. The plant remains leafless during winter season, that is, from October to March. New leaves sprout during April, are short-lived and do not fall until September.

Klaa Beeni (Macroscopic): Drug occurs in vermicular pieces of pale yellow or brown colored mass with aromatic odour and bitter astringent taste; when fresh it is viscid and golden colored. Makes milky emulsion in hot water and readily burns. Tears of varying sizes, reddish yellow or brown in color, more often occurring in resinous lumps which turn darker in color on long storage. Fracture-brittle, exposing a rough or waxy surface having a moist unctuous appearance; balsamic odour, acrid, bitter and aromatic taste.

Juz-e-Mustamil (Parts used) : Exudate from the bark

Maskan (Habitat) : Guggal is a xerophyte and grows naturally in arid and rocky zones. It is restricted to dry regions of western India and adjoining regions of Pakistan. In India the species is recorded mainly in Gujarat and Rajasthan and to a small extent in adjoining Madhya Pradesh, Maharastra and Karnataka.

Jwoher'e Nabatati (Phytoconstituents): Over a hundred metabolites of various chemical compositions were reported from the leaves, stem, latex, root and fruit samples. High concentrations of quinic acid and myo-inositol were found in fruits and leaves. Basically the exudate consists of essential oil, gum, resin and steroids.

Mizaj (Temperament) : 3rd Degree Hot & 2nd Degree Dry
Or, 2nd Degree Hot & Dry

Musleh (Correction) : Saffron(Crocus sativus), Katira Gum(Gum tragakanth), Cow milk, and Ghee.

Badal (Proximal substitute) : Suranjan(*Colchicum luteum*), Azaraki(*Strychnos nux-vomica*), Murmakki(*Commiphora myrrha*) and Musabbar(*Aloe barbadensis*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

Foreign matter	: Not more than 4 per cent, Appendix 2.2.2
Total ash	: Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 27 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 53 per cent, Appendix 2.2.7
Volatile oil	: Not less than 1%, v/w and between 1.0 and 1.5 percent of guggulsterones (Z and E).

Aa'mal-e-Advia (Pharmacological action) : Mohallil-e-Waram, Muqawwi-e-Asab, Mufatteh Sudad, Kasir-e-Riyah.

Mahall-e-Istemalat (Therapeutic uses) : Bawaseer-e-A'ama, Qabz, Nafkh-e-Shikam,, Waz-ul-Mafasil, Waram-e-Mafasil.

Meqdar-e-khorak (Dose) : 1-1.5 gm.

Muzir (Side-effects / adverse-effects) : Stomach upset, headache, nausea, vomiting, loose stools, diarrhea, belching, and hiccups, skin rash and itching that is not related to allergy.

Aaham Nukhsajat (Important formulations): Habb-e-Muqil, Zimad e-Mohallil, Majoon-e-Jograj Gugal, Zimad-e-Kibreet, Majoon-e-Muqil, Itrifal-e-Muqil Mulaiyin, Habb-e-Shabyar, Iyarij-e-Loghaziya.

NEEM GUM

(Exudate)

It is the gum of Neem tree which exudate from the bark of *Azadirachtaindica* A. Juss., Syn. *Meliaazadirachta* Linn. (Meliaceae) which is found in abundance in tropical and semitropical regions like India, Bangladesh, Pakistan, and Nepal. It is a fast-growing treeNeem treeis a large evergreen tree that grows up to 20–23meters in height and trunk is straight and has a diameter around 4-5 ft.. Neem leaves grow alternately with 8-19 leaves present in each leaflet. The leaf has serrated edges and is 2-3 cm long. The terminal leaflet is often missing. The petioles are short. It bears white flowers that are 5-6 mm in size, protandrous resulting in male and female flowers in the same tree.Fruits are green drupes which turn golden yellow on ripening in the months of June–August. The fruits are 2-3 cm long and 0.6-0.8 cm broad. The hard, inner shell contains two to three seeds. The branches form a broad crown.

Naam-e-Degar (Other names) :

a) Botanical name:	*AzadirachtaIndica*
b) Family:	Meliaceae
c) Bengali name:	Neemaatha
d) English name:	Nim tree gum, Indian Lilac gum, Margosa tree gum

Tafseel (Description) :

Aam (General): Neem gum is a natural extracted from Neem tree by induced or natural injury. Neem gum is clear, bright and amber-coloured material non-bitter in taste and is soluble in cold water.

ORGANIC NEEM GUM

KlaaBeeni (Macroscopic): Found as small tears or vermiform pieces; surface cracked or fissured, darkening with age; fresh gum has Pink to bright amber colour, semi-transparent; characteristic odour and not bitter to taste; hard to fracture; mixes with water and forms gum paste; along with Neem gum, bark remnants are also found; soluble in hot boiling water, dilute. HCl and dilute H_2SO_4; in conc. HNO3 it becomes yellowish brown and jelly like.

KhurdBeeni (Microscopic): Under microscope it shows multifaced, solid fragments. some are transparent with longitudinal glistening striations on surface; yellowish brown coloured, thick fibre bundles varying in length found along with dark brown coloured cells from bark.

Colour Tests for Identification of Neem Gum:

I. Heat a solution of Neem gum in test tube with an equal volume of conc. HCl containing a little phloroglucinol, violet colour is produced (Distinction from Kateera Gum).

2. Heat a solution of Neem gum in a test tube with Resorcinol-HC1 (Selivanoffs Reagent); a brown coloured precipitate formed which dissolves in alcohol. (Distinction from Kateera Gum).

3. Boil Neem gum in 10 nil H_2O. add a mixture of 2 ml each of Fehling's solution A & 13; a green colour is obtained. (Distinction from Kateera Gum)

4. Shake 1 gm. of the Neem gum powder with 100 ml of water and titrate with 0.0IN sodium hydroxide, using methyl red solution as an indicator. Not more than 1 I ml. is required to change the colour from red to yellow.

5. Prepare an original solution of Neem Gum as follows: Boil I g of Neem gum powder with 10 ml of Conc. HCI for 5 min. cool, filter and make up the volume to 100 ml with distilled water.

a. To 5 ml of the original solution of Neem Gum add gradually, while shaking, 10 ml. of Alcohol (60%). No cloudy solution is obtained; add to this clear solution 0.5 ml acetic acid, no white precipitate obtained; add 50 ml. of ammonium oxalate solution: the solution does not become cloudy. (Distinction from Kateera gum).

b. To the original solution of Neem gum, add Barium chloride solution, no white precipitate of barium sulphate is obtained (Distinction from agar).

c. To the original solution of Neem gum add Iodine solution, no blue or brown colour is obtained, but red colour is obtained. (absence of starch and dextrin).

Juz-e-Mustamil (Part used): Exudate

Maskan (Habitat): Neem is native to Indian sub continent. It grows in all the countries in the subcontinent such as Bangladesh, Sri Lanka, Pakistan, and Nepal. It also grows in Australia, the Middle East, and in parts of Africa.

Jwoher'eNabatati (Phytoconstituents): L-arabinose, L-fructose, D-galactose and D-glucuronic acid, ldobiuronic acid, 4-0-(D-glucopyranosyluronic acid)-d-galactopyanose, D-glucosamine.

Mizaj (Temperament): Hot 1^{O} and $Dry1^{O}$

Musleeh (Corrective): Not required.

Bdal (Proximal substitute): No proximal substitute is identified.

Shinakht, KhalisyatwaQuwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 3 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive value	Not less than 2 %	Appendix 2.2.6

TLC (Thin-layer Chromatography) behavior of Ethanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Ethyl Acetate : Formic acid (40 : 25: 0.4)	On exposure to iodine vapours	3	0.20 0.46 0.83

Aa'maal-e-Adviya (Pharmacological action): Musaffi-e-Dam, Moharrik. Dafe-Humma, Daf-e-Taffun, Qatil-e-Kirm.

Mahall-e-Istemalat (Therapeutic use): Jarb, Hikka, Bahar, Bars, Namsh, Awram e-Khabeesa, Basoor, Qurooh.

Meqdar-e-Khorak (Dose): 2 gm.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed.

OOD-E-SALEEB
(Tuber / Rhizome)

The drug Ood-e-Saleeb (Tuber / Rhizome) isa dried root tubers / rhizomes of*Paeonia emodi Wall.* (Paeoniaceae), a herb or under shrub; found in Western Himalayas from Kashmir region.

Naam-e-Degar (Other names):

a) Botanical name:	*Paeonia emodi Wall.*
b) Family:	Paeoniaceae
c) Bengali name:	Oode Salam
d) English name:	Himalayan Peoni

Tafseel (Description):

Aam (General): *Paeonia emodi* is a perennial herb/shrub with glabrous stems and grows upto 70 cm tall. It grows in wide altitudinal range from 1500–3000 m. Proximal leaves are two ternate with some leaflets segmented; leaflets and segments up to 15, oblong-elliptic or oblong-lanceolate, 8-12×1.9–3.3 cm, both surfaces glabrous, base cuneate, decurrent, apex acuminate. Flowers are 2–3 in number, showy, large sized, 7.5–10 cm across, long-stalked, usually solitary in the axils of the upper leaves. Buds are globose. They are bracteate (3–6), leaf like, lanceolate. Sepals are three, sub-orbicular, 1.5×1.5 cm with caudate apex. Petals are white, obovate, 4×2.5 cm long. There are many stamens; 1–3 ovaries, which are densely hairy, many ovuled, and the style is short. Filaments are 1.5–2 cm in length. Follicles are ovoid, 2–3.5×1–2 cm. Flowering occurs from May–June and fruiting from August–September. Seeds are black, globose, few and large in size.

P. emodi is a robust, perennial shrub, with large white flowers having numerous orange-yellow stamens and large deep-cut leaves; flowers 8–12 cm across, with 5–10 elliptical petals and five persistent outersepals. Leaves 30–60 cm, with lanceolate long-pointed leaflets or lobes to 14 cm long; stem 30–75 cm. Fruit usually a single follicle 3–4 cm, densely hairy or hairless; seeds round, brown-black.

its morphology as perennial herbs, 70 cm tall, stem glabrous, proximal leaves two-ternate; some leaflets segmented; leaflets and segments up to 15, oblong-elliptic or oblong-lanceolate, 9–13×2–3.5 cm, both surfaces glabrous, base cuneate, decurrent, apex acuminate. Flowers 2–4 per shoot, both terminal and axillary, single, 8–12 cm wide, all or only terminal one fully developed. Bracts 3–6, leaf like lanceolate. Sepals three, sub-orbicular, 1.5×1.5 cm, apex caudate. Petals white, obovate, 4.5×2.4 cm. Filaments 1.5–2 cm. Disc annular. Carpel one (or two), pale yellow tomentose, rarely glabrous. Follicles ovoid, 2–3.5×1–2 cm. Seeds black, globose. Flowering in May-June.

b) KlaaBeeni (Macroscopic): Tuberous roots are light brownish grey in colour; upto 8 cm long, and 3 cm wide, spindle shaped; surface deeply furrowed and shrunken longitudinally; fracture tough and granular; faint odour. taste sweet later on bitter.

c) Khurd Beeni (Microscopic): Transverse section of root tuber shows a circular outline with a wavy margin; multi-layered periderm consisting of 2 or 3 layers of tangentially elongated rectangular cork cells on the outer side and phelloderm of 2 or 3 layers of parenchymatours cells tangentially elongated; stone cells isolated and in groups found, scattered in the cortex: phloem consisting of several layers of parenchyma with starch grains and cluster crystals of calcium oxalate: xylem with tracheids and parenchyma; vessels pitted, occurring more or less in groups distributed throughout; xylem fiber thick walled; medullary raysuni seriate or multiseriate 2 to 6 cell wide and 5 to 13 cells in height; pith cells thin walled, circular.

Powder: Creamish-white: shows patches of cork cells, numerous stone cells 20 to 90 µ in diameter, isolated and in groups with narrow lumen, very thick walls showing pit canals,cluster crystals of calcium oxalate 2 to 7 µ in size; pitted, reticulate, and scalariform vessels; fragments of medullary rays; starch grains having diameter 4 to 30 µ.

Juz-e-Mustamil (Part used):

Tubers / rhizomes of Ood-e-Saleeb is mainly use as drugs purpose.

Maskan (Habitat): A herbaceous or a shrubby perennial with a cluster of fleshy roots found in westtemperate Himalayas from Kumaon to Hazara, in the upper Tons Valley &Kashmir at altitudes of 2000-3000 m.

Jwoher'eNabatati (Phytoconstituents): Glucosides, essential oil, fixed oil, tannins, and terpenes. Asparagin, benzoic acid, flavonoids, paeoniflorin, paeonin, paeonol, protoanemonin, tannic acid, triterpenoids and volatile oils.

Mizaj (Temperament): Hot 3^{O}, Dry 3^{O}

Musleeh (Corrective): Not require.

10. Badal (Proximal substitute): No proximal substitute identified

Shinakht, KhalisyatwaQuwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 5 %	Appendix 2.2.3
Acid insoluble ash	Not more than 2%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 15 %	Appendix 2.2.6
Water soluble extractive	Not less than 14 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior ofmethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Ethanol : Cylco hexane (8:4)	On spraying plate with Ethanoloc H_2SO_4 and heated for 30 minutes at 105^{O} C		0.23 0.31 0.66

Aa'maal-e-Adviya (Pharmacological action): Daf-e-Sara, Daf-e-Tashannuj, Muqawwi-e-Asab, Muhafiz-e-Asab,Musakkin**.**

Mahall-e-Istemalat (Therapeutic use): Sara, Tashannuj, Ehtanaqur-e-Reham, Zof-e-Asab, Shahiqa, Bwaseer, *Dawali*

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): No significant side effects/adverse effects have been observed.

AahamNukhsajat (Important formulations): KhameeraGaozabanAmbriJadwar Ood SalebWala, Roughan-e-Jund,Habb-e-kuchla,Majoon-e-Maddat-ul-Hayat-Jadwari, Dawa-e-SalasulBaul,Itrifal-e-Zabeeb, Majoon-e-HamalAmbariAlviKhani, SharbatFaryadRas, Habb-e-FawaniaMushil, Sufoof-e-Binai.

PAMBADANA
(Seeds)

Drug, Pambadana consists of seeds of fruits of perennial shrub. The seeds have the medicinal value that is used for the treatment of different diseases in Unani system of medicine.

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

Naam-e-Degar (Other names) :

a. Botanical : *Gossypium herbaceum* Linn.
b. Family : Malvaceae
c. Bengali : Kapas, Tula
d. English : Kapasia, Common cotton

Tafseel (Description) :

Aam (General): The Gossypium herbaceum is a tall annual herbaceous plant of 1 to 4 meter with tap root, trunk and leaves. Leaves or palmate-lobed glabrous or pubescent. The flowers have a corolla with 5 petals and produce a coriacea capsule with 3 or 4 lodges containing angular seeds covered with a thicker or longer hair (cotton). Cotton blooms between June and late summer also depending on the Maskan (Habitat) where it is grown.

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

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

Juz-e-Mustamil (Parts used) : Seeds

Maskan (Habitat) : *Gossypium herbaceum*, commonly known as Levant cotton, is a species of cotton native to the semi-arid regions of sub-Saharan Africa and Arabia where it still grows in the wild as a perennial shrub. It is a sister-species of Gossypium arboreum. The epithet Gossypium derives from gossypĭŏn, name of Egyptian origin used by Pliny the elder for cotton and the plant that produces it. This variety is native to India, while the others come mostly from South America or Africa. Now this variety is abudently grown in this subcontinent including Bangladesh.

Jwoher'e Nabatati (Phytoconstituents) : Flavonoids, tannins, carbohydrates, saponins, steroids, terpenoids, glycosides, resins, phenols, proteins, fixed oil and sterols..

Mizaj (Temperament) : 2nd Degree Hot ant Moist/2nd order warm and moist.

Musleh (Correction) : Currently no information available regarding correction.

Badal (Proximal substitute) : Mexican cotton/Wild cotton*(Gossypium raimondii*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :
Foreign matter : Not more than 2 per cent, Appendix 2.2.2

Total ash	: Not more than 5 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 0.1 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 14 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 8 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action) : Musammin-e-Badan, Muqawwi-e-Bah, Muallid-e-Mani, Munaffis-e-Balgam, Jali.

Mahall-e-Istemalat (Therapeutic uses) : Zof-e-Aam, Qillat-e-Mani.

Meqdar-e-khorak (Dose) : 3-7 gm.

Muzir (Side-effects / adverse-effects) : Miscarriage, infertility.

Aaham Nukhsajat (Important formulations) : Majoon-e-Ard Khurma, Majoon-e-Mapbadana.

PETHA
(**Se**ed)

The drug Petha consists of the seeds of *Benincasa hispida* Thunb, Synonym- *Benincasa cerifera*. It is commonly known in Bangladesh as Chalkumra belong to family Cucurbitaceae. *Benincasa hispida* native of Malaysia but it is believed that originated in java, Indonesia. Now cultivated in all the tropical world. It is a large trailing or climbing herb and cultivated as a vegetable all over Bangladesh.

Naam-e-Degar (Other names) :

a) Botanical name: *Benincasa hispida* Thunb, Synonym- *Benincasa cerifera*.
b) Family: Cucurbitaceae
c) Bengali name: ChalKumrabeej
d) English name: Wax gourd, Ash gourd, White gourd melon

Tafseel (Description):

a) Aam (General): It is oblong in shape and covered with wax. *B.hispida* also used as a vegetable. It is a perennial, large trailing gourd climbing with tendrils and resembles the pumpkin in appearance. Leaves are simple, alternate, large, with numerous hairs; flowers yellow large and unisexual; fruits cylindrical, hairy, and covered with ashy powder throughout. Fruits contain numerous white coloured embedded seeds.It is warm season crop growing up to six meter the seeds are sow in the month of March and they are germinated within three month, flower formation take place in the month of July to September and the seed ripe from August to November. Both male and female flower found in same plant. And these pollinated by bees. In some cases plant is self fertile. Soil for this plant should be sandy, lomy and clay. Soil ph will beacidic (5.8-6.8) and soil can tolerate the draught. The ideal temperature for growth and production is 24-30^{o}C. We can cooked the raw food and used as different food preparation like vegetable, pickles and curries. Due to the waxy coating it is kept for several months as long as one year. A mature fruit vary in weight from 2kg to 50 kg. y steamed leaves and young flower eaten as vegetable and in some cases it is used as a flavouring soup. It is the rich source of oil and protein.

b) KlaaBeeni (Macroscopic): Seed shiny; smooth to touch; about 1.5 cm long and about 1 cm broad; ellipsoid; compressed and corrugated at the margins; pale yellow to light brown; taste starchy; odourless.

c) KhurdBeeni (Microscopic): Testa consists of three layers, with an external cuticle; epidermis columnar, containing mucilage; a Middle Palisade layer of thin walled, polygonal parenchymatous cells and inner layer consists of compactly arranged sclerenchymatous stone cells. Tegmen is one or two layered, parenchymatous. Cotyledons are made up of an outer single layered epidermis and a middle layer of elongated polygonal parenchymatous cells. Seed is exalbuminous. The cells are filled with oil droplets, aleurone grains. Oval or circular simple starchgrains having hilum in centre with a few striations, size 4 to 1 1µ in diameter.

Powder: Powder dirty white in colour, oily with sweet aroma. Under microscope it shows fragments of stone cells, palisade cell, columnar epidermal cells and polygonal parenchymatous cells; epidermis of testa and cotyledons are also seen in surface view. In addition to this oil droplets, aleurone grains and starch grains are observed.

Juz-e-Mustamil (Part used): The seeds and fruit, fruit pulpand extract of Petha used as drugs purpose.

Maskan (Habitat): Cultivated as a vegetable all over Bangladesh.

Jwoher'eNabatati (Phytoconstituents): Arachidic acid. Linoleic acid, Linolenic acid, Oleic acid, Palmitic acid, Stearic acid, β-sitosterol.

Mizaj (Temperament): Cold 2° Moist 2°

Musleeh (Corrective): Baadyan, Flfilseyah

Badal (Proximal substitute): No proximal substitute is identified

Shinakht, Khalisyatwa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 4 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive(s)	Not less than 19 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 4 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior of ethanolic extract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Petroleum ether: Diethyl ether: Acetic acid (80:20:1)	On spraying plate with 10% MethonolicH_2SO_4 and heated for 5 minutes at 105^{O} C	10	0.9 0.13 0.16 0.21 0.25 0.29 0.50 0.66 0.81 0.89

Aa'maal-e-Adviya (Pharmacological action): Musakkin-e-Hararat, Mudir-e-Baul, Habis ud Dam, Mubarrid, Qat-e- Bah Musakkin-e-Asab, Daf-e-Tashannuj, Musakkin-e-Dard, Muqawwe-e-Kulayyah

Mahall-e-Istemalat (Therapeutic use): Atash, Sozish-e-Baul, Khafqan, Naf-sud-dam, Humma, Suda,

Meqdar-e-Khorak (Dose): 2-3 gm.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed.

AahamNukhsajat (Important formulations): MajoonHamalAmbariAlviKhani.

PISTA
(Seed)

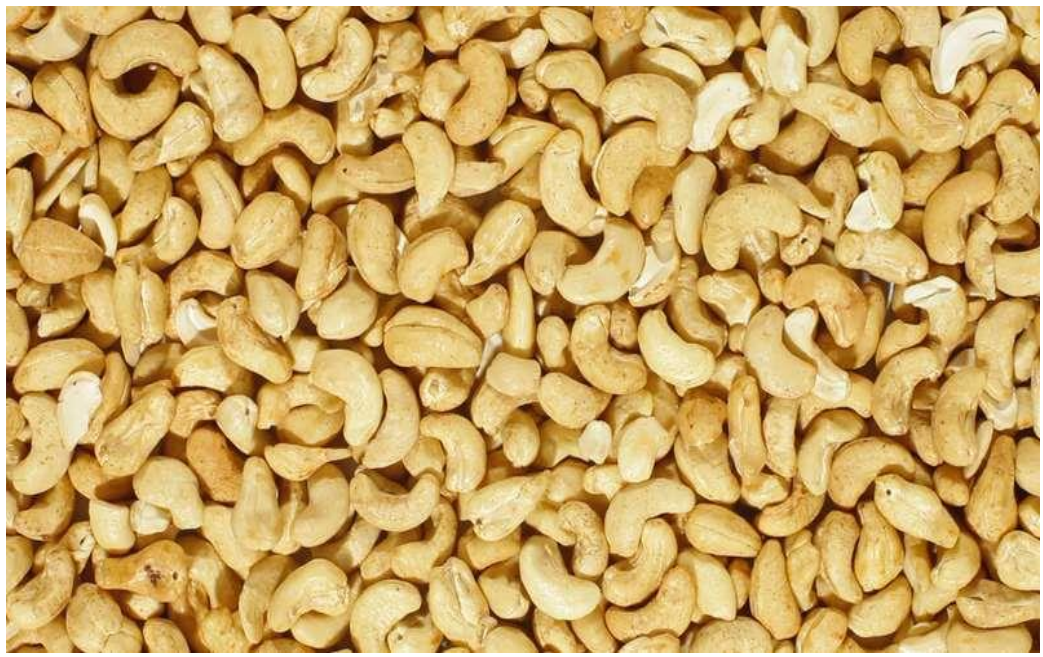
The drug Pista seed / nut consists of seeds or nuts.The pistachio (*Pistacia vera*), a member of the cashew family, is a small tree originating from Central Asia and the Middle East. The tree produces seeds that are widely consumed as food.

Naam-e-Degar (Other names):

a) Botanical name:	*Pistacia vera* Linn.
b) Family:	Anacardiaceae
c) Bengali name:	Paystabadaam
d) English name:	Pistachia nut

Tafseel (Description):

Aam (General): Pista is a native of Central and West Asia, and also is distributed throughout the Mediterranean basin. It is grown in California and Arizona and other countries where it has been introduced and imported into Bangladesh, shelled or unshelled. It is a spreading tree and partially deciduous and grows up to 10 m high. Leaves occur in 1 to 5 pairs of thick, oval leaflets. Tiny, brown-green flowers give way to clusters of the oblong pistachio kernel. The exudate of the plant forms a gum that is traditionally used for medicinal purposes.



b) KlaaBeeni (Macroscopic):Seeds red purple, having a marked depression at one end; 1.4 to 2 cm in length. 0.6 to 1.2 cm in width and 0.5 to 1.0 cm in thickness; cotyledons two, green, piano-convex; short radicle at the end of embryo; odour, aromatic; taste, sweet.

c) Khurd Beeni (Microscopic): Transverse section shows two layered testa; outer layer of collapsed cells, some cells containing reddish purple pigment; inner layer of 2 or 3 cells, consisting of large, irregular, compactly arranged cells: cotyledons two, epidermis single layered; ground tissue parenchymatous, cells oval to polygonal, filled with abundant oil droplets and aleurone grains; vascular bundles simple, consisting of xylem and phloem.
Powder: Green; shows groups of palisade parenchymatous cells, filled with oil globules and aleurone grains measuring 2 to 4 in diameter; in surface view cells of seed coat polygonal in shape, thick walled and filled with reddish purple pigment.

Juz-e-Mustamil (Part used): Seed / kernel is mainly used as drugs purpose.

Maskan (Habitat): Pista is a native of Central and West Asia, and also is distributed throughout the Mediterranean basin. It is grown in California and Arizona and other countries where it has been introduced and imported into Bangladesh, shelled or unshelled.

Jwoher'eNabatati (Phytoconstituents):
Cyanidin-3-O-galactoside; 6-alkyl (III, IV) & cisalkenyl (V) salicylic acids, anacardic acids. Nut oil contains — myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid.

Mizaj (Temperament): Hot 2° Moist 2°

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute identified.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 4 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive(s)	Not less than 14 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 9 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior of ethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***

Petroleum ether: Diethyl ether: Acetic acid (80:19:1)	On spraying plate with 10% MethonolicH_2SO_4 and heated for 5 minutes at 105^{O} C	5	0.09 0.13 0.15 0.20 0.46

Aa'maal-e-Adviya (Pharmacological action): Muqawwi-e-Qalb, Muqawwi-e-Dimagh, Muqawwi-e-Meda,Musammin, Muwallid-e-Mani.

Mahall-e-Istemalat (Therapeutic use): Zof-e-Qalb, Zof-e-Dimagh, Zof-e-Hafiza,Laghari-e-Badan, Zof-e-Aam, Huzal-e-Kulya, Zof-e-Bah, Riqqat-e-Mani, Surat-e-Inzal.

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed.

AahamNukhsajat (Important formulations): Luboob-e-Kabeer,MajoonSupari Pak, Habb-e-Gul-e-Pista.

POST-E-GULAR
(Bark)

Drug Post-e-Gular consists of dried bark of a large decidudous tree which is a popular medicinal plant in Indo-Pak sub-continent and has long been used in Unani and Ayurvedic systems of medicine, for various diseases/disorders including diabetes, liver disorders, diarrhea, inflammatory conditions, hemorrhoids, respiratory, and urinary diseases.

Naam-e-Degar (Other names) :

a. Botanical : *Ficus racemosa* Linn
b. Family : Moraceae
c. Bengali : Jagyadumur, Dumur
d. English : Cluste Fig, Country Fig

Tafseel (Description) :

Aam (General): *Dumur* is an evergreen, moderate to large, spreading, lactiferous, deciduous tree which is 15-18 meter high, without prominent aerial roots. Young shoots are glabrous, pubescent or scaberulous, leaves are dark green colored, 7.5 to 15 by 3.2 to 6.3 cm, ovate oblong, or elliptic-lanceolate, tapering to a bluntish point at the apex, with entire margins, glabrous on both surfaces when mature, base acute or rounded, 3-nerved; lateral main nerves 4 to 6 pairs; petioles 1.3 to 3.8 cm long, glabrous; stipules 2 cm long, ovate-lanceolate, scarious, pubescent; fruit receptacles 2 to 5 cm in diameter, subglobose or pyriform, found in large clusters on short leafless branches arising from main trunk or large branches.

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

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

Juz-e-Mustamil (Parts used) : Dried bark

Maskan (Habitat) : *Ficus racemosa* is not epiphytic but is found throughout greater part of India and some part of Bangladesh in moist localities, along the banks of streams, sides of ravines and also on rocky slopes, sometimes almost gregariously. It is also found in Burma, China, Indonesia, Malaysia, and Australia. It is often cultivated round villages in India in India and Bangladesh for its edible fruits.

Jwoher'e Nabatati (Phytoconstituents) : The leaves contain triterpenoids,tannins, kaempferol, rutin, arabinose, bergapten, psoralenes, flavonoids, ficusin, coumarin, phenolic glycosides and saponins. Fruits are reported to contain sterols, triterpenoids, flavonoids, glycosides, tannins, carbohydrates, β-sitosterol, gluanol acetate, hentriacontane, tiglic acid of taraxasterol, lupeol acetate, gallic acid, ellagic acid and α-amyrin acetate. Stem bark contains steroids, alkaloids, tannins, gluanol acetate, leucocyanidin-3-*O*-β-D-glucopyrancoside, leucopelargonidin-3-*O*-β-D-glucopyranoside,leucopelargonidin-3-*O*-α-L-rhamnopyranoside, ceryl behenate, lupeol acetate, α-amyrin acetate, lupeol, friedelin, behanate, stigmasterol, β-sitosterol, β-sitosterol-D-glucoside, gluanol acetate, and quercetin. Bergenin, racemosic acid, friedelin, β-sitosterol, β-amyrin, and lupeol acetate have been isolated from the bark of *F. racemosa*

Mizaj (Temperament) : Dry fruit, 2nd Degree Hot & 1st Degree Moist
Ripe fruit, 1st Degree Hot & 2nd Degree Moist

Musleh (Correction) : For dry fruit; Akhrot(*Juglans regia*) & Anisun(*Pimpinella anisum*)
And Ripe fruit; Filfilsiyah(*Piper nigrum*), Sekenjabeen and Honey.

Badal (Proximal substitute) : Joggodumur (*Ficus glomerata*), Alubokhara (*Prunus communis*), Kakdumur (*Ficus hispida*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (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 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 3 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 15 per cent, Appendix 2.2.7

TLC behavior of chloroform extract : T.L.C. of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) shows under UV (366 nm) eight flourescent zones at Rf. 0.05 (light blue), 0.14 (blue), 0.24 (light blue), 0.38 (light blue), 0.45 (light blue), 0.55 (blue), 0.93 (blue) and 0.96 (blue). On exposure to Iodine vapour nine spots appear at Rf. 0.05, 0.24, 0.38, 0.45, 0.51, 0.55, 0.65, 0.93 and 0.96 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C nine spots appear at Rf. 0.05, 0.24,0.38,0.45, 0.51,0.55,0.63,0.93 and 0.96 (all grey).

Aa'mal-e-Advia (Pharmacological action: Musakkin-e-Alam, Mohallil-e-Waram, Daf-e-Taffum, Mufarreh, Kasir-e-Riyah, Munaffis-e-Balgham, Maqawwi-e-Bah, Muallid-e-Mani, Jali, Musammin-e-Badan, Molayen.

Mahall-e-Istemalat (Therapeutic uses): Zof-e-Aam, Qabj, Iltihab-e-Tihal, Zeequn Nafas, Su-e-Hzam, Qillat -e-Boul, Zof-e-Qulaiya, Bawashir, Hissatul Qulaiya, Qillat-e-Mani, Zof-e-Bah, Sual wa Zuqam.

Meqdar-e-khorak (Dose): 5-10 gm.

Muzir (Side-effects / adverse-effects): Might cause bleeding in the digestive tract, It can cause skin to become extra sensitive to the sun, skin rash.

Aaham Nukhsajat (Important formulations): Majoon Joozam, Sharbat Laxafig, Sharbat Khasina, Sharbat Badiyan, Zimad Kibrit.

QINNAB
(Leaves)

Qinnab is a common wild herb, mostly grows in moist and waste places near houses and alongside roads. The drug yielding plant consists of dried leaves which is known since the ancient times for its medicinal value to the Unani and Ayurvedic physicians.

Naam-e-Degar (Other names) :

a. Botanical : *Cannabis sativa* Linn
b. Family : Cannabinacae
c. Bengali : Bhang, Sidhi
d. English : Indian Hemp

Tafseel (Description) :

Aam (General): Bhang is an annual herb up to 1 meter tall. Stem erect, branched, herbaceous 4 to 8 ft, and angular. Leaves simple, alternate, petiolate, and palmate; leaf lobes are sessile, narrow at the base, and upper surface is hairy green. Flowers numerous, pale yellow, small, and drooping. Female flowers erect; perianth a single entire leaf enclosing the ovary; style thread-like. Fruit yellowish-brown, an achine, enclosed in persistent leaf and single-seeded.

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

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

Juz-e-Mustamil (Parts used): Dried leaves

Maskan (Habitat): *Cannabis sativa* is an annual herbaceous flowering plant indigenous to eastern Asia. It is abundantly found in Indo-Pak Sub-continent. Due to its widespread distribution and cultivation, now it is a common. weed throughout Central Asia and tropical Africa. It is also cultivated elsewhere.

Jwoher'e Nabatati (Phytoconstituents) : Mainly volatile terpenes and sesquiterpenes. α-Pinene, Myrcene, Linalool, Limonene, Trans-β-ocimene, α-Terpinolene, Trans-caryophyllene, α-Humulene, Caryophyllene and resin (Cannabinols particularly tetrahydrocannabinol).

Effects on other systems:

Mizaj (Temperament) : 3rd Degree Hot & Dry

Musleh (Correction) : Gaojaban(*Onosma bracteatum*) and Honey.

Badal (Proximal substitute) : Other parts of the plant.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

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

Aa'mal-e-Advia (Pharmacological action) : Qabiz, Muqawwi-e-Meda, Mushahhi, Mufarreh, Muqawwi-e-Bah, Mumsik, Mujaffif, Musakkin-e-Alam, Munawwim, Daf-e-Tashannuj.

Mahall-e-Istemalat (Therapeutic uses) : Ishal, Kasrat-e-Tams, Bawaseer, Sual, Waj-ul-Kabid, Qulanj.

Meqdar-e-khorak (Dose) : 1 gm.

Muzir (Side-effects / adverse-effects) : Bronchitis, cancer of the respiratory tract, exacerbation of pre-existing cardiovascular disease, bradicardia, over sperm count, irregular menstrual bleeding, cannabinoid hyperemesis syndrome.

Aaham Nukhsajat (Important formulations) : Majoon-e-Falaksair, Kushta-e-Qalai, Araq-e-Aswad Barid.

QIRFA
(Leaf)

Qirfa (Leaf)is an ancient spice used in many countries.It consists of the dried leaf of *Cinnamomum cassia*Blume (Lauraceae) tree.An evergreen tree, indigenous to Indo-China and Southern China, cultivated in other parts of southern Asia like Bangladesh, Pakistan, Srilanka etc.

Naam-e-Degar (Other names):

a) Botanical name: *Cinnamomum cassia* Blume
b) Family: Lauraceae
c) Bengali name: Dalchini, Daruchinipata
d) English name: Cassia, Chinese Cinnamon,

Tafseel (Description):

Aam (General): Qirfa tree, is an evergreen tree originating in southern China, and widely cultivated there and elsewhere in South and Southeast Asia (Bangladesh, India, Indonesia, Laos, Malaysia, Thailand, and Vietnam). The leaf, bark and buds etc. are used as a spice, especially in Indian subcontinent, and were once used by the ancient Romans.The tree grows to 10–15 m (33–49 ft) tall, with greyish bark and hard, elongated leaves that are 10–15 cm (3.9–5.9 in) long and have a decidedly reddish colour when young.

KlaaBeeni (Macroscopic): Leaves petiolate; petiole 1.5 to 2 cm long and swollen at the base; exstipulate. dorsiventral. olive green; variable in size, 8 to 12 cm long and 2.5 to 5 cm broad at center; oblong, tapering at base, acute or obtuse at apex, entire, very smooth, shining and green above, dull and glaucous with very minute tomentum beneath and finely reticulate; strongly three nerved, two lateral one united with the midrib for a short distance from the base and reaching at the apex of the leaves; odour aromatic, pleasant like a mixture of clove and cinnamon, taste slightly sweet, mucilaginous.

KhurdBeeni (Microscopic):

i) Petiole- Transverse section of petiole shows single layered epidermis consisting of squarish cells covered with thick cuticle. Epidermis is followed by single layered collenchyma with distinct angular thickenings; cortex is divided into upper loose parenchymatous cortex with elongated cells containing starch grains and lower compact parenchymatous cortex containing simple, spherical starch grains 10 µ to 30 µ size with hilum at the center and isolated prismatic crystals; 45µ to 50µ. in size, lignified, inner and radial walls with thick striations visible; schizogenous cavities present. Stele somewhat 'C' shaped; vascular bundle consists of xylem and phloem ; xylem vessels arranged in radial rows transversed by medulary rays.

ii) Midrib - Transverse section of midrib shows single layered upper and lower epidermis covered with cuticle; straight anticlinal walls: and a few cells containing mucilage: hypodermis of 2 or 3 layers of collenchyma present adjacent to both sides; parenchymatous cells of ground tissue isodiametric to circular with intercellular spaces; starch grains abundant, simple, spherical 20µ to 30µ in size and acicular crystals; stele crescent-shaped; vascular bundle surrounded by 2 or 3 layered sclerenchymatous sheath centering and/or contain simple spherical starch grains measuring 10 µ to 20 µ in size.

iii) Lamina -Dorsiventral shows single layered upper and lower epidermis covered with cuticle: some epidermal cells contain mucilage: mesophyll 1 or 2 layered; single palisade layer interrupted by oil cells followed by multilayered and distinct spongy parenchyma: traces of vascular tissue: only lower epidermis shows paracytic stomata, stomatal index 16.

Powder: Powder olive green in colour: shows fragments of epidermis with stomata; collenchyma, parenchyma. spongy parenchyma, palisade cells, xylem and phloem; starch grains simple. spherical with hilum at the center: sclerids, calcium oxalate crystals of acicular and prismatic type.

Juz-e-Mustamil (Part used): Qirfa tree's leaves, bark, flowers, buds,fruits are used as drugspurpose**.**

Maskan (Habitat): Indigenous to Indo-China and Southern China, cultivated in other parts of southern Asia like Bangladesh, Pakistan, Srilanka etc.

Jwoher'eNabatati (Phytoconstituents): Terpenoids: 1-terpineol, 4 *cis*-β-terpineol. α-terpineol, Caryophyllene, Phenylpropanoids: eugenol, cinnamyl acetate.

Mizaj (Temperament): Hot 2^{O}, Dry 2^{O}

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute is identified.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash	Not more than 6 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive(s)	Not less than 3 %	Appendix 2.2.6
Water soluble extractive(s)	Not less than 5 %	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior ofEthanolic extract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Benzene: Petroleum ether :Ethyl acetate (60:25:15)	On spraying plate with 10% Methonolic H_2SO_4 and heated for 5 minutes at 105^{O} C	5	0.05 0.40 0.53 0.73 0..83

Aa'maal-e-Adviya (Pharmacological action): Mulattif, Mohaalil-e-waram, Muqawwi-e-Aza-e-Raisa, Mudirr-e-Baul, Daf-e-Nazla, Daf-e-Zukam.

Mahall-e-Istemalat (Therapeutic use): Sual, Warm-e-Reham, Ehtebas-e-Baul, Ehtebas-e-Tams, Salabat-e-Reham, Wajaul Mafasil, Nazla, Zukarm.

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): No significant side effects / adverse effects have been observed

Aaham Nukhsajat (Important formulations): Raughan-e-Surkh.

QUARANFUL
(Flower bud)

Drug Quaranful is the dried flower bud which is collected twice a year in the months of October and February when they change colour from green to crimson and then carefully separated from their peduncles for uses.

Naam-e-Degar (Other names) :

a. Botanical : S*yzygium aromaticum*
b. Family : Myrtaceae
c. Bengali : Lavang
d. English : Clove

Tafseel (Description) :

Aam (General): : The clove tree is a small, handsome, evergreen tree reading 12-15 meter in height, conical in shape when young, later becoming roughly cylindrical in a mature plant. The trunk is up to 30 cm in diameter, is composed of very hard wood. The bark is grey and rough, and slash on a healthy tree is white to rose-pink in colour. Leaves are simple, opposite, coriaceous, extipulate, glabrous and aromatic. The petiole is slender, 2-3 cm long, somewhat swollen and pinkish at the base and the lamina is lanceolate or narrowly elliptic dotted with glands, the new leaves appear in flakes and are bright pink. Later the upper surface becomes glossy and dark green, and the lower surface dull and paler

Klaa Beeni (Macroscopic): Flower bud measuring 10-17.5 mm in length, dark brown or dusty red, consisting of a sub-cylindrical, slightly flattened, four sided hypanthium readily exuding oil when pressed hypanthium containing upper portion a two called inferior ovary with numerous ovules attached to an axile placenta, surmounted by four thick, divergent sepals and covered by unopened corolla consisting of four membranous imbricate petals, frequently detached, enclosing numerous incurved stamens and one erect-style; odour, strongly aromatic; taste, pungent, aromatic followed by slight tingling of the tongue.
Khurd Beeni (Microscopic): Transverse section of hypanthium show epidermis and calyx teeth composed of straight walled cells, with thick cuticle having large anomocytic stomata, hypanthium tissue spongy, cluster of calcium oxalate crystals varying in size from 6-20 m in diameter, small number o0f stone cells and prismatic crystals of calcium oxalate present in stalk; stamens, each with an oil gland in the apex of connective triangularly centricular pollen grains, 15-20 m in diameter anther walls showing a typical fibrous layer, schizolysigenous glands found in all parts of clove; occasional isolate pericyclic firbres present.
Powder: Dark Brown, fragments of parenchyma showing large oval, schizolysigenous oil cavities, spiral tracheids and a few rather thick-walled, spindle shaped fibres, calcium oxalate crystals in rosette aggregates, 10-15m in diameter, fragments of anther walls with characteristic reticulated cells, pollen grains numerous, tetrahedral, 15-20 in diameter.
Juz-e-Mustamil (Parts used) : Dried flower bud

Maskan (Habitat) : The plant is indigenous to North Molocca Islands of Indonesia. It is cultivated in Zanzibar, Madagascar, Malaysia, Sri Lanka, and India. In India it is mainly grown in the Western ghats. The tree prefers well drained rich soil with sufficient soil moisture throughout the year. High atmospheric temperature (25-35 degree C) with heavy sunlight, good well distributed rainfall(above 150 cm) and high humidity (above 70%) are preferred.

Jwoher'e Nabatati (Phytoconstituents): Clove comprises of volatile as well as non-volatile constituents.
Volatile constituents: Major oil component is eugenol. Bud oil: contains 15-20% essential oil. This oil is dominated with eugenol(70-85%), eugenyl acetate(15%) and beta-caryophyllene(5-12%). Leaf oil: yields 3-4.8% essential oil. This differs on the stages of leaf growth. Clove stem oil: yields 6% volatile oil containing 80.2% eugenol and 6.6% beta-caryophyllene. Fruit oil: ripe fruits yield 2% of oil which is composed of 50-55% eugenol.

Nonvolatile constituents: Tis includes tannins, sterols, triterpenes and flavonoids. Cloves contain 10-13% tannins which have the same chemical composition as gallotannic acid Triterpenes: cloves contain about 2% of triterpene, oleanolic acid.maslinic acid and 2 alpha hydroxyoleanolic acid has also been isolated. Sterols: sterols isolated from clove include sitosterol, sigmasitosterol and campesterol. Flavonoids: a chromone C-glucoside, isobiflorin, and biflorin were found.

Mizaj (Temperament) : 3rd Degree Hot & Dry.

Musleh (Correction) : Babla Gum(*Vachellia nilotica*), fresh cheese & Ghee

Badal (Proximal substitute) : Darchini(*Cinnamomum zeylanicum),* Khulanjan(*Alpinia galangal*), Jauzbuwa(*Myristica fragrans).*

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

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

Aa'mal-e-Advia (Pharmacological action) : Mohallil-e-Waram, Daf-e-Taffum, Mufarreh, Musakkin-e-Alam, Maqawwi-e-Qalab, Muqawwi-e-Digmah, Munaffis-e-Balgham, Daf-e-Tashannnuj, Muqawwi-e-Meda, Muqawwi-e-kabid, Muqawwi-e-Ama.

Mahall-e-Istemalat (Therapeutic uses) : Bakhrul Fam, Waz-ul-Asnan, Zof-e-Meda, Zof-e-Kabid, Su-e-Hazam, Nafkh-e-Shikam Qulanj.

Meqdar-e-khorak (Dose) : 0.5-1 gm.

Muzir (Side-effects / adverse-effects) : Itching, rash; mild skin irritation; or. sore gums, mouth irritation, bleeding or swollen gums, or tooth changes after using clove inside the mouth.

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

QURTUM
(Flower)

The drug Qurtum flowers is the flower ofQurtum plant, is a famous Unani drug used in a number of pathological conditions.Although the entire plant has medicinal value but its seed, oil and flowers havemore important medicinal values. Botanically known as *Carthamus tinctorius* Linn. (Asteraceae).

Naam-e-Degar (Other names):

a) Botanical name:	*Carthamus tinctorius* Linn.
b) Family:	Asteraceae
c) Bengali name:	Kusum or Kusamful, , Kajirah
d) English name:	Safflower, Parrot Seed, Bastard Saffron, Wild Saffron, African Saffron, American saffron, Dyer's Saffron.

Tafseel (Description):

Aam (General): As it is an erect plant about half meter in height with spinous leaves; orange red flowers in large terminal heads.Qurtum is a slender, glabrous or pubescent, much branched, annual herb,growing to a height of 45-60 cm (tall varieties 85-150 cm) The leaves are broad, lanceolate, spinosely serrate (rarely unarmed) sub erect, oblong, sessile. Flowering takes place during December to January.The flowers have a bitter taste and a bad odour. Flower heads are orange-red, sometimes white or yellow in colour and globular in shape.

Klaa Beeni (Macroscopic): The terminal capitulate heads measure 2 to 4 cm in length; bracteates, outer involucral bracts leafy. ovate oblong, constricted above the base, green, usually spinous: inner involucral bracts ovate-oblong, acute; flower, bisexual, sessile; colour orange red to yellow; pappus absent: corolla gamopetalous: 5 lobed, tube slender and lower part embedded in a dense mass of fringed scale: stamens epipetalous, 5, syngenecious; anther basifixed; carpels 2, syncarpous: stigma, bifid and curved; style longer than the staminal tube: ovary interior, unilocular; basal placentation.

Khurd Beeni (Microscopic):

Bract - Shows outer single layer of epidermal cells with cuticle and multicellular, unbranched trichomes present only on upper epidermis; followed by 2 to 3 layered collenchymatous cells. Middle layer consists of irregular spongy parenchymatous zone along with oil cells and collateral vascular bundle: lower epidermis consisting of irregular, single layer cells covered with cuticle.

Corolla - Shows outer layer of single layered parenchymatous cells: irregularly elongated middle layer parenchymatous, cells consisting of oil cells and cuboid calcium oxalate crystals; lower layer parenchymatous, small, irregular with acicular crystals.

Anther - Anther lobes 4 and anther wall 1 to 2 layered, parenchymatous cells with dispersed acicular crystals.

Powder: Reddish brown, shows fragments of small and large. elongated and irregular parenchymatous cells; scattered cuboid and acicular calcium oxalate crystals; starch grains simple. spherical, 5µ to 15µ in size. Petal epidermis wavy with anticlinal walls in surface view. Antheridial tissue shows fibrous layer of anther with reticulated cell wall pattern in surface view. Pollen grains spheroid, 3-colporate, 70µ to 90µ in size; exine spinate, 2µ thickness, spins blunt: intine smooth walled.

Juz-e-Mustamil (Part used): The entire plant has medicinal value but its seed, oil and flowers have more important and interesting medicinal values. Its different parts are used after little processing as a single drug but mostly it is included as an ingredient in Unani formulations.

Maskan (Habitat): The plant is native to Europe and Asia. The cultivatedsafflower is considered to have originated either from the saffron thistle(*Carthamus lanata*) or the wild safflower (*Carthamus oxyacantha*) in the twoprimary centres of origin i.e. the mountainous regions of Ethiopia andAfghanistan; and also from the plains of India and Mayanmar (Burma), whichare considered to be its secondary centre of origin.It is also grow in Bangladesh.

Jwoher'e Nabatati (Phytoconstituents): Carthamine, neocarthamine, kaempferol-3-rhamnoglucoside. Kaempferol glycoside. Tracheloside, steroids, cellobioside. luteolin, luteolin-7-O glycoside, B-sitosterol & its glycoside, polyacetylenes, acylserotonins, nonacosane, palmitic acid, lauric acid, myristic acid.

Mizaj (Temperament): Hot 2^{O}, Dry 2^{O}

Musleeh (Corrective): Not required.

Badal (Proximal substitute): No proximal substitute is identified.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2%	Appendix 2.2.2
Total ash	Not more than 10 %	Appendix 2.2.3
Acid insoluble ash	Not more than 4%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 5%	Appendix 2.2.6
Water soluble extractive	Not less than 27%	Appendix 2.2.7

TLC (Thin-layer Chromatography) behaviorof ethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Petroleum ether: Chloroform: Acetone (70:20:10)	On spraying plate with 10% Methanolic H_2SO_4 and heated for 5 minutes at 105^{O}C	5	0.05 0.40 0.53 0.73 0..83

Aa'maal-e-Adviya (Pharmacological action): Munaffis-e-Balgham, Mulattif., Muhallil-e-Waram, Mohafiz-e- Kabed, Mohafiz-e-Jild wa Shyer, Moqawwi wa Mohafiz-e-Qalb, Moqawwi wa Mohafiz -e-Reyah, Many Qashb, Many Jarasem, Moqawwi-e-Asab

Mahall-e-Istemalat (Therapeutic use): Waram-e-Reham. Waram-e-Ahsha, Waram-e-Kabid , Amraz-e-Jild wa Shyer, Zof-e-Qalb, Zof-e-Reyah, Sul'ya, Zof-e-Asab

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosages.

Aaham Nukhsajat (Important formulations): Ranghan -e- Qurtum, Majoon -e - Qurtum.

QUST
(Roots)

Drug yielding plant is a tall, robust, perennial herb with thick roots of a perennial herb commonly grew in cold and humid areas. It has been used in the treatment of various disease ailments and conditions in Unani medicine since ancient time.

Naam-e-Degar (Other names) :

a. Botanical : *Saussurea lappa*
b. Family : Compositate
c. Bengali : Kudo, Kut
d. English : Costus root

Tafseel (Description) :

Aam (General): Kut is used as different names in different regions of this Indo-Pak Sub-continent. But commonly known as costus or kuth which is a species of thistle in the genus Saussurea native to India. Essential oils extracted from the root have been used in traditional medicine and in perfumes since ancient times. The root of the plant is the key part used for medicinal purposes.

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

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

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

Juz-e-Mustamil (Parts used) : Dried root

Maskan (Habitat): It is usually found at elevations of 2,500 to 3,000 meter including the Himalayas, Kashmir, Jammu, Western Ghats, and the Kishenganga Valley. Its typical flowering season spans from July to August, with the seeds ripening from August to September. The plant can be grown in a wide variety of soils, ranging from light sandy, medium to heavy clay soils that are acid, neutral or basic, alkaline soils, preferring soils that are moist. The amount of sunlight the plant thrives upon can vary from semi-shaded areas or areas with no shade.

Jwoher'e Nabatati (Phytoconstituents): Dehydrocostus lactone, Costunolide, Cynaropicrin, Essential oil, Alkaloid(Saussurine) and bitter resin.

Mizaj (Temperament) : 3rd Degree Warm & Dry.

Musleh (Correction) : No sufficient information available regarding Correction.

Badal (Proximal substitute): Pushkara/Pushkarmool/Pushkaramula (*Inula racemosa*), Arand/Erandamula(*Ricinus communis*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :

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

Aa'mal-e-Advia (Pharmacological action) : Jali, Muhallil-e-Waram, Mujaffif, Muqawwi-e-Asab, Munaffis-e-Balgam, Musakkin-e-Alam, Qatil-e-Deedan-e-A'ama, Kasir-e-Riyah, Mudirr-e-Boul, Mudirr-e-Haiz,

Mahall-e-Istemalat (Therapeutic uses) : Falij, Laqwa, Rasha, Waj-ul-Mafasil, Niqras, Waram-e-Tehal, Deedan-e-A'ama, Ehrebas-e-Tams, Daf-e-T'afun.

Meqdar-e-khorak (Dose) : 2-3 gm

Muzir (Side-effects / adverse-effects) : Dizziness and nausea.

Aaham Nukhsajat (Important formulations) : Jawarish-e-Jalinoos, Dawa-ul-Kurkum, Majoon-e-Dabeedul Ward, Majoon-e-Juntiyana, Majoon-e-Khadar, Tiryaq-e- Samania, Zimad-e-Khanazeer, Sabadaritoos, Anqaruya-e-Kabir.

SALAB MISRI / KHUSYATUS SALAB

(Root tuber)

The drug Salab Misri also known as Khusyatus salabconsists of dried root tubers of *Orchis mascula* Linn.(*Orchis latifolia* Linn)(Orchidaceae). It is a terrestrial herb commonly known as "Salep" in English language. It is an important medicinal plant used in clinical practice in Unani system of medicine.

Naam-e-Degar (Other names):

a) Botanical name:	*Orchis mascula* Linn. (*Orchis latifolia* Linn)
b) Family:	Orchidaceae.
c) Bengali name:	Salab Misri, Salam Michri
d) English name:	Salep, Saloop, Adam and Eve root

Tafseel (Description):

a) Aam (General): Salabmisri or Khusyatus salab is a tuberous terrestrial orchid. Tuber are paired lobed and palmate, stems of this plants are usually fistular and measure upto 90 cm long. Leaves are many, 15 cm long. Spike is cylindrical and dense flowered. It also measures 15 cm long. Flowers are 2 cm long variable in colour from pink to purple to almost pure white.The ovary is inferior and the fruit a capsule, seeds are very small and light. Odour is acetonic, sweet and salty in taste with a mucilaginous *feel.*

b) KlaaBeeni (Macroscopic): Root tubers palmate or simple, the simple ones creamish-white in colour, 5 cm in length and upto 3 cm wide, oblong, often pointed at the lower end and rounded at the upper, where occurs a depressed scar, left by the remains of the stem; generally shrunken. contorted, covered with a rough granular skin, translucent, very hard and horny: fracture is short and granular; fractured surface is shiny, yellowish-white; palmate tubers yellowish white to deep yellow in colour, having 3 to 5 digits, usually broken; odouracetonic, sweet and salty taste with a mucilaginous feel.

c) KhurdBeeni (Microscopic):
Unprocessed tuber: Transverse section shows an outermost indistinct dark brown layer of epiblema, followed by a few layers of hypodermis, distinct, made up of slightly elongated parenchymatous cells, cortex consisting of 6 to 10 layers of large, thick walled, loosely arranged. mucilagenous parenchymatous cells; with aerenchyma; abundant starch grains are present within the parenchymatous cells; vascular bundles conjoint, collateral, closed, around 4 to 6 in number; bundles sheath well marked.
Powder: Creamish-yellow, shows circular to polygonal yellow colouredmucilagenous parenchyma; reticulate vessels and starch grains.
Note: In "processed" tubers starch grains appear completely gelatinized, but gives the reaction with iodine, although individual grains cannot be made out. Otherwise, they are similar to -unprocessed" tubers.

Juz-e-Mustamil (Part used): Mainly the Root tubers used as drugs purpose.

Maskan (Habitat): Found in between Western Himalaya and Kashmir between 3000 to 4000m altitudes. It is cultivated in Europe, India and South Asia.

Jwoher'e Nabatati (Phytoconstituents): Glucosides, bitter substances, starch, mucilage, sugar albumin, volatile oil and loroglossin

Mizaj (Temperament): Hot 2^{O}, Dry 2^{0}

Musleeh (Corrective): Samaghearabi, Nabatesafed, Shikanjabeen, Aabekasni.

Badal (Proximal substitute): Boozidaan

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2%	Appendix 2.2.2
Total ash	Not more than 2 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 1%	Appendix 2.2.6
Water soluble extractive	Not less than 30%	Appendix 2.2.7

TLC (Thin-layer Chromatography) behaviorof ethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Chloroformte : Methanol: Glacial acetic acid (6:3:1)	On spraying plate withEthanolic H_2SO_4 and heated for 30 minutes at 105^{O} C	6	0.11 0.19 0.26 0.37 0.45 0.56

Aa'maal-e-Adviya (Pharmacological action): Mughalliz-e-Mani, Moallid-e-Mani, Mumsik, Moqawwi-e-Bah, Moqawwi-e- Asab, Surat-e-Inzal, Zof-e-Bah, Jiryan, Qillat-e-Mani, Qillat-e-Haiwanat-e-Manviya, Falij, Tashannuj, Laqwa, Zof-e-Bah, Kuzaz, QulaeDahan, Uqr, SurateInzal, Jiryaan

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects): No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosages.

Aaham Nukhsajat (Important formulations): Majoonefalasfa, Sufoofe salab, Halwae Salab, HalwaeGhekwar, Hab Mumsik, HabAmbarMomiyayi, LaboobKabir, MajoonSuparipak and MajoonMughalizsada.

SHALGUM
(Tuber)

This drug is a dried sliced pieces of Shalgum's tuber. It is an erect, annual herb grows well in territories in cold environments and may be stored for months after harvest. Itsnapiform tuberous root used as vegetable.

Naam-e-Degar (Other names) :

a) Botanical name:	*Brassica rapa Linn.*
b) Family:	Brassicaceae
c) Bengali name:	Shalgom
d) English name:	Turnip

Tafseel (Description):

a) Aam (General): Shalgum or Turnip grow well in territories in cold environments and may be stored for months after harvest. The leaves are usually light green, thin and sparsely downy. The turnip plant has a white-fleshed edible part, and the large sphered root develops underneath the flowering stems and leaf petioles. The flowers form a bunch at the top of the raceme and are usually raised above the terminal buds. Bolting of turnip plants occurs in late winter, followed by the formation of flower buds, which are also consumed before opening, while still green.

Shalgum or Turnip greens have an intense aroma, the colour of the leaves and a salty taste, while the tops are unique for their colour, moistness, fibrosity in the mouth and bitter taste. Two turnip varieties are grown, small, tender ones and large sized ones.

Turnip is a biennial herb with swollen tuberous white-fleshed taproot, lacking a neck. Basal leaves are light to medium green, hairy or bristly, stalked, lyrate-pinnatifid, 30-50 cm long. Stem-leaves are oblong-lanceshaped, stem-clasping. Flowers are bright yellow, sepals spreading: petals 6-10 mm long, those in anthesis close together and commonly overtopping the unopened buds. Outer 2 stamens curved outwards at base and much shorter than inner stamens. Fruit is 4-6.5 cm long, with long tapering beak, on divaricate-ascending pedicels 3.2-6.5 cm long; seeds blackish or reddish-brown, 1.5-2 mm in diameter. Turnip is probably native to Europe, now cultivated throughout the world. Found flowering: June.

b) KlaaBeeni (Macroscopic): Whole, dried tuber or dried sliced pieces of variable sizes, pieces with outer epidermis intact reddish-brown, smooth except for protuberances at a few places, cut surface creamy-white, difficult to break, pliable; edges curly; scars of rootlets or occasionally a few rootlets present. Taste is sweet; odour not distinct.

c) KhurdBeeni (Microscopic): Transverse section of tuber shows outer single layered epiblema, cells small, rectangular; cork a few layers of slightly compressed, irregularly arranged, tangentially elongated cells filled with dark-reddish brown content; cortex consists of isodiameteric, thin walled parenchymatous cells containing circular to oval, simple starch grains with hilum at the center, 5µ to 10µ in diameter; phloem present on outer side of the cambium, sieve elements usually crushed; cambium consists of thin walled cells, 2 to 3 layered; meduallary rays distinct, up to 5 cells in width, few cells containing small prism of calcium oxalate crystals; xylem consists of vessels, (30 to 40µ in diameter) and fibers; primary xylem located at the center; pith absent.

Powder: Light brown in colour; shows fragments of parenchymatous cells, cork cells, xylem fibers 600 to 800 µ in length, scalariform- reticulate, scalariform and helical vessels, starch grains 8 to 15 µ in diameter and crystals of calcium oxalate.

Juz-e-Mustamil (Part used): Roots/tubers, leaves, shoots and seeds of Shalgum plant used as

medicinal purposes.

Maskan (Habitat): Shalgum is probably native to Europe, now cultivated throughout the world even in Bangladesh.

Jwoher'e Nabatati (Phytoconstituents): Reducing sugars, flavonoids, saponins.

Mizaj (Temperament): Cold 2°, Moist 2^0

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute identified.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2%	Appendix 2.2.2
Total ash	Not more than 14 %	Appendix 2.2.3
Acid insoluble ash	Not more than 10%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 7%	Appendix 2.2.6
Water soluble extractive	Not less than 38%	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior ofethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Benzene: Chloroform: Methanol (90:7.5: 2.5)	On spraying plate with10% MethanolicH_2SO_4 and heated for 5 minutes at 105^O C	4	0.20 0.27 0.70 0.76

Aa'maal-e-Adviya (Pharmacological action): Muqawwi-e-Bah, Hazim, Mudirr-e-Baul, Mudirr-e-Haiz.

Mahall-e-Istemalat (Therapeutic use): Sual, Laghari, Zof-e-Ishteha, Ehtebas-e-Baul, Ehtebas-e-Haiz.

Meqdar-e-Khorak (Dose): Q. S.;Seed 500mg-1g paste.

Muzir (Side-effects / adverse-effects: No significant side effects / adverse effects have been observed

SHALGUM

(Seed)

The drug Shalgum seed consists of dried seeds of *Brassica rapa Linn.* (Brassicaceae). It is an erect, annual herb grows well in territories in cold environments and may be stored for months after harvest.

Naam-e-Degar (Other names):

a) Botanical name:	*Brassica rapa Linn.*
b) Family:	Brassicaceae
c) Bengali name:	Shalgombeej
d) English name:	Turnip

Tafseel (Description) :

a) Aam (General): Shalgum or Turnipgrow well in territories in cold environments and may be stored for months after harvest. The leaves are usually light green, thin and sparsely downy. The turnip plant has a white-fleshed edible part, and the large sphered root develops underneath the flowering stems and leaf petioles. The flowers form a bunch at the top of the raceme and are usually raised above the terminal buds. Bolting of turnip plants occurs in late winter, followed by the formation of flower buds, which are also consumed before opening, while still green.

Shalgum or Turnip greens have an intense aroma, the colour of the leaves and a salty taste, while the tops are unique for their colour, moistness, fibrosity in the mouth and bitter taste. Two turnip varieties are grown, small, tender ones and large sized ones.

Turnip is a biennial herb with swollen tuberous white-fleshed taproot, lacking a neck. Basal leaves are light to medium green, hairy or bristly, stalked, lyrate-pinnatifid, 30-50 cm long. Stem-leaves are oblong-lanceshaped, stem-clasping. Flowers are bright yellow, sepals spreading: petals 6-10 mm long, those in anthesis close together and commonly overtopping the unopened buds. Outer 2 stamens curved outwards at base and much shorter than inner stamens. Fruit is 4-6.5 cm long, with long tapering beak, on divaricate-ascending pedicels 3.2-6.5 cm long; seeds blackish or reddish-brown, 1.5-2 mm in diameter. Turnip is probably native to Europe, now cultivated throughout the world. Found flowering: June.

b) KlaaBeeni (Macroscopic): Seeds small, black to brown, spherical, 1.5 to 2 mm in diameter; testa thin, brittle, surface minutely reticulate; taste sharp and bitter.

c) KhurdBeeni (Microscopic): Transverse section of seed shows embryo and two cotyledons enclosed in a testa. The testa is single layered, well developed, formed of polygonal tabular cells completely filled brownish content; hypodermis 2-3 layered, consists of large empty and flattened cells, few cells contain oil globules; mucilage present below the hypodermis; cotyledons two, large, consist of oval to polygonal, thin-walled parenchymatous cells containing aleurone grains and oil globules; embryo conduplicate, consists of thin walled parenchymatous cells.
Powder : Brownish-yellow; fragments of testa with thin-walled hexagonal epidermal cells in surface view, filled with brown content; group of thin walled palisade parenchymatous cells, filled with oil globules and aleurone grains are visible.

Juz-e-Mustamil (Part used):Seeds, Roots/tubers, leaves, and shoots of Shalgum plant used medicinally.

Maskan (Habitat): Shalgum is probably native to Europe, now cultivated throughout the world.

Jwoher'e Nabatati (Phytoconstituents): L-arabinose, D-galactose, D-glucuronic acid, 3-butenyl iso-thiocynate, 2-phenyl ethyl iso-thiocynate, phenyl acetonitrile, D-galactosyl-myo-inositol.

Mizaj (Temperament): Cold 2°, Moist 2°

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute is identified

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2%	Appendix 2.2.2
Total ash	Not more than 5 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 17%	Appendix 2.2.6
Water soluble extractive	Not less than 37%	Appendix 2.2.7

TLC (Thin-layer Chromatography) behaviorof ethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Benzene: Chloroform: Methanol (90:7.5: 2.5)	On spraying plate with10% Methanolic H_2SO_4 and heated for 5 minutes at 105^{O} C	6	0.16 0.22 0.49 0.89

Aa'maal-e-Adviya (Pharmacological action): Mudirr-e-Haiz, Mudirr-e-Baul, Mughazzi, Mushtahi, Daf-e-Sual.

Mahall-e-Istemalat (Therapeutic use): Sual, Laghari, Zof-e-lshtiha, Ehtebas-e-Baul, Ehtebas-e-Haiz.

Meqdar-e-Khorak (Dose): 3 gm.

Muzir (Side-effects / adverse-effects: No health hazards were recorded with the proper administration of designated therapeutic dosages

Aaham Nukhsajat (Important formulations): Luboob-e-Kabeer, Laboob-e-Sagheer.

SUMBUL-UT-TEEB
(Rhizome)

Drug yilding plant has a rich history of medicinal use and has been valued for centuries in Unani and Ayurvedic systems of medicine. The rhizomes of the plant are used in the Unani system of medicine as a bitter tonic, stimulant, antispasmodic, and to treat hysteria, convulsions, and epilepsy.

Naam-e-Degar (Other names) :

a. **Botanical :** *Nardostachys jatamansi*
b. **Family :** Valerianaceae/Caprifoliaceae
c. **Bengali :** Jatamansi
d. **English :** Muskroot, Spikenard

Tafseel (Description) :

Aam (General): **Jatamansi** is a flowering plant of the honeysuckle family that grows in the eastern Himalayas. The plant grows to about 1 meter in height and has pink, bell-shaped flowers. The calyx of the plant consists of 5 well-developed lanceolate or dentate lobes that continue to grow during maturation of the fruit. The plan is found at an altitude of 3,000 to 5,000 meter.

Klaa Beeni (Macroscopic): Dried rhizome dark brown, 2.5-7.5 cm long, cylindrical, covered with reddish-brown fibres forming a net work, which are skeletons of sheathing leaf

bases; fracture, brittle; internal colour reddish-brown, colour, strongly aromatic, taste, acrid, slightly bitter.

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

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

Juz-e-Mustamil (Parts used) : Dried rhizome

Maskan (Habitat): The plant is grown in the eastern Himalayas, primarily in a belt through Kumaon, Nepal, Sikkim and Bhutan. It is found at an altitude of 3,000 to 5,000 meter Steep rocky cliffs and grassy slopes, wet, moist and shady meadows Random growth of the plant is seen in rock crevices. Its native is the Alpine Himalayes

Jwoher'e Nabatati (Phytoconstituents) : This herb contains essential oils, flavonoids, terpenoids, and mono sesquiterpenes. The plant contains the following chemical constituents; cyprotene, acopaene, cyperene, aselinene, rotundene, valencene, cyperol, gurjunene, trans-calamenene, dcadinene, gcalacorene, cadalene, amuurolene, gmuurolene, cyperotundone, mustakone, isocyperol, acyperone, 4,11-selinnadien-3-one and 1,8-cineole. The oil of *C. rotundus* was mainly composed of cyperol, α-cyperene, rotundine, α-cyperone, α-copaene, valerenal, myrtenol, β-pinene, α-pinene and α-Selinene, sesquiterpene hydrocarbons (Caryophyllene).

Mizaj (Temperament) : 1st Degree Hot & 2nd Degree Dry
Or, 2nd Degree Hot & Dry.

Musleh (Correction) : Katira Gum(Gum tragakanth), Ispaghula(*Plantago ovate*) and Tabashir(*Bambusa arundinacea).*

Badal (Proximal substitute) : Afsanteen(*Artemisia absinthium*), Saadkufi(*Cyperus rotundus)*, Ajkhar, Sajaj Hindi(*Cinnamomum tamala*).

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (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 5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 2 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 5 per cent, Appendix 2.2.7
Volatile oil	: Not less than 0.1 per cent v/w
Moisture content	: Not more than 8.5per cent

Aa'mal-e-Advia (Pharmacological action) : Mohallil-e-Waram, Musakkin, Jali, Mutayyib-e-Dahan, Mujaffif, Kasir-e-Riyah, Muqawwi-e-Qalb, Muqawwi-e-Dimag, Mudirr-e-Boul.

Mahall-e-Istemalat (Therapeutic uses) : Suda, Nafkh-e-Shikam, Istiaka, Yarkan, Waram-e-Kabid, Waram-e-Rahem, Waram-e-Masana.

Meqdar-e-khorak (Dose) : 3-5 gm.

Muzir (Side-effects / adverse-effects): Stimulates fibroblasts to produce collagen and elastin fibers giving more elastic and less wrinkled properties to the skin. Avoid use during pregnancy and lactation and also patients with known hypersensitivity reactions should avoid it.

Aaham Nukhsajat (Important formulations) : Jawarish-e-Fanjnosh, Barshasha, Anoshdaru, Anoshdaru Lulvi, Kohal-e-Roshnai, Sufoof-e-Mohazzil, Lyarij-e-Faiqra, Raughan-e-Babuna Qawi, Zimad-e-Sumbul-ut-Teeb.

TAGAR
(Rhizome)

Tagar consists of predominantly dried rhizome, stolon and small root. Drug yielding plant is a hairy perennial herb growing in temperate Himalayas upto an altidute of 3,000 meter. Rhizome of the plant is colleted in autumn and then well washed with water and dried for medicine. In Unani systems of medicine, the drug is used in obesity, skin disease, insanity, epilepsy and snake poisoning.

Naam-e-Degar (Other names) :

a. Botanical : *Valeriana wallichii* DC
b. Family : Valerianaceae
c. Bengali : Tagar Pduka, Mushkbala
d. English : Indian Valerian

Tafseel (Description) :

Aam (General): Tagar is a wild, erect and pubescent herb, having horizontal, thick rootstock or rhizomes, with thick descending fibrous roots. The root of the plant yields 0.3 to 2.1% essential oil that gives a musky, woody, sweet and balsamic odor

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

Khurd Beeni (Microscopic):
Rhizome: Transverse section of rhizome shows cork, consisting of 4-14 layers of lignified cells occasionally containing oil globules; cortex parenchymatous containing numerous starch grains oil globules and yellowish-brown substance; outer 2 or three layers of cortex, collenchymatous occasional root traces appear as paler strands, endodermis single layered; pericycle, parenchymatous and within it 12-18 collateral vascular bundles, separated by dark medullary rays present; pith large, parenchymatous, lacunar, containing starch grains; starch occurs as single or occasional compound grains of two components, individual grains being 7-30 m mostly 10-25 m in diameter; calcium oxalate crystals absent.

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

Juz-e-Mustamil (Parts used) : Dried rhizome

Maskan (Habitat): Drug yielding plant is a hairy perennial herb growing in subtropical and temperate zone of north western Himalayas from Kashmir to Bhutan and Khasia Hill upto an altidute of 3,000 meter.

Jwoher'e Nabatati (Phytoconstituents): Isoaromadendrene epoxide, isocaryophyllene, epiglobulol, longifolene, panasinene, lognifolenaldehyde and butanoic acid and essential oil.

Mizaj (Temperament) : 2nd Degree Hot & Dry
Or, 3rd Degree Hot & Dry

Musleh (Correction) : Monakka(*Vitis Vinifera*), Rowghan-e-Badam.

Badal (Proximal substitute): Jatamansi (*Valeriana jatamanci)*, Agarkath(*Aquilaria malaccensis*), Khulanjan(*Alpinia galangal)* , Chandan Surkh(*Pterocarpus santalinus)*.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength) :
Foreign matter : Not more than 2 per cent, Appendix 2.2.2

Total ash	: Not more than 12 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 10 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 30 per cent, Appendix 2.2.6
Water- soluble extractive	: Not more than 19 per cent, Appendix 2.2.7

Aa'mal-e-Advia (Pharmacological action) : Mufatteh Sudad, Mohallil-e-Waram, Muqawwi-e-Dimagh, Muqawwi-e-Asab, Mudirr-e-Boul, Mudirr-e-Haiz

Mahall-e-Istemalat (Therapeutic uses) : Sara, Falij, Laqwa, Istirkha, Khadar, Nisyan, Yarqan-e-Suddi, Istisqa, Waram-e-Kabid, Salabat-e-Tehal, Waj-ul-Mafasil, Irqum-Nisa, Niqras, Waj-ul-Warik, Zof-e-Bah, Ehtebas-e-Baul, Ehtebas-e-Haiz.

Meqdar-e-khorak (Dose): 2-5 gm.

Muzir (Side-effects / adverse-effects): Headache, dizziness, stomach problems or sleeplessness may occur.

Aaham Nukhsajat (Important formulations): Sufoof-e-Qaranful.

TURANJ
(Pericarp)

The drug Turanj consists of dried pericarp of *Citrus medica* Linn. (Rutaceae). It is an evergreen bushy small shrub or tree found almost everywhere in the world.

Naam-e-Degar (Other names):

a) Botanical name:	*Citrus medica* Linn.
b) Family: As usual	Rutaceae
c) Bengali name:	Bara Numbu, Begpura, Bijaura, Honsanebu, Lebu, Bijapur, Bijapurana, DanturaChhada, Jantughna,
d) English name:	Citron

Tafseel (Description):

a) Aam (General): The Turanj tree is an evergreen shrub, 1.8 to 3.6 m high.It is a bushy small shrub of irregular habit of growth with twigs angled and purplish when young and cylindrical at maturity, glabrous, with stout, short, single spines in the axils of the leaves. The inflorescences are short. The fruits were large, oblong or oval, with acid or sweetish pulp Seed sweremonoembryonic in nature, numerous in numbers, small, pointed at the base, smooth with spheroid or ovoid shape; cotyledon white and reddish chalazal cap. All citrus species have dark green, waxy leaves with a characteristic citrus odour and sweet smelling flowers. Most species are easy to differentiate by their fruits. Flowers and leaves of Citrus are usually strong scented, the extracts of which contain many usefulflavonoids and other compounds that are effective insecticides, fungicides, and medicinal agents.

b) KlaaBeeni (Macroscopic): Pericarp bright yellow; pieces of about 7 cm long and about 5 cm in width; surface rugged with raised oil glands, clear to naked eye in sections, the inner surface bears a small amount of white 'zest': fracture is short and granular, fractured surface is yellowish white in colour; characteristic aromatic odour and slightly bitter taste.

c) KhurdBeeni (Microscopic): **Pericarp**: Transverse section of pericarp shows a thick cuticle and a layer of tangentially elongated cells of epicarp; mesocarp consisting of irregular loosely arranged parenchymatous cells containing crystals of calcium oxalate, masses of large oil glands, circular to oval in shape arranged in a row, numerous sclerified fibers and vascular elements.
Powder: Light pale yellow; shows thin walled irregular parenchyma cells, crystals of calcium oxalate 16 to 24 µ in diameter; fibers 180 to 250 µ in length and 45 to 70 µ wide and reticulate vessels.

Juz-e-Mustamil (Part used): The Pericarp, Fruit, Leave, Seeds, Juice and Oil of Turanj plant used as drugs.

Maskan (Habitat): Chittagong and other hilly areas.

Jwoher'e Nabatati (Phytoconstituents): Essential oils

Mizaj (Temperament): Cold 2°, Moist 2^0

Musleeh (Corrective): Shaheed

Badal (Proximal substitute): No proximal substitute is identified.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2%	Appendix 2.2.2
Total ash	Not more than 5 %	Appendix 2.2.3
Acid insoluble ash	Not more than 3%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 3%	Appendix 2.2.6
Water soluble extractive	Not less than 22%	Appendix 2.2.7

TLC (Thin-layer Chromatography) behavior of ethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Chloroform: Ethyl Acetate (4:1)	On spraying plate with 10% Ethanolic H_2SO_4 and heated for 10 minutes at 105^O C	8	0.11 0.17 0.24 0.29 0.43 0.54 0.76 0.83

Aa'maal-e-Adviya (Pharmacological action): Daf-e-Qai, Daf-e-Ghasyan, Qat-e-Safra

Mahall-e-Istemalat (Therapeutic use): Qai, Ghasyan, Humma-e-Safrawi, Ghasyan-e-Harkati

Meqdar-e-Khorak (Dose): 3-5 gm.

Muzir (Side-effects / adverse-effects: No significant side effects / adverse effects have been observed

Aaham Nukhsajat (Important formulations): AnushdaruLului, Jawarish Tamar Hindi, JawarishZarishk, KhamirahAbresham Hakim Arshad wala.

ZAQOOM
(Fresh latex)

Zaqoom latext consists of the fresh latex obtained by giving longitudinal incisions to the stem and branches of Zaqoom(Euphorbia royleana Bioss.)

Naam-e-Degar (Other names):

a) Botanical name:	*Euphorbia royleana* Bioss.
b) Family:	Euphorbiaceae
c) Bengali name:	Mansa Gachros, Manasasij, Coot Raj
d) English name:	Common milk hedge

Tafseel (Description):

a) Aam (General): Zaqoom is a large deciduous fleshy shrub like sprugeup to 1.5 m. girth and 6 m. in height with copious milky juice in all its parts. The plant is abundant between 600- 1800 m. above sea level in close association with the rocks and slopes.

Latex is a mixture of water soluble, alcohol soluble, and caoutchouc, a vegetable “gum”. It emits a sweet odour and flavours anything handled for days.

Fresh latex obtained by giving longitudinal incisions to the stem and branches of Zaqoom (Euphorbia royleana Bioss.).

b) KlaaBeeni (Macroscopic): Whitish, viscous liquid; coagulates on standing and when dried yields a pale brown coloured powder; fresh miscible in water; has a rich sweet odour and characteristic taste.

c) KhurdBeeni (Microscopic): Latex when mounted in water shows oval to elongated transparent bodies, some dumbbell shaped; occur singly or in cluster, size ranges from 3 to 56 micron in length and 2 to 25 micron in breadth, found scattered.

Juz-e-Mustamil (Part used): The Leaves, stem, latex of Zaqoom shrub are used as drugs purpose.

Maskan (Habitat): Indo-pak subcontinent at altitude of 3000 to 5000 feet.

Jwoher'e Nabatati (Phytoconstituents): Caoutchouc, Euphorbin and Calcium.

Mizaj (Temperament): Hot 3^{O} , Dry 3^{O}

Musleeh (Corrective): Sher-e-gao

Badal (Proximal substitute): No proximal substitute is identified.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2%	Appendix 2.2.2
Total ash	Not more than 2 %	Appendix 2.2.3
Acid insoluble ash	Not more than 1%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 13%	Appendix 2.2.6
Water soluble extractive	Not less than 9 %	Appendix 2.2.7
Moisture content	Not less than 71 %	Appendix 2.2.9

TLC (Thin-layer Chromatography) behaviorof ethanolicextract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Toluene : Ethyl Acetate Hexane (3 : 1 : 1)	On spraying plate with10% H_2SO_4 and heated for 30 minutes at 110^{O} C	6	0.14 0.30 0.37 0.48 0.61 0.67

Aa'maal-e-Adviya (Pharmacological action): Mohammir-e-Jild, Mohallil, Muqarreh, Munaffis-e-Balgham.

Mahall-e-Istemalat (Therapeutic use): Wajaul-Mafasil, Niqras, lrqun-Nisa,Falij, Laqwa, Soal-e-Muzmin, Zeeq-un-Nafas, Dard-e-Gosh, Atishak, Istisqa, Juzam

Meqdar-e-Khorak (Dose): 1/2 to 1 drop

Muzir (Side-effects / adverse-effects: No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosages.

Aaham Nukhsajat (Important formulations): Habb-e-Suranjan, Habb-e- Deedan, ItrifalHabbulQara

ZAQOOM
(Leaves)

The drug Zaqoom Leaves consist of the leaves of *Euphorbia royleana* Bioss. (Euphorbiaceae).

Naam-e-Degar (Other names):

a) Botanical name:	*Euphorbia royleana*Bioss.
b) Family:	Euphorbiaceae
c) Bengali name:	Mansa Gach, Manasasij, Coot Raj
d) English name:	Common milk hedge

Tafseel (Description):

Aam (General): It is a large deciduous fleshy shrub like sprugeup to 1.5 m. girth and *6* m. in height with copious milky juice in all its parts. The plant isabundant between 600- 1800 m. above sea level in close association with therocks and slopes.

KlaaBeeni (Macroscopic): Exstipulate, petiolate, petiole tough, greenish, more or less cylindrical, 1 to 1.5 cm long and 0.4 to 0.5 cm in diameter, extends as midrib in lamina, tapering, toward apex in a line; mid-rib greenish prominent, rather flat on the upper surface of lamina and ridge like on the lower surface. secondary veins alternate; leaf base tapered, lamina glabrous, greenish on upper surface and pale yellow on lower surface; about 25 to 30 cm in length, spathulate, spirally arranged on the fleshy axis: leaf margin reflux very slightly; apex acute.

KhurdBeeni (Microscopic):Petiole: Transverse section shows a more or less cylindrical outline; cuticle present; epidermal cells barrel shaped. single layered ; trichomes absent: multilayered cortex chlorenchymatous towards periphery and parenchymatous towards stele; cells compactly packed, oval; three closed vascular bundles triangularly arranged, with phloem outside and xylem divided into 5 or 6 radial groups of vessels.

Mid-rib: Transverse section more or less triangular in out-line; epidermis, single layered, cells barrel shaped, covered by thin cuticle; hypodermis of 5 or 6 layers, polygonal, chlorenchymatous; cortical cells parenchymatous, polygonal, compact, concave are like vascular cylinder centrally situated, vessels thick walled, spirally thickened, phloem cells also seen.

Lamina: Transverse section shows dorsiventral structure, cuticle present, single layered epidermis on both sides. trichomes absent, palisade cells one or at places in two layers, stomata absent on upper surface but present on lower epidermis; paracytic; mesophyll cells compactly arranged, 2 to 3 layer, polygonal cells of spongy parenchyma in the lower part, vascular cylinder ectophlolic, xylem with spirally thickened vessels, polygonal thick walled phloem cells present. Stomatal index 8.3 to 12.5, vein islet ratio 5 to 7; pallisade ratio 3 to 5.

Powder: Pale green in colour, characteristic odour and taste; under microscope shows remnants of thick walled xylem vessels with spiral thickenings; barrel shaped epidermal cells; thick walled cortical cells are also found.

Juz-e-Mustamil (Part used): The Leaves, stem, latexof Zaqoom shrub are used as drugs purpose.

Maskan (Habitat): Indo-pak subcontinent at altitude of 3000 to 5000 feet.

Jwoher'e Nabatati (Phytoconstituents): Phorbal ester, eupholtriterpene.

Mizaj (Temperament): Hot 3^{O} , Dry 3^{O}

Musleeh (Corrective): Sher-e-gao

Badal (Proximal substitute): No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosages.

Shinakht, Khalisyat wa Quwwat / Shinakht-e-Adviya (Identity, purity and strength):

Foreign matter	Not more than 2%	Appendix 2.2.2
Total ash	Not more than 16 %	Appendix 2.2.3
Acid insoluble ash	Not more than 2%	Appendix 2.2.4
Alcohol soluble extractive	Not less than 9%	Appendix 2.2.6
Water soluble extractive	Not less than 20%	Appendix 2.2.7

TLC (Thin-layer Chromatography) behaviorof ethanolic extract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Toluene : Ethyl Ethyl Acetate (9:1)	On exposure to Iodine vapours	5	0.38 0.54 0.64 0.88 0.94

Aa'maal-e-Adviya (Pharmacological action): Mohammir-e-Jild, Mohallil, Moqarreh, Munaffis-e-Balghum.

Mahall-e-Istemalat (Therapeutic use): Wajul-Mafasil, Niqras, IrqunNasa, Falij, Laqwa, Sual-e-Muzmin, Zeequn-Nafas, Dard-e-Gosh, Atishak, lstisqa, Juzam

Meqdar-e-Khorak (Dose): 1/2 to 1 drop.

Muzir (Side-effects / adverse-effects): No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosages.

Aaham Nukhsajat (Important formulations): Ayarij-e-Logha.

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APPENDIX – 1

APPARATUS FOR TESTS AND ASSAYS

1.1.1 Nessler Cylinders

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

1.1.2 Sieves

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

Sieves conform to the following specifications.:

Approximate sieve number*	Nominal mesh aperture size in mm	Tolerance average aperture size +mm
4	4.0	0.13
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)**
120	180	11(7.6)
100	150	9.4(6.6)
85	125	8.1(5.8)
150	106	7.4(5.2)
170	90	6.6(4.6)
200	75	6.1(4.1)
240	63	5.3(3.7)
300	53	4.8(3.4)
350	45	4.8(3.1)

*Sieve is the number of meshes in a length of 2.54 cm. in each transverse direction parallel to the wires.

**Figures in brackets refer to close tolerances, those without brackets relate to full tolerances.

1.1.3 Thermometers

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

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

1.1.4 Volumetric Glasswares

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

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

Volumetric Flask : I.S. 915-1975

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

One Mark Pipettes : I.S. 1117-1975

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

Graduated Pipettes : I.S. 4162-1967

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

Burettes : I.S. 1997-1967

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

1.1.5 Weights and Balances

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

APPENDIX - 2

TESTING OF DRUGS

2.1. Systematic study of Crude Drugs

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

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

studies of diagnostic elements are helpful especially when the drugs are in powdered condition and give clue in the identification of drugs. Linear measurements and other methods of quantitative microscopy give further aid in the identification of the drugs. The sections or the powdered drug samples are cleared by clearing agents mostly by chloral-hydrate solution, before mounting on the slide.

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

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

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

2.1.1 Microscopical Methods of Examining Crude Vegetable Drugs

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

I. Leaves, Herbs and Flowers

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

a) Entire and cut materials

(i) **Entire materials** - When examining entire leaves, herbs and flowers, take pieces of leaf (margin and vein of leaves only), herbs (only leaf) and flowers (only calyx and corolla) in a test tube. Add a solution of caustic alkali or nitric acid to the test tube and boil for 1-2 minutes, pour the contents into a porcelain dish, drain off the liquid, wash the material

with water and leave for sometimes. Remove the pieces of the material from the water with a spatula and put on the slide, add a few drops of the solution of *glycerol and chloral hydrate.*
Crush the material with scalpel and cover with cover slip before examining.

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

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

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

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

b) Powder

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

II. Fruits and Seeds

a) Entire materials

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

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

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

b) Powder

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

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

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

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

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

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

III. Barks

a. Entire material

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

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

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

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

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

b. Cut materials

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

c. Powder

Prepare specimen for examination by placing a little amount of powder on a slide, add 1-2 drops of *phlorogucinol* and a drop of *concentrated hydrochloric acid*, cover it with a cover slip, draw off the liquid from one side of the slide with filter paper, and then apply 1-2 drops of *chloral-hydrate solution* from the other side of the slide, lignified elements are stained

crimson-red. Specimen may also be prepared with *caustic alkali* or *ferric ammonium sulphate* for this purpose.

IV. Roots and Rhizomes

a. Entire materials

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

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

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

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

4. **Fixed Oil -** For fixed oil detection use Sudan III, as mentioned above for fruits and seeds.

   If required for tannin, anthraquinone derivatives, test as mentioned above.

b. Cut material

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

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

C. Powder

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

2.1.2 Types of Stomata

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

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

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

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

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

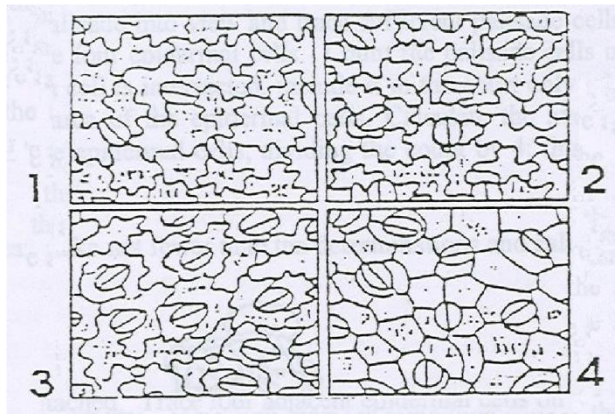

Fig. 1. Various types of stomata

2.1.3 Determination of Stomatal Index

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

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

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

Where S = the number of stomata in a given area of leaf; and

E = the number of epidermal cells (including trichomes) in the same area of leaf.

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

2.1.4 Determination of Palisade Ratio

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

number of palisade cells beneath one epidermal cells, dividing the count by 4; this is the "Palisade ratio" (See figure 2).

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

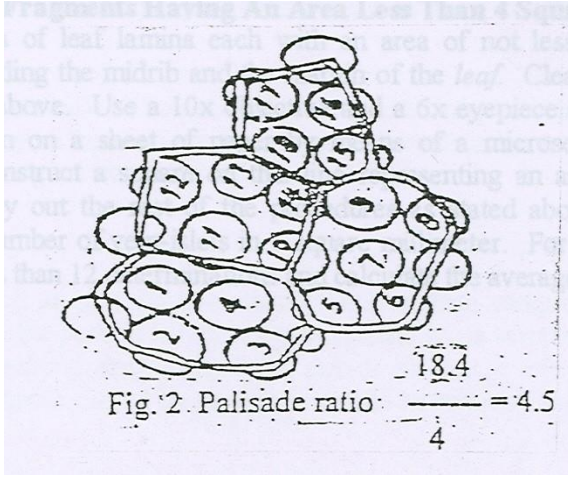

Figure 2

2.1.5 Determination of vein-Islet Number

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

For Whole or Cut leaves - Take pieces of leaf lamina with an area of not less than 4 square millimeters from the central portion of the Lamina and excluding the midrib and the margin of the leaf. Clear the pieces of lamina by heating in a test tube containing *Chloral hydrate solution* on a boiling water-bath for 30 to 60 minutes or until clear and prepare a mount in *glycerol-solution* or, if desired, stain with *safranin solution* and prepare the mount in

Canada Balsam. Place the stage micrometer on the microscope stage and examine with 4x objective and a 6x eyepiece. Draw a line representing 2 mm on a sheet of paper by means of a microscopical drawing apparatus and construct a square on the line representing an area of 4 square millimeters. Move the paper so that the square is seen in the centre of the field of the eyepiece. Place the slide with the cleared leaf piece on the microscope stage and draw in the veins and vainlets included within the square, completing the outlines of those vein-islets which overlap two adjacent sides of the square. Count the number of vein-islets within the square including those overlapping on two adjacent sides and excluding those intersected by the other two sides. The result obtained is the number of vein-islets in 4 square millimeters. For each sample of leaf make not fewer than three determinations and calculate the average number of vein-islets per square millimeter.

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

2.2 Determination of Quantitative Data of Vegetable Drugs

2.2.1 Sampling of Vegetable Drugs

Original Samples:

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

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

When the total weight of the drug to be sampled is more than 100 kg, several samples are taken in the manner described, mixed and quartered, two of the diagonal quarters being rejected, and the remaining two quarters being combined and carefully mixed, and again

subjected to quartering process in the same manner until each of the quarters weigh at least 125g; two such quarters then constitute an original sample.

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

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

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

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

Test Sample

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

2.2.2 Foreign Matter and Determination of Foreign Matter

A. Foreign Matter

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

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

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

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

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

B. Determination of Foreign Matter

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

2.2.3 Determination of Total Ash

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

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

2.2.4 Determination of Acid-insoluble Ash

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

2.2.5 Determination of Water-soluble Ash

Boil the ash for 5 minutes with 25 ml of water; collect insoluble matter in a Gooch crucible, or on an ashless filter paper, wash with hot water, and ignite for 15 minutes at a temprature not exceeding 450°C. Subtract the weight of the insoluble matter from the weight of the

ash; the difference in weight represents the water-soluble ash. Calculate the percentage of water-soluble ash with reference to the air-dried drug.

2.2.6 Determination of Alcohol-soluble extractive

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

2.2.7 Determination of Water-soluble extractive

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

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

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

2.2.9 Determination of Moisture Content (Loss on drying)

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

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

Seeds and fruits smaller than 3 mm should be cracked. Avoid the use of high speed mills in preparing the samples, and exercise care that no appreciable amount of moisture is lost during preparation and that the portion taken is representative of the official sample. After placing the above said amount of the drug in the tared evaporating dish dry at 105°C for 5 hours, and weigh. Continue the drying and weighing at one hour interval until difference

between two successive weighings corresponds to not more than 0.25 per cent. Constant weight is reached when two consecutive weighting after drying for 30 minutes and cooling for 30 minutes in an desccator, show not more than 0.01g difference.

2.2.10 Thin Layer Chromatography

Preparation of chromatoplates

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

Method

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

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

2.2.11 Determination of Sulphated Ash

Heat a silica or platinum crucible to redness for 10 minutes, allow to cool in a desiccator and weigh. Put 1 to 2 g of the substance, accurately weighed, into the crucible, ignite gently at

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

2.2.12 Determination of Phenolics

Dissolve 5 gm of drug in water and filter. The filtrate is shaken with petroleum ether to remove greasy matter. It is precipitated with a saturated solution of lead acetate, digest for few minutes on water bath let the ppt. settle and filter. Dry the residue, then suspend it in alcohol and slightly warm on water bath and decompose by passing H2S. The clear alcoholic solution is concentrated under reduced pressure. It is subjected to vacuum distillation 3 times, after adding fresh quantity of alcohol each time, to get rid of all the H2S gas. The residue is transferred to a weighed petridish with alcohol and excess of alcohol evaporated on waterbath. The residue is dried at 105^0C till constant weight.

2.2.13 Determination of Volatile Oil

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

The apparatus consists of the following parts. The apparatus described below is recommended but any similar apparatus may be used provided that it permits complete distillation of the volatile oil. All glass parts of the apparatus should be made of good quality resistance glass.

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

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

Tube AC, length – 220 to 240 mm.

Internal diameter – 13 to 15 mm.

Bulb CD, length – 100 to 110 mm.

Internal diameter – 13 to 15 mm.

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

Tube EG, length – 80 to 90 mm.

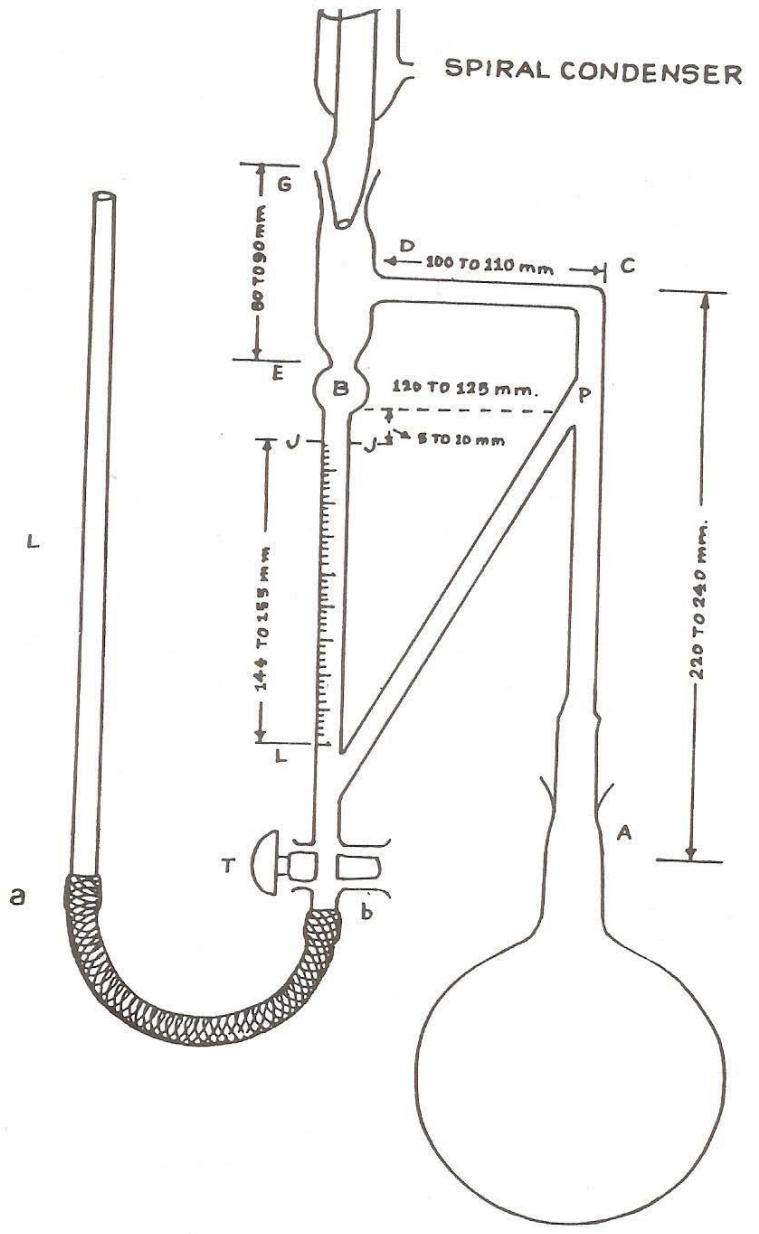

Fig. Apparatus for volatile oil determination

Internal diameter – 15 to 20 mm
The distance between B and P is 120 to 125 mm.

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

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

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

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

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

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

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

The Whole of the apparatus is effectively screened from draught.

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

Method of determination

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

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

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

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

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

2.2.14 Estimation of Starch

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

2.3 Limit Tests

2.3.1 Limit Test for Arsenic

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

Apparatus

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

liquid, and the hole in the side is below the bottom of the bung. The upper end of the tube is cut off square and is either slightly rounded or ground smooth.

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

Reagents

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

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

Arsenic solution, dilute, AsT:

Strong arsenic solution AsT	1 ml
Water sufficient to produce	100 ml

Dilute arsenic solution AsT must be freshly prepared

1 ml contains 0.01 mg of arsenic, As

Arsenic Solution, strong, AsT:

Arsenic trioxide	0.132g
Hydrochloric acid	50 ml
Water sufficient to produce	100 ml

Brominated hydrochloric acid AsT:

Bromine solution AsT	1 ml
Hydrochloric acid AsT	100 ml

Bromine solution AsT:

Bromine	30 g

Potassium bromide	30 g
Water Sufficient to produce	100 ml

It complies with the following test:

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

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

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

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

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

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

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

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

Heat 20 ml in a porcelain dish with 2 ml of sulphuric acid AsT until white fumes are given off. Cool, add 2 ml of water, and again heat until white fumes are given off; cool, add 50 ml

of water, and 10 ml of stannated hydrochloric acid AsT, and apply the General test; no visible stain is produced.

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

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

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

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

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

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

Stannated hydrochloric acid AsT:

Stannous chloride solution AsT	1 ml
Hydrochloric Acid AsT	100 ml

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

It complies with the following test:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Phosphoric acid:

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

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

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

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

2.3.2 Limit Test for Chlorides

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

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

2.3.3 Limit Test for Heavy Metals

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

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

Special Reagents -

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

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

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

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

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

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

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

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

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

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

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

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

Method A

Standard Solution : In a 50 ml *Nessler cylinder,* pipette 2 ml of *standard lead solution* and dilute with *water* to 25 ml. Adjust with *dilute acetic acid Sp.* Or *dilute ammonia solution Sp.* To a pH between 3 and 4, dilute with water to about 35 ml., and mix.
Test Solution : In a 50 ml *Nessler cylinder,* place 25 ml of the solution prepared for the test as directed in the individual monograph; or using the stated volume of acid when specified in the individual monograph, dissolve and dilute with *water* to 25 l the specified quantity of the substance being tested. Adjust with *dilute acetic acid Sp.* Or *dilute ammonia solution Sp.* To a pH between 3 and 4 *dilute with water* to about 35 ml and mix.

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

Method B

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

filtrate and washings in a 50 ml *Nessler Cylinder.,* dilute with water, to about 35 ml, and mix. Procedure : Proceed as directed under Method A.

Method C

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

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

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

2.3.4 Limit Test for Iron

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

Method

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

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

2.3.5 Limit Test for Lead

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

Special Reagents -

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

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

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

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

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

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

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

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

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

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

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

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

Method

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

2.3.6 Limit Test for Sulphates

Reagents -

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

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

Method

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

APPENDIX - 3

3.1 PHYSICAL TESTS AND DETERMINATIONS

3.1.1 Determination of Boiling or Distilling Range

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

Apparatus -

Use an apparatus consisting of the following:

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

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

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

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

Method

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

Assemble the apparatus, and place in the flask 100 ml of the liquid under examination, taking care not to allow any of the liquid to enter the side-arm. Insert the thermometer and seal the entire heating and flask assembly from external air currents. Add a few pieces of porous material and heat rapidly to boiling using a Bunsen burner an asbestos plate pierced by a hole 33 mm in diameter. Record the temperature at :h the first drop of distillate faJls into the cylinder, and adjust the rate of heating to in a regular distillation rate of 4 to 5 ml per minute. Record the temperature when the drop of liquid evaporates from the bottom of the flask or when the specified entage has distilled over. Correct the observed temperature readings for any variation le barometric pressure from the normal (760 torr) using the following expression:

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

where

t_4 = the corrected temperature

t_2 = the observed temperature a = 760 (torr)

b = the Barometric pressure in torr at the time of determination

k = the correction factor indicated in the following table

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

3.1.2 Determination of congealing range of temperature

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

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

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

Apparatus –

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

Method

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

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

3.1.3 Determination of pH Values

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

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

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

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

TABLE 1 - pH of Reference Solutions at various Temperatures.

Temperature	Buffer Solutions							
T^O	A	B	C	D	E	F	G	H
15	1.67	-	3.80	4.00	6.90	7.45	9.28	10.12
20	1.68	-	3.79	4.00	6.88	7.43	9.22	10.03
25	1.68	3.56	3.78	4.01	6.86	7.41	9.18	10.01
30	1.68	3.55	3.77	4.02	6.85	7.40	9.14	9.97
35	1.69 + 0.001	3.55 -0.001	3.76 -0.002	4.02 +0.001	6.84 -0.003	7.39 +0.003	9.10 -0.008	9.98 -0.00

$\Delta pH/\Delta t$

Reference buffer solutions

The following reference buffer solutions must be prepared using *carbon dioxide free water;* phthalate and phosphate salts should be dried at 110°C for two hours before use. Buffer solutions should be stored in bottles made of alkali-free glass, and must not be used later than three months after preparation.

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

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

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

NOTE - This solution must be freshly prepared.

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

5. **Buffer solution E :** Dissolve 3.40 g of *potassium dihydrogenphosphate* and 3.55 g of *anhydrous disodium hydrogen phosphate*, both previously dried at 110°C to 1300 for two hours, in sufficient *carbon dioxide-free water* to produce 1000 ml.
6. **Buffer solution F :** Dissolve 1.184 g of *potassium dihydrogen phosphate* and 4.303 g of *anhydrous disodium hydrogen phosphate*, both previously dried at 1100 to 130°C for two hours in sufficient *carbon dioxide-free water* to produce 1000 ml.

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

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

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8. **Buffer solution H :** Dissolve 7.155 g of *sodium carbonate* and 2.10 g of *sodium bicarbonate* in sufficient *carbon dioxide-free water* to produce 1000 ml.

Method

Immerse the electrodes in the solution to be examined and measure the pH at the same temperature as for the standard solutions. At the end of a set of measurements, take a reading of the solution used to standardise the meter and electrodes. If the difference between this reading and the original value is greater than 0.05, the set of measurements must be repeated.

When measuring pH values above 10.0 ensure that the glass electrode is suitable for use under alkaline conditions. and apply any correction that is necessary.

All solutions of substances being examined must be prepared using *carbon dioxide free water*.

3.1.4 Determination of melting range of temperature

In this Pharmacopoeia, melting range or temperature of a substance is defined as those points of temperature within which, or the point at which, the substance begins to coalesce and is completely melted except as defined otherwise for certain substance. The following procedures are suitable for the various substances described in the Pharmacopoeia. Any other apparatus or method capable of the same accuracy may also be used. The accuracy should be checked frequently by the use of one of the following reference substances, that melts nearest to the melting range of the substance to be tested:

Melting range	
Venillin	81^0-83^0C
Acetanilide	114^0-116^0C
Phenacetin	134^0-136^0C
Sulphapyridine	164.5^0-166.5^0C
Sulphapyridine	191^0-193^0 C
Caffeine (dried at 100^0)	234^0-237^0 C

Unless otherwise specified in the individual monograph, Method I should be used.

Method I

Apparatus :

(a) A glass heating vessel of suitable construction and capacity containing one of the following or any other suitable bath liquid, to a height of not less than 14 cm.

(i) Water for temperatures upto 60°C
(ii) Glycerin for temperatures upto 150°C
(iii) Liquid paraffin for sufficiently high boiling range for temperatures upto 250°C (iv) Sesame oil or a suitable grade of liquid silicone for temperatures upto 300°C

(b) A suitable stirring device, capable of rapidly mixing the liquids.

(c) An accurately standardised thermometer suitable for the substance under examination (see Appendix 1.1.3). The thermometer must be positioned in the bath liquid to its specified immersion depth and yet leave the bulb at about 2 cm above the bottom of the bath.

(d) Thin-walled capillary glass tubes of hard glass, about 12 cm long, with a well thickness of 0.2 to O.3mm and an internal diameter of 0.8 to 1.1 mm. The tubes should preferably be kept sealed at both ends and cut as required.

(e) Source of heat (open flame or electric heater).

Procedure: Reduce the substance to a very fine powder and unless otherwise directed, dry it at a temperature considerably below its melting temperature or under pressure over a suitable desiccant for not less than. 16 hours. Introduce into a capillary glass tube, one end of which is sealed, a sufficient quantity of the dry powder to form a compact column about 3 mm high.

Heat the bath until the temperature is about 10°C below the expected melting point. Remove the thermometer and quickly attach the capillary tube to the thermometer by wetting both with a drop of the liquid of the bath or otherwise and adjust its height so that the closed end of the capillary is near the middle of the thermometer bulb. Replace the thermometer and continue the heating, with constant stirring, sufficiently to cause the temperature to rise at a rate of about 3°C per minute. When the temperature is about 3°C below the lower limit of the expected melting range, reduce the heating so that the temperature rises at a rate of about 1° to 2°C per minute. Continue the heating and note the temperature at which the column of the sample collapses definitely against the side of the tube at any point, when melting may be considered to have begun and note also the temperature at which the sample becomes

liquid throughout as seen by the formation of a definite meniscus. The two temperatures fall within the limits of the melting range.

Method II

Apparatus: Use the apparatus described under Method I except that the glass capillary tube is open at both ends and has an internal diameter of 1.1 to 1.3 mm an external diameter of 1.4 to 1.3 mm and length of 50 to 60 mm.

Procedure: Rapidly melt the material to be tested, at a temperature not more than 10°C above the point of complete fusion. Draw it into a capillary tube to a depth of about 10 mm. Cool the charged tube at 10°C, or lower, for 24 hours, or in contact with ice for at least 2 hours. Attach the tube to the thermometer and adjust it so that the column of substance is in level with the thermometer bulb; suspend the thermometer in the heating vessel containing water at 15°C so that the lower end of the column of the substance is 30 mm below the surface of the water and heat the water with constant stirring so that the temperature rises at the rate of 1°C per minute the temperature at which the partly melted substance is observed to rise in the capillary tube is the melting temperature.

Method III

Apparatus:

(a) A glass boiling-tube, overall length, 110mm, internal diameter, 25 mm thermometer and with a grove cut in the side.

(b) A cork about 25 mm long to fit into the boiling-tube, bored with a central hole to fit the standard thermometer and with a grove cut in the side.

(c) A glass beaker, of such a size that when the apparatus is assembled, the boiling tube can be immersed vertically to two-thirds of its length in the water in the beaker with its lower end about 2.5 cm above the bottom of the beaker.

(d) A stirrer or any of the device which will ensure uniformity of the temperature throughout the water in the beaker.

(e) An accurately standardised thermometer suitable for the substances under examination (see Appendix 1.1.3).

(f) Suitable means of heating the water in the beaker.

Procedure: Melt a quantity of the substance slowly, while stirring, until it reaches a temperature of about 90°C. Cool and allow the temperature of the molten substance to drop

to a temperature of 8° to 10°C above the expected melting point. Chill the bulb of the thermometer to 5°C, wipe it dry and while it is still cold, dip it in the molten substance so that the lower half of the bulb is submerged. Withdraw it immediately, and hold it vertically away from the heat until the wax surface dulls, then dip it for five minutes into a water-bath at a temperature not higher than 15°C,

Fit the thermometer through the bored cork into the boiling tube so that the lower part is 15 mm above the bottom of the tube. Suspend the tube in the beaker filled with water adjusted to about 15°C and raise the temperature of the bath at rate of 2°C per minute to 30°C, then adjust the rate to 1°C per minute and not the temperatures at which the first drop of melted substances leaves the thermometer. Repeat the determination twice on a freshly melted portion of the substance. If the three readings differ by less than 1°C, take the average of the three as the melting point. If they differ by more than 1°C, make two additional determinations and take the average of the five readings.

3.1.5 Optical rotation and specific optical rotation

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

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

The *optical rotation,* unless otherwise specified, is measured at the wavelength of the D line of sodium (λ =589.3 μm) at 25°C, on a layer dim thick. It is expressed in degrees.

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

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

the substance per ml. The specific optical rotation of a solid is always expressed with reference to a given solvent.

Apparatus

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

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

(a) The instrument must be in a good condition. Optical elements must be very clean and in exact alignment. The match point should be close to .the normal zero mark.
(b) The light source must be properly aligned with respect to the optical bench. It should be supplemented by a filtering system capable of isolating the D line from sodium light.
(c) Specific attention should be paid to temperature control of the solution and of the polarimeter.
(d) Differences between the initial readings or between observed and corrected optical rotation calculated as either specific optical or optical rotation should not be more than one fourth of the range specified in the monograph for the substance.
(e) Polarimeter tubes should be filled in such a way as to avoid air bubbles. Particular care is necessary for semi-micro or micro tubes.
(f) For tubes with removable end-plates fitted with gaskets and caps, tighten the end plates only enough to ensure a leak-proof seal between the end-plate and the body of the tube.
(g) For substances with low rotatory power, the end plates should be loosened and tightened again after each reading, in the measurement of both the rotation and the zero point.
(h) Liquids arid solutions of solids must be clear.

Calibration: The apparatus may be checked by using a solution of previously dried sucrose and measuring the optical rotation in a 2 dm tube at 25^0 and using the concentrations indicated below :

Concentration (g/100 ml)	Angle of Rotation (+) at 25^0
10.0	13.33
20.0	26.61
30.0	39.86
40.0	53.06
50.0	66.23

Method

For solids : Weigh accurately a suitable quantity of the substance being examined to give a solution of the strength specified in the monograph, and transfer to a volumetric flask by means of *water* or other solvent if specified. If a solvent is used, reserve a portion of it for the blank determination. Unless otherwise specified, adjust the contents of the flask to 25° by suspending the flask in a constant-temperature bath. Make up to volume with the solvent at 25°C and mix well. Transfer the solution to the polarimeter tube within 30 minutes from the time of the substances was dissolved and during this time interval maintain the solution at 25°C.

Determine the zero point of the polarimeter and then make five readings of the observed rotation of the test solution at 25°C. Take an equal number of readings in the same tube with the solvent in place of the test solution. The zero correction is the average of the blank readings, and is subtracted from the average observed rotation if the two figures are of the same sign or added if they are opposite in sign, to give the corrected observed rotation.

For liquids: Unless otherwise specified, adjust the temperature of the substance being examined to 25°C transfer to a polarimeter tube and proceed as described. For solids, beginning at the words "Determine the zero point…….. ".

Calculation - Calculate the specific optical rotation using the following formula, dextro-rotation and laevo-rotation being designated by (+) and (-) respectively :

$$\text{For liquid } (\propto)^{D25} = \frac{\propto}{id}$$

$$\text{For solid } (\propto)^{D25} = \frac{100 \propto}{lc}$$

Where

a = corrected observed rotation, in degrees, at 25°C

D = D line of sodium light (λ=589.3 mm) l = length of the polarimeter tub in dm.

d25/25 specific gravity of the liquid or solution at 25°C c = concentration of the substance in per. cent w/v

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Note: THE REQUIREMENTS FOR OPTICAL ROTATION AND SPECIFIC OPTICAL ROTATION IN THE PHARMACOPOEIA APPLY TO THE DRIED, ANHYDROUS OR SOL VENT FREE MATERIAL.

3.1.6 Powder fineness

The degree of coarseness or fineness of a powder is expressed by reference to the nominal mesh aperture size of the sieves for measuring the size of the powders. For practical reasons, the use of sieves, Appendix 1.1.2 for measuring powder fineness for most pharmaceutical purposes, is convenient but device other than sieves must be employed for the measurement of particles less than 100 mm in nominal size.

The following terms are used in the description of powders:

Coarse powder : A powder, all the particles of which pass through a sieve with a nominal mesh aperture of 1.70 mm and not more than 40 per cent through a sieve with a nominal mesh aperture of 355 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 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 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 1.1.2

Method

(1) For coarse and moderately coarse powders: Place 25 to 100 g of the powder being examined upon the appropriate sieve having a close fitting receiving pan and cover. Shake the sieve in a rotary horizontal direction and vertically by tapping on a hard surface for not less than twenty minutes or until shifting is practically complete. Weigh accurately the amount remaining on the sieve and in the receiving pan.

(2) For fine and very fine powder : Proceed as described under coarse and moderately coarse powders, except that the test sample should not exceed 25 g and except that the sieve is to be shaken for not less than thirty minutes, or until shifting is practically complete.

With oily or other powders which tend to clog the openings, carefully brush the screen at interval during siftings. Break up any lumps that may form. A mechanical sieve shaker which reproduces the circular and tapping motion given to sieves in hand sifting but has a uniform mechanical action may be employed

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

3.1.7 Refractive Index

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

Unless otherwise prescribed, the refractive index is measured at 25° (± 0.5) with reference to the wavelength of the $_D$ line of sodium (λ. = 589.3 mm). The temperature should be carefully adjusted and maintained since the refractive index varies significantly with temperature.

The Abbe refractometer is convenient for most measurements of refractive index but other refractometer of equal or greater accuracy may be used. Commercial refractometers are normally constructed for use with white light but are calibrated to give the refractive index in terms of the $_D$ line of sodium light.

To achieve accuracy, the apparatus should be calibrated against *distilled water:* which has a refractive index of 1.3325 at 25°C or against the reference liquids given in the following Table:

TABLE

Reference Liquid	n_D^{200} Temperature Co-efficient	<n/<t
Carbon tetrachloride	1.4603	-0.00057
Toluene	1.4969	-0.00056
a-Methylnaphthalene	1.6176	-0.00048

References index value for the $_D$ line of sodium measured at 20^0

The cleanliness of the instrument should be checked frequently by determining the refractive index of distilled water which at 25°C is 1.3325.

3.1.8 Weight Per Milliliter and Specific Gravity

Weight Per Milliliter - The weight per milliliter of a liquid is the weight in g of ml of liquid when weighed in air at 25°C, unless otherwise specified.

Method - Select a thoroughly clean and dry pycnometer. Calibrated the pyconometer by filling it with recently boiled and cooled *water* at 25°C and weighing the contents. Assuming that the weight of 1 ml of *water* at 25°C when weighed in air of density 0.0012 g per ml , is 0.99602 g calculate the capacity of the pycnometer. (Ordinary deviations in the density of air from the value given do not affect the result of a determination significantly). Adjust the temperature of the substance to be examined, to about 20°C and fill the pycnometer with it. Adjust the temperature of the filled pycnometer to 25°C, remove any excess of the substance and weigh. Substract the tare weight of the pycnometer from the filled weight of the pycnometer. Determine the weight per milliliter dividing the weight in air, expressed in g, of the quantity of liquid which fills the pycnometer at the specified temperature, by the capacity expressed in ml, of the pycnometer at the same temperature.

Specific Gravity - The specific gravity of a liquid is the weight of a given volume of the liquid at 25°C (unless otherwise specified) compared with the weight of an equal volume of *water* at the same temperature, all weighing being taken in air.

Method - Proceed as. described under Wt. per ml. - Obtain the specific gravity of the liquid by dividing the weight of the liquid contained in the pycnometer by the weight of *Water* contained, both determined at 25°C unless otherwise directed in the individual monograph.

APPENDIX - 4

4.1 REAGENTS AND SOLUTIONS

Acetic Acid - Contains approximately 33 per cent w/v of $C_2H_4O_2$ Dilute 315 ml of *glacial acetic acid* to 1000 ml with *water*.

Acetic Acid, xN - Solutions of any normality xN may be prepared by diluting 60 x ml of *glacial acetic acid* to 1000 ml *water.*

Acetic Acid, Dilute - Contains approximately 6 per cent w/w of $C_2H_4O_2$. Dilute 57 ml of *glacial acetic acid* to 1000 ml with water.

Acetic Acid Glacial - CH_3 COOH=60.05.

Contains not less than 99.0 per cent w/w of $C_2H_2O_2$. About 17.5 N in strength.

Descriptions - At a temperature above its freezing point a clear colourless liquid, odour, pungent and charactrtistic; crystallises when cooled to about 10 and does not completely re melt until warmed to about 15°C.

Solubility - Miscible with water, with alcohol, with glycerin and with most fixed and volatile oils.

Boiling Range - Between 117°C and 119°C , Appendix 3.1.1

Congealing Temperature - Not lower than 14.8°C, Appendix 3.1.2

Wt. per ml - At 25 about 1.047g. Appendix 3.1.8

Heavy Metals - Evaporate 5 ml to dryness in a porcelain dish on water-bath, warm the residue with 2 ml of 0.1 N hydrochloric acid and add water to make 25°C ml; the limit of heavy metals is 10 parts per million, Appendix 2.3.3

Chloride - 5 ml complies with the limit test for chlorides, Appendix 2.3.2.

Sulphate - 5 ml complies with the limit test for sulphates, Appendix 2.3.6

Certain Aldehydic Substances - To 5 ml add 10 ml of mercuric chloride solution, and make alkaline with sodium hydroxide solution, allow to stand for five minutes and acidify with dilute sulphuric acid the solution does not show more than a faint turbidity.

Formic Acid And Oxidisable Impurities - Dilute 5 ml with 10 ml of water, to 5 ml of this solution add 2 ml of 0.1 N potassium dichromate and 6 ml of sulphuric acid, and allow to stand for one minute, add 25 ml of water, cool to 15°C and add 1 ml of freshly prepared potassium iodine solution and titrate the liberated iodine with 0.1 N sodium thiosulphate, using starch solution as indicator. Not less than 1 ml of 0.1 N sodium thiosulphate is required.

Odorous Impurities - Neutralise 1.5 ml with sodium hydroxide solution; the solution has no odour other than a faint acetous odour.

Readily Oxidasable Impurities - To 5 ml of the solution prepared for the test for Formic Acid and Oxidisable Impurities, add 20 ml of water and 0.5 ml of 0.1 N potassium permaganate; the pink colour does not entirely disappear within half a minute.

Non-Volatile Mater - Leaves not more than 0.01 per cent w/w of residue when evaporated to dryness and dried to constant weight at 105°C.

Assay - Weigh accurately about 1 g into a stoppered flask containing 50 ml of water and titrate with *N sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *sodium hydroxide* is equivalent to 0.06005 g of $C_2H_4O_2$.

Acetic acid, lead free - Acetic acid which complies with following additional test, boil 15 ml until the volume is reduced to about 15 ml, cool, make alkaline with lead-free ammonia solution, add 1 ml of lead free *potassium cyanide solution*, dilute to 50 ml with water, add 2 drops of *sodium sulphide solution*; no darkening is produced.

Acetone - Propan - 2 one; $(CH_3)_2$ CO=58.08.

Description - Clear, colourless, mobile and volatile liquid; taste, pungent and sweetish, odour characteristic; flammable.

Solubility - Miscible with water, with alcohol, with solvent ether, and with chloroform, forming clear solutions.

Distillation Range- Not less than 96 per cent distils between 55.5°C and 57°C, Appendix 3.1.1

Acidity - 10 ml diluted with 10 ml of freshly boiled and cooled water; does not require for neutralisation more than 0.2ml of 0.1 N sodium hydroxide, using phenolphathalein solution as indicator.

Alkalinity - 10 ml diluted with 10 ml of freshly boiled and cooled water, is not alkaline to litmus solution.

Methyl Alcohol- Dilute 10ml with water to 100ml to 1 ml of the solution add 1 ml of water and 2ml of potassium permaganate and phosphoric acid solution. Allow to stand for ten minutes and add 2ml of oxalic acid and sulphuric acid solution; to the colourless solution add 5 ml of decolorised magenta solution and set aside for thirty minutes between 15°C and 30°C no colour is produced.

Oxidisable Substances - To 20 ml add 0.1 ml of 0.1 N potassium permanganate, and allow to stand for fifteen minutes; the solution is not completely decolorised.

Water - Shake 10 ml with 40 ml of carbon disulphide; a clear solution is produced.

Non-Volatile Matter - When evaporated on a water-bath add dried to constant weight at 105°C, leaves not more than 0.01 per cent w/v of residue.

Acetone Solution, Standard - A 0.05 per cent v/v solution of acetone in water.

Alcohol-

Description - Clear, colourless, mobile, volatile liquid, odour, characteristic and spirituous; taste, burining readily volatilised even at low temperature, and boils at abut 78°C, flammable. Alcohol containing not less than 94.85 per cent v/v and not more than 95.2 per cent v/v of C_2H_5OH at 15.56.

Solubility - Miscible in all proportions with water, with chloroform and with solvent ether.
Acidity or Alkalinity - To 20ml add five drops of phenolphithalein solution; the solution remains colourless and requires not more than 2 ml of 0.1 N sodium hydroxide to produce a pink colour.

Specific Gravity - Between 0.8084 and 0.8104 at 25°C ; Appendix 3.1.8

Clarity of Solution - Dilute 5 ml to 100 ml with water in glass cylinder, the solution remains clear when examined against a black background. Cool to 10°C for thirty minutes; the solution remains clear.

Methanol - To one drop add one drop of *water*, one drop of *dilute phosphoric acid*, and one drop of *potassium permanganate solution.* Mix, allow to stand for one minute and add *sodium bisulphite solution* dropwise, until the permaganate colour is discharged. If a brown colour remains, add one drop of *dilute phosphoric acid* to the colourless solution add 5 ml of freshly prepared *chromotropic acid solution* and heat on a water-bath at 60°C for ten minutes; no violet colour is produced.

Foreign Organic Substances - Clean a glass-stoppered cylinder thoroughly with *hydrochloric acid,* rinse with *water* and finally rinse with the alcohol under examination. Put 20 ml in the cylinder, cool to about 15°C and then add from a carefully cleaned pipette 0.1 ml of 0.1 *N Potassium permaganate*. Mix at once by inverting the stoppered cylinder and allow ato stnd at 15°C for five minutes; the pink colour does not entirely disappear.

Isopropyl Alcohol and T-Butyl Alcohol - To 1 ml add 2 ml of water and 10 ml of *mercuric sulphate solution* and heat in a boiling water-bath; no precipitate is formed within three minutes.

Aldehydes and Ketones - Heat 100 ml of *hydroxyl amine hydrochloride solution* in a loosely stoppered flask on a water-bath for thirty minutes, cool, and if necessary, add sufficient 0.05 *N sodium hydroxide* to stored the green colour. To 50 ml of this solution add 25ml of the *alcohol* and heat on a water bath for ten minutes in a loosely stoppered flask. Cool, transfer to a Nessler cylinder, and titrate with 0.05 *N sodium hydroxide* unitl the colour matches that of the remainder of the *hydroxylamine hydrochloride solution* contained in a similar cylinder, both solutions being viewed down the axis of the cylinder. Not more than 0.9 ml of 0.05 *N sodium hydroxide* is required.

Fuse Oil Constituents - Mix 10 ml of *water* and 1 ml of *glycerin* and allow the mixture to evaporate spontaneously from clean, odourless absorbent paper; no foreign odour is perceptible at any stage of the evaporation.

Non-Volatile Matter - Evaporate 40 ml in a tared dish on a water-bath and dry the residue at 105°C for one hour; the weight of the residue does not exceed 1 mg.

Storage - Store in tightly-closed containers, away from fire.

Labelling - the label on the container states "Flammable".

Dilute alcohols - Alcohol diluted with water to produce Dilute Alcohols. They are prepared as described below:

Alcohol - (90 per cent).

Dilute 947 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C, 0.863 to 0.865, Appendix - 3.1.8 *Alcohol* (60 per cent).

Dilute 623 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C, 0.863 to 0.865, Appendix - 3.1.8 *Alcohol* (50 per cent).

Dilute 623 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56° C/15.56°C , 0.913 to 0.914, Appendix - 3.1.8 *Alcohol* (50 per cent).

Dilute 526 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C, 0.934 to 0.935, Appendix - 3.1.8 *Alcohol* (25 per cent).

Dilute 263 ml of alcohol to 1000 ml with water.

Specific Gravity - At 15.56°C /15.56°C , 0.9705 to 0.9713, Appendix 3.1.8 *Alcohol* (20 per cent).

Dilute 210 ml of alcohol to 1000 ml with water.

Alcohol, Aldehyde-free - Alcohol which complies with the following additional test

Aldehyde - To 25ml, contained in a 300 ml flask, add 75 ml of dinitrophenyl hydrazine solution heat on a water bath under a reflux condenser for twenty four hours, remove the alcohol by distillation, dilute to 200 ml with a 2 per cent v/v solution of sulphuric acid, and set aside for twenty four hours; no crystals are produced.

Alcohol Sulphate-free - Shake alcohol with an excess of an ion exchange resin for thirty minutes and filter.

Ammonia, xN – solution of any normality xN may be prepared by diluting 75 xml of strong *ammonia solution* to 1000 ml with water.

Ammonia - Ammonium chloride Solution, Strong - Dissolve 67.5g of *ammonium chloride* in 710 ml of strong *ammonia solution* and add sufficient water to produce 1000 ml.

Ammonia Solution, Dilute - Contain approximately 10 per cent w/w of NH .

Dilute 425 ml of strong *ammonia solution* to 1000 ml with water.

Wt. per ml - At 25°C, about 0.960 g. Appendix - 3.1.8.

Storage - Dilute Ammonia Solution should be kept in a well-closed container, in a cool place.

Ammonia Solution 2 per cent - Ammonia Solution 2 per cent is the ammonia solution strong diluted with purified water to contain 2 per cent v/v of Ammonia solution strong.

Ammonia Solution, Strong - Contains 25 per cent w/w of NH (limit , 24.5 to 25.5). About 13.5N in strength.

Description - Clear, colourless liquid; odour, strongly pungent and characteristic.

Solubility - Miscible with *water* in all proportions.

Wt. per ml - At 25°C, about 0.91g, Appendix 3.1.8.

Heavy Metals - Evaporates 5 ml to dryness on a water-bath. To the residue, add 1 ml of *dilute hydrochloric acid* and evaporate to dryness. Dissolve the residue in 2 ml of dilute *acetic acid* and add *water* to make 24 ml; the limit of heavy metals is 15 parts per million, Appendix 2.3.3.

Iron - Evaporate 40ml on a water-bath to about 10ml. The solution complies with the limit test for iron, Appendix 2.3.4.

Chloride - Evaporate 40 ml on water-bath to about 5ml. The solution complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - Evaporate 20ml on a water-bath to about 5 ml. The solution complies with the *limit test for sulphate*; Appendix 2.3.6

Tarry Matter - Dilute 5 ml with 10 ml of water, mix with 6g of powdered *citric acid* in a small flask, and rotate until dissolved; no tarry or unpleasant odour is perceptible.

Non-Volatile Residue - Evaporate 50ml to dryness in a tared porcelain dish and dry to constant weight at 105 not more than 5 mg of residue remains.

Assay - Weight accurately about 3g in flask containing 50ml of *N Sulphuric acid* and titrate the excess of acid with *N sodium hydroxide*, using *methly red solution* as indicator. Each ml of *N sulphuric acid* is equivalent to 0.01703 g of NH_3.

Storage - Preserve Strong Ammonia Solution in a well-closed container, in a cool place.

Ammonia Solution, iron-free - Dilute *ammonia solution* which complies with the following additional test :-

Evaporate 5 ml nearly to dryness on a water-bath add 40 ml of *water*, 2 ml of 20 per cent w/v solution of iron free *citric acid* and 2 drops of *thioglycollic acid*, mix, make alkaline with *iron-free ammonia solution* and dilute to 50 ml with *water*, no pink colour is produced.

Ammonia buffer pH 10.00 - Ammonia Buffer Solution. Dissolve 5.4g of *ammoium chloride* in 70ml of 5 *N ammonia* and dilute with *water* to 100 ml.

Ammonium Chloride - NH_4 CI=53.49.

Description - Colourless crystals or white crystalline powder; odourless; taste, saline.

Solubility - Freely soluble in *water*, sparingly soluble in *alcohol*.

Arsenic - Not more than 4 parts per million.

Heavy Metals - Not more than 10 parts per million, determined by Method A, on 2.0g dissolved in 25ml of water, Appendix 2.3.3.

Barium - Dissolve 0.5 g in 10ml of *water* and add 1 ml of *dilute sulphuric acid*; no turbidity is produced within two hours.

Sulphate - 2g complies with the limit test for sulphates, Appendix 2.2.7.

Thiocyanate - Acidity 10ml of a 10 per cent w/v solution with *hydrochloric acid* and add a few drops of *ferric chloride solution*; no red colour is produced.

Sulphated Ash - Not more than 0.1 per cent, Appendix 2.2.11

Assay - Weigh accurately about 0.1g. dissolve in 20 ml of *water* and add a mixture of 5ml of *formaladehyde solution,* previously neutralised to *dilute phenolphtale in solution* and 20ml of *water*. After two minutes, titrate slowly with 0.1 *N sodium hydroxide*, using a further

0.2 ml of *dilute phenolphthale in solution*. Each ml. of 0.1 *N sodium hydroxide* is equivalent to 0.005349g of NH_4CI.

Storage - Store in tightly closed container.

Ammonium Chloride Solution - A 10 per cent w/v solution of *ammonium chlorid*e in water.

Ammonium Citrate Solution - Dissolve with cooling, 500g *citric acid* in a mixture of 200ml of *water* and 200ml of 13.5 *M ammonia,* filter and dilute with *water* to 1000ml.

Ammonium Nitrate - NH_4NO_3 = 80.04.

Description - Colourless crystals.

Solubility - Freely soluble in water.

Acidity - A solution in water is slightly acid to litmus solution.

Chloride - 3.5g complies with the limit test for chloride Appendix 2.3.2.

Sulphate - 5g complies with the limit test for sulphates, Appendix 2.3.6

Sulphated Ash - Not more than 0.05 per cent, Appendix 2.2.11

Ammonium Oxalate - $(CO_2NH_4)_2H_2O = 142.11$.

Description - Colourless crystals.

Solubility - Soluble in water.

Chloride - 2g, with an additional 20 ml of *dilute nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - Dissolve 1 g in 50ml of water, add 2.5 ml of *hydrochloric acid* and 1 ml of *barium chloride solution* and allow to stand for one hour; no turbidity or precipitate is produced.

Sulphated Ash - Not more than 0.005 per cent, Appendix - 2.2.11

Ammonium oxalate solution - A 2.5 per cent w/v solution of *ammonium oxalate* in water.

Ammonium Phosphate - $(NH_4)_2\ HPO_4$

Description - White crystals or granules.

Solubility - Very soluble in water; insoluble in alcohol.

Reaction - 1g dissolved in 100 ml of *carbon dioxide-free water* has a reaction of about pH8.0, using solution of cresol red as indicator.

Iron - 2g complies with the limit test for iron, Appendix 2.3.4.

Chloride - 2g with an additional 3.5ml of nitric acid complies with the limit test for chlorides appendix 2.3.2.

Sulphate - 2.5g with an additional 4ml of *hydrochloric acid*, complies with the limit test for sulphate, appendix 2.3.6

Ammonium Phosphate, Solution - A 10 per cent w/v solution of *ammonium phosphate* in water.

Ammonium Thiocyanate - NH_4SCN = 76.12.

Description - Colourless crystal.

Solubility - Very soluble in water, forming a clear solution, add 1g of *sodium hydroxide*, warm gently, rotate the flask until a vigorous reaction commences and allow to stand until the reaction is complete; add a further 30 ml of *hydrogen peroxide solution* boil for two minutes, cool and add 10 ml of *dilute nitric acid* and 1 ml of *silver nitrate solution*; any opalescence produced is not greater than that obtained by treating 0.2ml of 0.01 *N hydrochloric acid* in the same manner.

Sulphated Ash - Moisten 1g with *sulphuric acid* and ignite gently, again moisten with *sulphuric acid* and ignite; the residue weighs not more than 2.0mg.

Ammonium Thiocyanate, 0.1N - NH_4SCN=76.12; 7.612g in 1000ml. Dissolve about 8g of *ammonium thiocyanate* in 1000ml of water and standardize the solution as follows:

Pipette 30ml of standardized 0.1 *N silver nitrate* into a glass stoppered flask, dilute with 50ml of *water* than add 2ml of *nitric acid* and 2ml of *ferric ammonium sulphate solution* and titrate with the *ammonium thiocyanate solution* to the first appearance of a red brown colour. Each ml of 0.1 *N Silver nitrate* is equivalent to 0.007612g of NH_4SCN.

Ammonium thiocyanate solution - A 10.0 per cent w/v solution of *ammonium thiocyanate solution.*

Arsenic Trioxide - $As_2 O_3$ =197.82. Contains not less than 99.8 per cent of As_2O_3

Description - Heavy White Powder.

Solubility - Sparingly soluble in water; more readily soluble in water on the addition of *hydrochloric acid*, or solutions of *alkali hydroxides* or *carbonates.*

Arsenious Sulphide - Weigh acccurately 0.50g and dissolve in 10ml of *dilute ammonia solution*; forms a clear colourless solution which, when diluted with an equal volume of water and acidified with *hydrochloric acid*, does not become yellow.

Non-Volatile Matter - Leaves not mere than 0.1 per cent of residue when valatilised.

Assay - Weigh accurately about 0.2 g and dissolve in 20ml of boiling water and 5ml of *N sodium hydroxide*, cool, add 5ml of *N hydrochloric acid* and 3 g of *sodium bicarbonate*, and titrate with 0.1 *N iodine*. Each ml of 0.1 *N iodine* is equivalent to 0.004946 g of As_2O_3.

Barium Chloride - $BaC1_2$, $2H_2$ O=244.27.

Description - Colourless crystals.

Solubility - Freely soluble in water.

Lead - Dissolve 1g in 40ml of recelty boiled and cooled water, add 5 ml of *lead-free acetic acid*, render alkaline with *lead-free ammonia solution* and add 2 drops of *lead-free sodium sulphide solution;* not more than a slight colour is produced.

Nitrate - Dissolve 1g in 10ml of *water,* add 1ml of *indigo carmine solution* and 10 ml of *nitrogen free sulphuric acid* and heat to boiling; the blue colour does not entirely disappear.

Barium Chloride Solution - A 10 per cent w/v solution of *barium chloride* in water.

Bismuth Oxynitrate : Bismuth Oxide Nitrate contains 70 to 74 per cent of Bi.

Description - White, micro crystalline powder.

Solubility - Practically insoluble in *water* in *alcohol*; freely soluble in *dilute nitric acid and* in *dilute hydrochloric acid.*

Assay - Weigh accurately about 1g and dissolve in a mixture of 20ml of *glycerin* and 20 ml of *water*. Add 0.1g of *sulphuric acid* and *titrate* with 0.05 *M disodium ethylene diamine tetra acetate*,using *catechol violet solution* as indicator. Each ml of 0.05 *M disodium ethylene diamine tetra acetate* is equivalent to 0.01045 g of Bi.

Borax - Sodium Tetraborate, $Na_2\ B_4\ O_7\ 10H_2O$ = 381.37 Contains not less than 99.0 per cent and not more than the equivalent of 103 per cent of $Na_2\ B_4\ O_7\ 10H_2\ O$.

Description - Transparent, colourless crystals, or a white, crystalline powder, colourless, taste saline and alkaline, Effloreces in dry air, and, on ignition, loses all its water of crystallisation.

Solubility - Soluble in *water*, practically insoluble in *alcohol*.

Alkalinity - A solution if alkaline to *litmus solution*.

Heavy Metals - Dissolve 1g in 16ml of *water* and 6ml of *N hydrochloric acid* and add *water* to make 25ml; the limit of heavy metals is 20 parts per million, Appendix 2.3.3.

Iron - 0.5g complies with the *limit test for iron*. Appendix 2.3.4.

Chlorides - 1g complies with the *limit test of chlorides*. Appendix 2.3.2.

Sulphates - 1g complies with the *limit test for sulphates*. Appendix 2.3.6

Assay - Weigh accurately about 3 g and dissolve in 75ml of *water* and *titrate* with 0.5 *N hydrochloric acid*, using *methyl red solution* as indicator. Each ml of 0.5 *N hydrochloric* acid is equivalent to 0.09534 g of $Na_2\ B_4\ O_7.\ 10.H_2\ O$.

Storage - Preserve Borax in well-closed container.

Boric Acid - $H_3\ BO_3$ = 61.83.

Description - Colourless plates or white crystals or white crystallin powder, greasy to the touch; odourless; taste, slightly acid and bitter with a sweetish after taste.

Solubility - Soluble in *water* and in *alcohle*: freely soluble in boiling *water*, in boiling alchole and in *glycerin*.

Sulphate - Boil 3 g with 30ml of water and 1 ml of *hydrochloric acid*, cool and filter; 25ml of the filtrate complies with the *limit test for sulphates*, Appendix 2.3.6

Arsenic - Not more than 10 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 20 parts per million, determined by Method A on a solution obtained by dissolving 1.0g in 2ml of *dilute acetic acid* and sufficient *water* to produce 25ml, Appendix 2.3.3.

Assay - Weigh accurately about 2 g, and dissolve in a mixture of 50ml of *water* and 100ml of *glycerine* previously neutralized to *phenolphthalein solution*. Titrate with *N Sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *N Sodium hydroxide* is equivalent to 0.06183 g of $H_3 BO_3$.

Storage - Store in well-closed container.

Labelling - The label on the container states "Not for internal use".

Boric acid Solution - Dissolve 5 g of *boric acid* in a mixute of 20ml of *water* and 20ml of *absolute ethanol* and dilute with *absolute ethanol* to 250 ml.

Bromine - Br_2 = 159.80.

Description - Reddish-brown, fuming, corrosive liquid.

Solubility - Slightly soluble in *water*, soluble in most organic solvents.

Iodine - Boil 0.2 ml with 20 ml of *water*, 0.2 ml of *N sulphuric acid* and a small piece of marble until the liquid is almost colourless. Coool, add one drop of *liquified phenol*, allow to stand for two minutes, and then add 0.2 g of *potassium iodide* and 1 ml of *starch solution*; no blue colour is produced.

Sulphate - Shake 3 ml with 30 ml of dilute *ammonia solution* and evaporate to dryness on a water-bath, the residue complies with the *limit test for sulphates*, Appendix 2.3.6

Bromine Solution - Dissolve 9.6 ml of *bromine* and 30g of *potassium bromide* in sufficient *water* to produce 100ml.

Bromocresol Purple - 4,4 - (3H-2, Benzoxathiol -3-ylidene)bis (2,6- dibromoocresol) SS-dioxide; $C_{21}H_{14}Br_2\ O_4\ S$ = 540.2.

Gives a yellow colour in moderately acid solutions, and a bluish-voilet in weakly acid and alkaline solutions. (pH range, 2.8 to 4.6).

Bromophenol purple solution - Warm 0.1g of *bromophenol purple* with 5.0 ml of ethnol (90 %) until dissolve, at 100 ml of ethnol (20%), 3.7 ml of 0.5 m *M Sodium hydroxide* and sufficient ethnol (20 per cent) to produce 250 ml.

Complies with following test:

Sensitivity - A mixture of 0.2 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.05 ml of 0.2 *M Sodium hydroxide VS* has been added in bluish violet. Not more than 0.20 ml of 0.2 *M hydrochloric acid V*S is required to change the colour to yellow.

Bromothymol Blue – 4,4' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-6 dibromothymol) SS-dioxide $C_{19}H_{19}\ Br_4\ O_5\ S$=670.

Gives a yellow colour in moderately acid solution and a bluish violet in weakly acid and alkaline solutions (pH range, 2.8 to 4.6).

Bromothymol blue solution - Warm 0.1g of *bromothymol blue* with 3.0 ml of 0.05 *N Sodium hydroxide* and 5 ml of *alcohol* (90 per cent); after solution is effected add sufficient *alcohol* (20 per cent) to produce 250 ml.

Complies with the following tests:

Sensitivity - A mixture of 0.5 ml of the solution and 20 ml of *carbon dioxide - free water* to which 0.05 ml of 0.1 *N hydrocholoric acid* has been added is yellow. Not more than 0.10 ml of 0.1 *N Sodium hydroxide* is required to change the colour to bluish violet.

Bromothymol Blue - 6,6' - (3H-2, 1-Benzoxathiol -3-ylidene) bis (2-bromothymol) SS-dioxide $C_{19}H_{19}$ Br_4 O_5 S=624.

Gives a yellow colour in weakly acid solutions and a blue colour in weakly alkaline solutions. Neutrality is indicated by a green colour (pH range, 6.0 to 7.6).

Bromothymol blue solution - Warm 0.1g of *bromothymol blue* with 3.2 ml of 0.05 *N Sodium hydroxide* and 5 ml of *alcohol* (90 per cent); after solution is effected add sufficient *alcohol* (20 per cent) to produce 250 ml.

Complies with the following tests:

Sensitivity - A mixture of 0.3 ml of the solution and 100ml of *carbon dioxide - free water* is yellow. Not more than 0.10 ml of 0.2 *N Sodium hydroxide* is required to change the colour to blue.

Cadmium Iodide - CdI_2 = 366.23.

Description - Pearly white flakes or a crystalline powder.

Solubility - Freely soluble in water.

Iodate - Dissolve 0.2 g in 10 ml of *water*, and add 0.5g of *citric acid* and 1 ml of *starch solution* no blue colour is produced.

Cadmium Iodide Solution - A 5.0 per w/v solution of *cadmium iodide* in water.

Calcium Carbonate - $CaCO_3$ = 100.1

Analytical reagent grade of commerce.

Calcium Chlordie - $CaCI_2H_2$ O=147.0 Analytical reagent grade of commerce.

Calcium Chloride Solution - A 10 per cent w/v solution of calcium chloride in water.

Calcium Hydroxide - Ca $(OH)_2$ = 74.09.

Analytical reagent grade of commercie.

Calcium Hydroxide Solution - Shake 10g of Calcium hydroxide repeatedly with 1000 ml of water and allow to stand until clear.

Calcium Sulphate - Ca SO_4, $2H_2O$ = 172.17.

Description - White powder.

Solubility - Slightly soluble in *water*.

Chloride - Boil 5 g with 50ml of *water* and filter while hot. The filtrate, after cooling, complies with the *limit test for chlorides*, Appendix 2.3.2.

Acid-Insoluble Matter - Boil 2 g with 100 ml. of *N hydrochloric acid*, and then with *water* dry, ignite, and weigh; the residue weighs not more than 2 mg.

Alkalinity - Biol 1 g with 50 ml of *water*, cool, and titrate with 0.1 *N hydrochloric acid*, using *bromothymol blue solution* as indicator; not more than 0.3 ml. of 0.1 *N hydrochloric acid* is required.

Carbonate - Boil 1 g with 10 ml of *water* and add 1 ml of *hydrochloric acid* no carbon dioxide is evolved.

Residue on Ignition - When ignited, leaves not less than 78.5 per cent and not more than 80.0 per cent residue.

Camphore - $C_{10}H_{16}O$ = 152.23.

Camphor is a ketone, obtained from *Cinnamonum camphora* (Linn.) Nees. and Eberm. (Fam. Lauraceae) and *Ocimum kilimandscharicum* Guerke (Fam. Labiatae) (Natural Camphor) or produced synthetically (Synthetic Camphor). It contains not less than 96.0 per cent of $C_{10}H_{16}O$.

Description - Colourless or white crystals, granules or crystalline masses or colourless to white translucent tough masses; odour, penetrating and characteristic; taste, pungent, aromatic, and followed by a sensation of cold. Readily pulverisable in the presence of a little *alcohol chloroform*, or *solvent ether*.

Solubility - Slightly soluble in *water*; very soluble in *alcohol*, in *chloroform* and in *solvent ether* freely soluble in fixed oils and in volatile oils.

Melting Range - 174°C to 179°C , Appendix 3.1.4

Specific Optical Rotation - + 41° to + 43°, determined in a 10 per cent w/v solution of Natural Camphor in alcohol, Appendix 3.1.5 Synthetic Camphor is the optically inactive, racemic form.

Water - A 10 per cent w/v solution in *light petroleum* (boiling range 40°C to 60°C) is clear.

Non-Volatile Matter - Leaves not more than 0.05 per cent of residue when volatilized at 105°C.

Assay - Weigh accurately about 0.2g and dissolve in 25 ml of *aldehyde-free alcohol*, in a 300ml flask. Slowly add while stirring 75 ml of *dinitrophenylhydrazine solution* and heat on a water-bath for four hours under a reflux condenser. Remove the alcohol by distillation, allow to cool, dilute to 200ml with a 2 per cent v/v solution of *sulphuric acid* in water. Set aside for twenty-four hours, filter in a tared Gooch crucible, and wash the precipitate with successive quantities of 10 mlof cold *water* unitl the washings are neutral of *litmus paper*. Dry to constant weight at 80°C and weigh. Each g of precipitate is equivalent to 0.458g of $C_{10}H_{16}O$.

Storage - Preserve Camphor in a well-closed container in a cool place.

Canada balsam reagent - General reagent grade of commerce.

Carbon Dioxide - CO_2 = 44.01.
Commercially available carbon dioxide.

Carbon Disulphide - CS_2 = 76.14.

Description - Clear, almost colourless, flammable liquid.

Distillation Range - Not less than 95 per cent distils between 46°C 47°C Appendix 3.1.1

Wt. per ml. - At 25°C, about 1.263 g. Appendix 3.1.8

Non-Volatile Matter - When evaporated to dryness on a water bath, and dried to constant weight at 105°C, leaves not more than 0.005 per cent w/v of residue.

Carbon Tetrachloride - CCI_4 = 153.82.

Description - Clear, colourless, volatile, liquid; odour, characteristic.

Solubility - Practically insoluble in water, miscible with ethyl alcohol, and with solvent ether.

Distillation Range - Not less than 95 per cent distils between 76°C and 77°C, Appendix 3.1.1

Wt. per ml. - At 20°C, 1.592 to 1.595g, Appendix 3.1.8.

Chloride - Free Acid - Shake 20 ml of freshly boiled and cooled *water* for three minutes and allow separation to take place; the aqueous layer complies with the following test:

Chloride - To 10 ml add one drop of *nitric acid* and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Free Acid - To 10 ml add a few drops of *bromocresol purple solution*; the colour produced does not indicate more acidity than that indicated by the addition of the same quantity of the indicator to 10 ml of freshly boiled and cooled *water*.

Free Chloride - Shake 10 ml with 5 ml of *cadmium iodide solution* and 1 ml of *starch solution*, no blue colour is produced.

Oxidisable Impurities - Shake 20 ml for five minutes with a cold mixture of 10 ml of *sulphuric acid* and 10 ml of 0.1 *N potassium dichromate*, dilute with 100 ml of water and add 3 g of *potassium iodide* : The liberated iodine required for decolourisation not less than 9 ml of 0.1 *N sodium thiosulphate.*

Non-volatile Matter - Leaves on evaporation on a water-bath and drying to

constant weight at 105 not more than 0.002 per cent w/v of residue.

Caustic Alkali Solution, 5 per cent
5 g of *potassium* or *sodium hydroxide* in water and dilute to 100 ml.

Charcoal, decolourising - General purpose grade complying with the following test.

Decolourising Power - Add 0.10 g to 550 ml of a 0.006 per cent w/v solution of *bromophenol blue* in *ethanol* (20 per cent) contained in a 200 ml flask, and mix. Allow to stand for five minutes, and filter; the colour of the filtrate is not deeper than that of a solution prepared by diluting 1 ml of the *bromophenol blue solution* with *ethanol* (20 per cent) to 50 ml.

Chloral Hydrate CCI_3 $CH(OH)_2$ Mol Wt. 165.40.

Description - Colourless, transparent crystals, odour, pungent but no acrid; taste, pungent and slightly bitter, volatilises slowly on exposure to air.

Solubility - Very soluble in *water*; freely soluble in *alcohol*: in *chloroform* and in *solvent ether*.

Chloral Alcoholate : Warm 1g with 6 ml of *water* and 0.5 ml of *sodium hydroxide solution*: filter add sufficient 0.1 *N iodine* to impart a deep brown colour, and set aside for one hour; no yellow crystallin precipitate is produced and no smell of iodoform is perceptible.

Chloride : 3g complies with the limit test for chlorides, Appendix 2.3.2.

Assay : Weigh accurately about 4 g and dissolve in 10 ml of *water* and add 30 ml of *N sodium hydroxide.* Allow the mixute to stand for two minutes, and then titrate with *N sulphuric acid* using *phenophthalien solution* as indicator. Titrate the neutralised liquid with 0.1 *N silver nitrate* using potassium *chromate solution* as indicator. Add two-fifteenth of the solution amount of 0.1 *N Silver nitrate* used to the amount of *N sulphuric acid* used in the first titration and deduct the figure so obtained from the amount of *N sodium hydroxide* added. Each ml of *N sodium hydroxide*, obtained as difference; is equivalent to 0.1654g of $C_2 H_2 C1_3 O_2$.

Storage - Store in tightly closed, light resistant container in a cool place.

Chloral Hydrate Solution - Dissolve 20g of *chloral hydrate* in 5 ml of *water* with warming and add 5 ml of *glycerin*.

Chloral Iodine Solution - Add an excess of crystalline *iodine* with shaking to the *chloral hydrate solution*, so that crystals of undissolved iodine remain on the bottom of bottle. Shake before used as the iodine dissolves and crystals of the iodine to the solution. Store in a bottle of amber glass in a place protected from light.

Chlorinated Lime - Bleaching Powder.

Contains not less than 3.0 per cent of available chlorine.

Description - Dry dull white powder, odour, characteristic.
On expose to air it becomes moist and gradually decomposes.

Solubility - Slightly soluble in *water* and in *alcohol*.

Stability - Losses not more than 3.0 per cent of its available chlorine by weight when heated to 100 for two hours (The available chlorine is determined by the Assay described below).

Assay - Weigh accurately about 4 g. triturate in a mortar with successive small quantities of *water* and transfer to a 1000ml flask. Add sufficient water to produce 1000 ml and shake thoroughly. To 100 ml of this suspension add 3 g of *potassium iodide* dissolved in 100ml of *water*, acidify with 5 ml of *acetic acid* and titrate the liberated iodine with 0.1 *N sodium*

thiosulphate. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.003545 g of available chlorine.

Storage - Preserve in a well-closed container.

Chlorinated Lime Solution - Mix 100g of *chlorinated lime* with 1000 ml of *water* transfer the mixture to a stoppered bottle; set aside for three hours, shaking occasionally; filter through calico.

Chlorinated Lime Solution must be recently prepared.

Chloroform - $CHC1_3$ = 119.38.

Description - Colourless, volatile liquid; odour, characteristic, taste, sweet and burning.

Solubility - Slightly soluble in *water*; freely miscible with *ethyl alcohol* and with *solvent ether*.

Wt. per ml. - Between 1.474 and 1.478g. Appendix 3.1.8.

Boiling Range : A variable fraction, not exceeding 5 per cent v/v, destils below 60 and the remainder distils between 50°C to 62°C , Appendix 3.1.1

Acidity : Shake 10 ml with 20 ml of freshly boiled and cooled *water* for three minutes, and allow is separate. To a 5 ml portion of the aqueous layer add 0.1 ml of *litmus solution*; the colour produced to not different from that produced on adding 0.1 ml of *litmus solution* to 5 ml of freshly boiled and cooled water.

Chloride : To another 5 ml portion of the aqueous layer obtained in the test for acidity, add 5 ml of water and 0.2 ml of *silver nitrate solution*; not opalescence is produced.

Free, Chlorine - To another 10 ml portion of the aqueous layer, obtained in the test for Acidity, add 1 ml of *Cadmium iodide solution* and the two drops of *starch solution*; no blue colour is produced.

Aldehyde : Shake 5 ml with 5 ml of water and 0.2 ml of *alkaline potassium mercuri-iodide solution* in a stoppered bottle and set aside in the dark for fifteen minutes; not more than a pale yellow colour is produced.

Decomposition Products : Place 20 ml of the *chloroform* in a glass-stoppered vessel, previously mixed with *sulphuric acid* add 15 ml of *sulphuric acid* and four drops of *formaldehyde solution*, shake the mixture frequently during half an hour and set aside for

further half an hour, the vessel being protected from light during the test; the acid layer is not more than slightly coloured.

Foreign Organic Matter - Shake 20 ml with 10 ml of *sulphuric acid* in a stoppered vessel previously rinsed with *sulphuric acid* for five minutes and set aside in the dark for thirty minutes, both the acid and chloroform layers remain colourless. To 2 ml of the acid layer add 5 ml of water; the liquid remains colourless and clear, and has no unpleasant odour. Add a further 10 ml of water and 0.2 ml of *silver nitrate solution*; no opalescence is produced. Foreign Chlorine Compounds : Shake 15 ml of the chloroform layer obtained in the test for foreign organic matter with 30 ml of water in a stoppered bottle for three minutes and allow separation to take place; to the aqueous layer add 0.2ml of *silver nitrate solution* and set aside in the dark for five minutes; no opalescence is produce.

Foreign Odour - Allow 10 ml of evaporate from a large piece of filter paper placed on a warm plate; no foreign colour is detectable at any stage of the evaporation.

Non volatile matter - Not more than 0.004 per cent w/v determined on 25ml by

evaporation and drying at 105°C

Storage - Store in tightly-closed , glass-stoppered, light-resistant bottles.

NOTE : Care should be taken not to vaporise chloroform in the presence of a flame because of the production of harmful gases.

Chloroform Water

Chloroform	-	2.5 ml.
Purified Water	-	Sufficient to produce 1000 ml.

Dissolve the *chloroform* in the purified *water* by shaking.

Chromic-sulphuric Acid Mixture - A saturated solution of Chromium trioxide in *sulphuric acid*.

Chromium Trioxide - $Cr\ O_3$ = 99.99.
Analytical reagent grade.

Chromotropic Acid - $C_{10}H_8O_8S_2 2H_2O$=356.32.

Description - White to brownish powder. It is usually available as its sodium salt, $C_{10}H_8O_8S_2Na_2$, which is yellow to light brown in colour.

Solubility - Soluble in water; sodium salt is freely soluble in water.

Sensitivity - Dilute exactly 0.5ml of *formaldehyade solution* with water to make 1000ml. dissolve 5mg of *chromotropic acid* or its sodium salt, in a 10ml of a mixture of 9 ml of *suphuric acid* and 4 ml of water. Add 5ml of this solution to 0.2 ml of the *formaldehyde solution*, and heat for 10 minutes at 60 a violet colour is produced.

Chromotropic acid solution - Dissolve 5 mg of *chromotropic acid sodium* salt in 10 ml of a mixture of 9 ml of *sulphuric acid* and 4 ml of water.

Citric Acid - $C_6F_8O_7 7H_2$,O = 210.1

Colourless, translucent crystals, or a white, crystalline powder, slightly hygroscopic in moist air and slightly efflorescent in warm dry air; odourless, taste, strongly acid.

Analytical reagent grade.

Citric Acid, iron free - Citric acid which complies following additional test :

Dissolve 0.5 g in 40 ml of *water*, add 2 drops of *thioglycollic acid*, mix make alkaline with *iron free ammonia solution* and dilute to 50 ml with *water*; no pink colour is produced.

Copper Acetate - Cu $(C_2H_3O_2)$ H_2O = 199.65.

Contains not less than 98.0 per cent of C_4 H_6 O_4 Cu H_2 O

Description - Blue-green crystals or powder, having a faint odour of acetic acid. **Solubility -** Soluble in *water*, yielding a clear solution.

Chloride - 3g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 3g complies with the *limit test for Sulphates*. Appendix 2.3.6

Assay - Weigh accurately about 0.8 g and dissolve in 50 ml of *water*, add 2 ml of *acetic acid* and 3 g of *potassium iodide*, with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator, until only a faint blue colour remains; add 2 g of *potassium thiocyanate* and continue the titration until the blue colour disappears. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.01997 g of C_4 H_6 O_4 Cu H_2 O

Copper Acetate, Solution - 0.5 per cent w/v of copper acetate in water.

Cooper Sulphate - $Cu\ SO_4\ \ 5H_2\ O = 249.68$.

Contains not less than 98.5 per cent and not more than the equivalent to 101.0 per cent of $Cu\ SO_4\ \ 5H_2\ O$

Description - Blue triclinic prisms or a blue, cystalline powder.

Solubility - Soluble in water, very soluble in boiling *water*, almost insoluble in *alcohol*; very slowly soluble in *glycerin*.

Acidity and Clarity of Solution - 1g. dissolved in 20 ml of *water*, forms a clear blue solution, which becomes green on the addition of 0.1 ml of *methyl orange solution*.

Iron - To 5g. add 25ml of *water*, and 2 ml of *nitric acid*, boil and cool. Add excess of *strong ammonia solution*, filter, and wash the residue with *dilute ammonia solution* mixed with four times its, volumes of water, dissolve the residue, if any, on the filter with 2 ml of *hydrochloric acid*, diluted with 10 ml of *water* to be *acid solutions* add dilute *ammonia solution* till the precipitation is complete; filter and wash the residue after ignition weighs not more than 6 mg.

Copper Sulphate, Anhydrous - $CuSo_4 = 159.6$.
Prepared by heating copper sulphate to constant weight at about 230°C.

Copper Sulphate Solution - A 10 per cent w/v solution of *copper sulphate* in *water*.

Catechol Violet - 4,4' - (3H-2,I-Benzoxathil-3-ylidene) dipyrocatechol' SS-dioxide.

Gives a blue colour with bismuth ions in moderately acid solution. When metal ion are absent, for example, in the presence of an excess of *disodium ehylene diamine tetra acetate*, the solution if yellow.

Catechol Violet Solution - Dissolve 0.1 g of *catechol violet* in 100 ml of *water*.

Cresol Red - 4,4' – (3H-2 1-benzoxathiol-3 ylidone) di-o-cresol SS-dioxide; $C_{12}H_{18}O_5S$ =382.4,

Gives a red colour in very strongly acid solutions, a yellow colour in less strongly acid and neutral solutions, and a red colour in moderately alkaline solutions (pH ranges, 0.2 to 1.8 and 7.2 to 8.8).

Cresol Red Solution - Warm 50 mg of *cresol red* with 2.65 ml of 0.05 *M Sodium hydroxide* and 5 ml of *ethanol* (90 per cent) after solution is effected, add sufficient *ethanol* (20 per cent) to produce 250 ml.

Complies with the following test.

Sensitivity - A mixture of 0.1 ml of the solution and 100 ml of *carbon dioxide-free water* to which 0.15 ml of 0.02 *M Sodium hyderoxide* has been added is purplish-red. Not more than 0.15 ml of 0.02 *M hydrochloric acid* is required to change the colour to yellow.

Dimethyl Yellow - CI 11020; 4 - Dimethyl aminoagolenzone;

$C_{14}\ H_{15}\ N_3$ = 225.3

Gives a red colour in moderately acid alcoholic solutions, and a yellow colour in weakly acid and alkaline solution (pH range, 2.8 to 4.6).

Complies with the following test :

Dimethyl Yellow Solution- A 0.2 per cent w/v solution of *dimethyl yellow* in *alcohol* (90 per cent).

Sensitivity - A solution containing 2 g of *ammonium chloride* in 25 ml of *carbon dioxide-free water* to which is added 0.1 ml of the *dimethyl yellow solution*, is yellow, Not more than 0.10 ml of 0.1 *N hydrochloric acid* is required to change the colour to red.

Dinitrophenyl Hydrazine - 2,4 - Dinitrophenyl hydrazine; $(NO_2)_2\ C_6\ H_3$, NH NH_2 = 198.14.

Description - Orange-red crystals or a crystalline powder.

Solubility - Practicaly insoluble in *water* slightly soluble in *alcohol*.

Clafity and Colour or Solution - 0.5 g yields a clear yellow solution on heating with a mixture of 25 ml of water and 25 ml of *hydrochloric acid*.

Melting Range - 197°C to 200°C , with decomposition Appendix 3.1.4.

Sulphated Ash - Not more than 0.5 per cent, Appendix 2.3.6

Dinitrophenyl Hydrazine Solution - Dissolve 1.5 gm of *dinitrophenyl hydrazine* in 20 ml of *sulphuric acid* (50 per cent v/v/). Dilute to 100 ml with *water* and filter.

Dinitrophenyl hydrazine solution must be freshly prepared.

Diphenyl Benzidine - ($C_6\ H_5$, NH. $C_6\ H_4$) = 336.42.

Description - White of faintly Grey coloured, crystalline powder.

Melting Range - 246°C to 250°C . Appendix 3.1.4.

Nitrate - Dissolve 8 mg in a cooled mixture of 45 ml of *nitrogen free sulphuric acid* and 5 ml of *water*, the solution is colourless or not more than very pale blue.

Sulphated Ash- Not more than 0.1 per cent, Appendix 2.3.6

Diphenly Carbazide - 1,5 - Diphenyl Carbazide : C_6 H_5 NH. $NH)_2$ CO = 242.27.

Description - White crystalline powder which gradually acquires a pink tint on exposure to air.

Solubility - Practically insoluble in water; soluble in alcohol.

Diphenyl Carbazine Solution - A 0.2 per cent w/v solution of *diphenyl Carbazide* in a mixture of 10 ml of *glacial acetic acid* and 99 ml of *alcohol* (90 per cent).

Diphenyl Thiocarbazone - Dithizone : 1.5 - Diphenylthio Carbazone; C_6 H_5 N NCS, NH NH C_6 H_5 - 256.32.

Description - Almost black powder.

Solubility - Practically insoluble in *water*; soluble in *chloroform* in *carbon tetrachloride* and in other organic solvents, yielding solutions of an intense green colour.

Lead - Shake 5 ml of 0.1 per cent w/v solution in *chloroform* with a mixture of 5 ml of water, 2 ml of *lead free potassium cyanide solution*, and 5 ml of *strong ammonia solution*; the chloroform layer may remain yellow but has no red tint.

Sulphated Ash - Not more than 0.5 per cent. Appendix 2.3.6

Disodium Ethylene Diamine Tetra Acetate - (Disodium Acetate) C_{10} H_{14} N_2 Na_2 O_8, $2H_2$ O = 372.2.

Analytical reagent grade.

Dragendorff Reagent

Solution 1- Dissolve 0.85 g of *bismuth oxy nitrate* in 40 ml of *water* and 10 ml of *acetic acid.*

Solution 2 - Dissolve 8 g of *potassium iodide* in 20 ml of water.

Mix equal volumes of solution 1 and 2 and to 10 ml of the resultant mixture add 100 ml of *water* and 20 ml of *acetic acid.*

Eosin - CI 45380; Acid Red 87; Tetrabromo flurescein Disodium Salt; C_{20} H_6 O_5 Br_4 Na_2 = 691.86.

Description - Red powder, dissolves in water to yield a yellow to purplish-red solution with a greenish-yellow fluorescence.

Solubility - Soluble in *water* and in *alcohol*.

Chloride - Dissolves 50 mg in 25 ml of *water*, add 1 ml of *nitric acid*, and filter; the filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphated Ash - Not more than 24 per cent, calculate with reference to the substance dried at 110°C for two hours. Appendix 2.3.6

Eosin Solution - A 0.5 per cent w/v solution of *eosin* in *water*.

Eriochrome Black T - CI 14645 ; Mordant Black 11; Sodium 2 (1-hydroxy-2- naphthylazo) 5=nitro-2-naphtol-4-sulphonate; C_{20} H_{12} N_3 NaO_7 S = 461.38.

Brownish black powder having a faint, metallic sheen soluble in alcohol, in methyl alcohol and in hot water.

Ether, Diethyl Ether - $(C_2 H_5)_2 O = 74.12$.

Analytical reagent grade.

A volatile, highly flammable, colourless liquid, boilding point, about 34 ; weight per ml about 0.71 g.

Warning - It is dangerous to distil or evaporate ether to dryness unless precautions have been taken to remove peroxides.

Ethyl Acetate - $C_2 H_2 OH = 46.07$.

Absolute Alcohol - Dehydrated Alcohol.

Description - Clear, colourless, mobile volatile liquid; odour, characteristic and spirituous; taste, burning; hygroscopic. Readily volatilisable even at low temperature and boils at 78 . Is flammable.

Solubility - Miscible with *water*, with *solvent ether* and with *chloroform*. Contains not less than 99.5 per cent w/w or 99.7 per cent v/v of $C_2 H_5 OH$.

Identification - Acidity of Alkalinity : Clarity of solution; Methanol: Foreign organic substances; Isopropyl alcohol and butyl alcohol; Aledehydes and ketones; Fuse Oil constitutents; Non-volatile matter; complies with the requirements described under Alcohol.

Specific Gravity - Between 0.7871 and 0.7902, at 25°C , Appendix 3.1.8.

Storage - Store in tightly closed containers in a cool place away from fire and protected from moisture.

Labelling - The label on the container states "Flammable".

Ferric Ammonium Sulphate - Ferric Alum, $Fe (NH_4) (SO_4)_2 \ 12H_2 O = 482.18$.

Contains not less than 99 per cent and not more than the equivalent of 101 per cent of $Fe (NH_4) (SO_4)_7 12 H_2O$.

Description - Pale violet crystals, or a nearly colourless crystalline powder.

Solubility - Soluble in *water*, yielding a clear yellow or brown solution.

Ferrous Ion - Dissolve 1 g in 50 ml of *water*, add 1 ml of *dilute hydrochloric acid* and ml of *potassium ferricyanide solution*; no green or blue colour is produced.

ASSAY - Weigh accurately about 2g, dissolve in 10 ml of *dilute hydrochloric acid* and dilute to 50 ml with water, add 3 g of *potassium iodide*, allow to stand for ten minutes titrate the liberated iodine with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of titration Each ml of 0.1 *N Sodium thiosulphate* is equivalent to

0.04822 g of $Fe (NH_4) (SO_4)_2 \ 12 H_2O$.

Ferric Ammonium Sulphate - 0.1 N $Fe NH_4(SO_4)_2 \ 12 H_2O = 482.18$; 48.22g in 1000ml.

Dissolve 50g of *ferric-ammonium sulphate* in a mixture of 300ml of *water* and 6ml of *sulphuric acid*. Dilute with water to 1000ml , and mix. Standardize the solution as follows:-

Measure accurately about 30 ml of the solution into a glass-stoppered flask, add 5ml of *hydrochloric acid,* mix, and add a solution of 3g of *potassium iodide* in 10 ml of water. Insert the stopper, allow to stand for ten minutes in the dark, then titrate the liberated *iodine* with standardized 0.1 *N Sodium thiosulphate*, adding 3 ml of *starch solution* as the end-point is approached. Perform a blank determination and make any necessary correction. Each ml of 0.1 *N Sodium thiosulphate* is equivalent to 0.04822 g of Fe (NH_4) $(SO_4)_2$ 12 H_2 O.

NOTE - Store 0.1 N Ferric Ammonium Sulphate in tightly-closed, light resistant containers.

Ferric Chloride - Anhydrous Ferric Chloride; Ferric Chloride ; $FeC1_3$ = 162.22

Description - Greenish-black crystals or a crystalline powder, free from the orange colour of the hydrated salt, which is readily acquired by exposure to atmospheric moisture.

Solubility - Soluble in water, yielding an orange coloured opalescent solution.

Ferrous Salts - Dissolve 2 g in 100 ml of water, add 2 ml of *phosphoric acid* and titrate with 0.1 *N potassium permanganate* until a pink colour is produced, no more than 0.1 ml is required.

Free Chloride - Dissolve 5 g in 10 ml of *water* and boil the solution; no blue colour is produced on a starch iodide paper exposed to the vapours.

Ferric Chlordie Solution - Contains not less than 14.25 per cent and not more than 15.75 per cent w/v of $FeC1_3$.

Description - Clear, Yellowish-brown liquid.

Assay - Dilute 2 ml with 20 ml of *water,* add 1 ml of *sulphuric acid* and 0.1 *N potassium permanganate* drop by drop unitl a pink colour persists for five seconds. Add 15 ml of *hydrochloric acid* and 2 g of *potassium iodide,* allow to stand for three minutes, and titrate with 0.1 *N sodium thiosulphate,* using *starch solution* as indicator added towards the end of titration. Each ml of 01. *N Sodium thiosulphate* is equivalent to 0.01622g of $FeC1_3$.

Ferrous Sulphate - $FeSO_4$ $7H_2O$ = 278.0

Description - Transparent, green crystals, or a pale bluish-green, crystalline powder; odourless; taste, metallic and astringent, Eflorescent in dry air. On exposure to moist air, the crystals rapidly oxidise and become coated with brownish yellow basic ferrous sulphate.

Solubility - Freely soluble in water, very soluble in boiling water, practically insoluble in alcohol.

pH - Between 3 and 4, determined in a 5 per cent w/v solution, Appendix 3.1.3.

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Copper, Zinc And Lead - Dissolve 8 g in 40 ml of *hydrochloric acid*. Add 10 ml of *nitric acid* and 15 ml of *water*, boil gently for five minutes and cool. Shake with four quantities, each of 30 ml of *solvent ether* and discard the ether. Heat the acid solution on a water-bath to remove dissolved ether, cool and add sufficient *water* to produce 100 ml (solution A).

Copper - To 10 ml of solution A obtained in the test for Copper, Zinc and Lead, add1 g of *citric acid*, make alkaline with *dilute ammonia solution* and add 25ml of *water* and 5 ml of *sodium diethyldithiocarbamate*.

Ferrous Sulphate Solution - A 2 per cent w/v solution of *ferrous sulphate* in freshly boiled and cooled water.

Ferrous Sulphate Solution must be freshly prepared.

Ferrous Sulphate Solution, Acid - A 0.45 per cent w/v solution of *ferrous sulphate* in freshly boiled and cooled *water* containing 0.5 ml of *hydrochloric acid.*

Formaldehyde Solution - Formalin ; HCHO = 30.03.

Formalidehyde Solution is a solution of *formaldehyde* in *water* with *methyl alcohol* added to prevent plymerisation. It contains not less than 34.0 per cent w/w/ and not more than 38 per cent w/w of CH_2O.

Description - Colourless liquid; odour, characteristic, pungent and irritating; taste, burning. A slight white cloudy deposit is formed on long standing, especially in the cold, due to the separation of paraformaldehyde. This white deposit disappears on warming the solution.

Solubility - Miscible with *water*, and with *alcohol*.

Acidity - To 10 ml add 10 ml of *carbon dioxide free water* and titrate with 0.1 *N sodium hydroxide* using *bromothymol blue solution* as indicator; not more than 5 ml of 1 *N sodium hydroxide* is required.

Wt. per ml. - At 20°C, 1.079 g. Appendix 3.1.8.

Assay - Weigh accurately about 3 g and add to a mixture of 25 ml of *hydrogen peroxide solution* and 50 ml of *N sodium hydroxide*, warm on a water bath until effervescence ceases

and titrate the exces of alkali with *N sulphuric acid* using *phenolphthalein solution* as indicator. Repat the experiment with the same quantities of the same reagents in the same manner omitting the *formaldehyde solution*. The difference between the titrations represents the sodium hydroxide required to neutralise the formic acid produced by the oxidation of the *formaldehyde*. Each ml of *N sodium hydroxide* is equivalent to 0.03003 g of CH_2 O.

Storage - Preserve Formaldehyde Solution in a well-closed container preferably at a temperature not below 15°C.

Formaldehyde Solution, Dilute.

Dilute 34 ml of *formaldehyde solution* with sufficient water to produce 100 ml.

Glycerin - C_3 H_8 O_3 =82.09.

Description - Clear, colourless liquid of syrupy consistancy; odourless, taste sweet followed by a sensation of warmth. It is hygroscopic.

Solubility - Miscible with *water* and with *alcohol*; practically, insoluble in *chloroform*. In *solvent-ether* and in fixed oils.

Acidity - To 50 ml of a 50 per cent w/v solution add 0.2 ml of *dilute phenolphthalin solution*; not more than 0.2ml of 0.1 *N sodium hydroxide* is required to produce a pink colour.

Wt. per ml. - Between 1.252 g and 1.257g, Appendix-3.1.8, corresponding to between 98 per cent and 100 per cent w/w of C_3 H_8 O_3 .

Refractive Index - Between 1.470 and 1.474 determined at 20°C. Appendix 3.1.7

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Copper - To 10 ml add 30 ml of *water*, add 1 ml of *dilute hydrochloric acid*, add 10 ml of *hydrogen sulphide solution;* no colour is produced.

Iron - 10g complies with the *limit test for iron,* Appendix 2.3.4.

Heavy Metals - Not more than 5 parts per million, determined by Method A on a solution of 4g in 2 ml of 0.1 *N hydrochloric acid* and sufficient *water* to produce 25ml. Appendix 2.3.3.

Sulphate - 1 ml complies with the *limit test for sulphates,* Appendix 2.3.6

Chloride - 1 ml complies with the *limit test for chloride,* Appendix 2.3.2.

Acraldehyde and Glucose - Heat strongly; it assumes not more than a faint yellow and not a pink colour. Heat further; it burns with little or not charring and with no odour of burnt sugar.

A**ldehydes and Related Substances** - To 12.5 ml of a 50 per cent w/v solution in a glass-stoppered flask add 2.5 ml of *water* and 1 ml of *decolorised magenta solution.* Close the flask and allow to stand for one hour. Any violet colour produced is not more intense than that produced by mixing 1.6ml of 0.1 *N potassium permaganate* and 250 ml of water.

Sugar - Heat 5 g with 1 ml of *dilute sulphuric acid* for five minutes on a water-bath. Add 2 ml of *dilute sodium hydroxide solution* and 1 ml of *coppr sulphate solution.* A clear, blue coloured solution is produced. Continue heating on the water-bath for five minutes. The solution remains blue and no precipitate is formed.

Fatty Acids and Esters - Mix 50 g with 50 ml of freshly boiled *water* and 50.0 ml of 0.5 *N sodium hydroxide*, boil the mixute for five minutes. Cool, add a few drops of *phenolphthalein solution* and *nitrate* the excess alkali with 0.5 *N hydrochloric acid*. Perform a blank determination. Not more than 1 ml of 0.5 *N sodium hydroxide* is consumed.

Sulphated Ash - Not more than 0.01 per cent, Appendix 2.2.11

Storage - Store in tightly-closed containers.

Glycerin Solution - Dilute 33 ml of *glycerin* to 100 ml with water and add a samll piece of camphor or liquid phenol.

Hexamine $(CH_2)_6\ N_4$ = 140.2 Analytical reagent grade.

Hydrazine Hydrate - $NH_2\ NH_2\ H_2\ O$ =50.06.

Analytical reagent grade.

A colourless liquid with an ammonical odour; weight per ml. about 1.03 g.

Hydrochloric Acid - HC1=36.46 Concentrated Hydrochloric Acid.

Description - Clear, colourless, fuming liquid, odour, pungent.

Arsenic - Not more than 1 part per million, Appendix 2.3.1.

Heavy Metals - Not more than 5 parts per million, determined by method A on a solution prepared in the following manner : Evaporate 3.5 ml to dryness on a water-bath, add 2 ml of *dilute acetic acid* to the residue, and *water* to make 25 ml. Appendix 2.3.3.

Bromide and Iodide - Dilute 5 ml with 10 ml of *water*, add 1 ml of *chloroform*, and add drop by drop, with constant shaking, *chlorinated lime solution*; the chloroform layer does not become brown or violet.

Sulphite - Dilute 1 ml with 10 ml of *water*, and add 5 drops of *barium chloride solution* and 0.5 ml of 0.001 *N iodine*; the colour of the iodine is not completely discharged.

Sulphate - To 5 ml add 10 mg of *sodium bicarbonate* and evaporate to dryness on a water-bath; the residue, dissolved in *water*; complies with the *limit test for sulphates*, Appendix 2.3.6

Free Chlorine - Dilute 5 ml with 10 ml of freshly boiled and cooled *water*, add 1 ml of *potassium iodide solution*, and shake with 1 ml of *chloroform*; the chloroform layer does not become violet within one minute.

Sulphated Ash - Not more than 0.01 percent, Appendix 2.2.11

Assay - Weigh accurately about 4 g into a stoppered flask containing 40 ml of *water*, and titrate with *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.0364 g of HCI.

Storage - Store in glass- stoppered containers at a temperature not exceeding 30^0

Hydrochloric Acid, x N - Solution of nay normality x N may be prepared by diluting 84Xml of *hydrochloric acid* to 1000 ml with *water*.

Hydrochloric Acid - (1 percent w/v).

Dilute 1 g of *hydrochloric acid* to 100 ml with *water*.

Dilute Hydrochloric Acid

Description - Colourless liquid.

Arsenic Heavy Metals - *Bromide and iodide; sulphate; Free chlorine*-Complies with the tests described under *Hydrochloric acid*, when three times the quantity is taken for each test.

Assay - Weigh accurately about 10 g and carry out the Assay described under Hydrochloric Acid.

Storage - Store in stoppered containers of glass or other inert material, at temperature below 30^0.

Hydrochloric Acid: N: HCI=36.46
36.46 g in 1000 ml

Dilute 85 ml of *hydrochloric acid* with *water* to 1000 ml and standardize the solution as follows:
Weigh accurately about 1.5 g of *anhydrous sodium carbonate* P.S., previous heated at about 270^0 for one hour. Dissolve it in 100 ml of *water* and add two drops of *methyl red solution*. Add the acid slowly from a burette with constant stirring, until the solution becomes faintly pink. Heat again to boiling and titrate further as necessary until the faint pink colour no longer affected by continued boiling. Each 0.5299 g of *anhydrous* and *sodium carbonate* is equivalent to 1 ml of *N. hydrochloric acid*.

Hydrochloric Acid Iron free- Hydrochloric acid which complies with the following additional test.

Evaporate 5 ml on a water-bath nearly to dryness, add 40 ml of *water*, 2 ml of a 20 percent w/v solution of *citric acid* and two drops of *thioglycollic acid*, mix, make alkaline with *dilute ammonia solution*, and dilute to 50 ml with *water*; no pink colour is produced.

Hydrogen Peroxide Solution- (20 Vol.) H_2O_2*=34.02*

Analytical reagent grade of commerce or *hydrogen peroxide solution* (100 Vol) diluted with 4 volumes of water.

A colourless liquid containing about 6 percent w/v of H_2O_2 ; weigh per ml. about 1.02 g.

Hydrogen Sulphide- H_2S*=34.08*

Use laboratory cylindergrade, or prepared the gas by action of *hydrochloric acid*, diluted with an equal volume of *water*, on iron sulphide, the resulting gas is washed by passing it through *water*.

A colourless, poisonous gas, which a characteristic unpleasant odour.

Hydrogen Sulphide Solution – A recently prepared, saturated solution of hydrogen sulphide in water at 20^0.
Hydrogen Sulphide solution contains about 0.45 percent w/v of H_2s.
Hydroxylamine Hydrochloride; Hydroxylamonium Chloride:- $NH_2.OH,HC1$ = 69.49.
Contains not less than 97.0 percent w/w of $NH_2.OH,HC1$

Description – Colourless crystals, or a white, crystalline powder.

Solubility – Very soluble in *water*; soluble in *alcohol*.

Free Acid – Dissolve 1.0 g in 50 ml of *alcohol*, add 3 drops of *dimethyl yellow solution* and titrate to a full yellow colour with *N sodium hydroxide*; not more than 0.5 ml of *N sodium hydroxide* is required.

Sulphated ash – Not more than 0.2 percent, Appendix 2.2.11

Assay – Weigh accurately about 0.1 g and dissolve in 20 ml of *water*, add 5 g of *ferric ammonium sulphate* dissolved in 20 ml of *water*, and 15 ml of *dilute sulphuric acid*, boil for five minutes, dilute with 200 ml of *water*, and titrate with 0.1 *N potassium permanganate*. Each ml of 0.1 *N potassium permanganate* is equivalent to 0.003475 g of $NH_2OH.HC1$.

Hydroxylamine Hydrochloride solution – Dissolve 1 g of *hydroxylamine hydrochloride* in 50 ml of *water* and add 50 ml of *alcohol* 1 ml *of bromophenol blue solution* and 0.1 *N sodium hydroxide* until the solution becomes green.

* **Indigo Carmine** C1 730 15; $C_{16}H_8N_2Na_2O_8S_2$=466.4

Analytical regent grade.

A deep blue powder, or blur granules with a coppery lustre.

Indigo Carmine Solution – To a mixture of 10 ml of *hydrochloric acid* and 990 ml of a 20 percent w/v solution of *sulphuric acid* in *water*, add sufficient indigo carmine to produce a solution which complies with the following test.

Add 10 ml to a solution 1.0 mg of *potassium nitrate* in 10 ml of *water*, add rapidly, 20 ml of *sulphuric acid* and heat to boiling; the blue colour is just discharged in one minute.

***Indian ink** – General purpose grade:

Iodine : I_2 = 253.8

Description - Heavy, bluish-black, brittle, rhombic prisms or plates with a metallic lustre; odour characteristic; volatile at ordinary temperatures.

SOLUBILITY - Very slightly soluble in *water*; soluble in *alcohol* freely soluble in *carbon disulphide* and *in chloroform in solvent ether*; *in carbon tetrachloride* and in concentrated aquous solutions of iodides.

Chloride Bromide - Triturate 3.5 g thoroughly with 35 ml of *water*, filter and decolorise the filtrate by the addition of a little *zinc powder*. To 25 ml of the filtrate so obtained, add 5 ml of *dilute ammonia solution*, and then 5 ml of *silver nitrate solution* added gradually, filter;

dilute the filtrate to 50 ml, and acidify gradually with 4 ml of *nitric acid*; the opalescence in the *limit test for chloride*, Appendix 2.3.2.

Cyanides - To 5 ml of the filtrate obtained in the test for *Chloride and bromide* add a few drops of *ferrous sulphate solution* and 1 ml of *sodium hydroxide solution*, warm gently and acidify with *hydrochloric acid*, no blue or green colour is produced.

Non-Volatile Matter - Leaves not more than 0.1 percent as residue when volatilized on a water-bath.

Assay - Weigh accurately about 0.5 g and dissolve in a solution of 1 g of *potassium iodide* in 5 ml of *water*. Dilute to 250 ml with *water*, add 1 ml of *dilute acetic acid*, and titrate with 0.1N *sodium thiosulphate*, using starch solution as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.01269 g of 1.

Storage - Store in glass-stoppered bottles or in glass or earthern-ware containers with well-waxed bungs.

Iodine, 0.IN: I=126.90; 12.69 g in 1000 ml

Dissolve about 14 g of *iodine* in a solution of 36 g of *potassium iodide* in 100 ml of water, add three drops of *hydrochloric acid*. dilute with water to 100 ml and standardize the solution as follows.

Weigh accurately about 0.15 g of *arsenic trioxide* P.S., previously dried at 1050 for one hour, and dissolve in 20 ml of *N sodium hydroxide* by warming, if necessary. Dilute with 40 ml of *water*, add two drops of *methyl orange solution* and follow with *dilute hydrochloric acid* until the yellow colour is changed to pink. Then add 2 g of *sodium bicarbonate*, dilute with 50 ml of water, and add 3 ml of *starch solution*, slowly add the *iodine solution* from a burette until a permanent blue colour is produced. Each 0.004946 g of *arsenic trioxide* is equivalent to 1 ml of 0.1 N iodine.

Iodine solution- Dissolve 2.0 g of *iodine* and 3 g of *potassium iodide* in *water* to produce 100 ml.

Kieselguhr- A natural diatomaceous earth, purified by heating with dilute hydrochloric acid, washing with water and drying.

Lactic Acid - $CH_3CHOH.COOH$-90.08
Analytical reagent grade of commerce

Lactophenol – Dissolve 20 g *phenol* in a mixture of 20 g of *lactic acid*, 40 g of *glycerol*, and 20 ml of *water*.

Lead Acctate - Sugar of lead; $(CH_3CO_2)_2Pb$, $3H_2O$=379.33

Contains not less than 99.5 percent and not more than the equivalent of 104.5 percent of $C_4H_6O_4Pb,3H_20$.

Description - Small, white, transparent, monoclinic prisms, or heavy, crystalline bases; odour, acetous, taste, sweet and astringent. Efflorescent in warm air. Becomes basic when heated.

Solubility - Freely soluble in *water*, and in *glycerin*; sparingly soluble in *alcohol*.

Water Insoluble Matter - Dissolve 1 g in 10 ml of recently boiled and cooled *water* solution is produced which is at most faintly opalescent and becomes clear on the addition of one drop of *acetic acid*.

Chloride - 1 g complies with the *limit test for chlorides*. Appendix 2.3.2.

Copper, Iron, Silver and Zinc – Dissolve 0.5 g in 10 ml of *water*, add 2 ml of *dilute sulphuric acid*, allow to stand for thirty minutes, and filter, to the filtrate add an excess of potassium ferrocyanide solution no precipitate or colour is produced.

Assay - Weigh accurately about 0.8 g and dissolve in a mixture of 100 ml of *water* and 2 ml of *acetic acid*, add 5 g of hexamine, and titrate with 0.05 *M disodium ethylenediaminetertraacetate,* using 0.2 ml of *xylenol orange solution* as indicator, until the solution becomes pale bright yellow. Each ml of 0.05 *M disodium ethylenediaminetertraacetate* is equivalent to 0.01897 g of $C_4H_6O_4Pb,3H_20$.

Storage - Preserve lead acetate in a well closed container.

Lead acetate solution- A 10 percent w/v solution of *lead acetate in carbon dioxidefree water*.

Lead nitrate: $Pb(NO_3)_2$=331.21

Contains not less than 99 percent of $Pb(NO_3)_2$

Description- Colourless or white crystals, or a white crystalline powder.

Solubility - Soluble in *water*, forming a clear, colourless solution.

Assay - Weigh accurately about 0.3 g and dissolve in 150 ml of *water*, add 5 ml of *dilute acetic acid*, heat to boiling, add a slight excess of *potassium chromate* solution, and boil gently until the precipitate becomes granular; collect the precipitate in a Gooch crucible, wash it with hot *water*, and dry to constant weight at 120^0 each g of residue is equivalent to 1.025 g of $Pb(NO_3)_2$.

Lead solution standard - See limit test for heavy metals. Appendix, 2.3.3.

Liquid paraffin- General reagent grade.
Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility -Practically insoluble in water, and in alcohol, soluble in chloroform, in solvent either and in volatile oils.

Wt. per ml. - At 25^0C, 0.860 to 0.904 g Appendix 3.1.8

Litmus- Fragments of blue pigment prepared from various species of *Rocella lacanora* or other lichens. It has a characteristic odour.

Partly soluble in water and in alcohol. Gives a red colour with acids and a blue colour with alkalies ($_P$H range, 5.0 to 8.0).

Litmus solution - Boil 25 g of coarsely powered litmus with 100 ml of *alcohol* (90 percent) under a reflux condenser for one hour, and pour away the clear liquid; repeat this operation using two successive quantities, each of 75 ml, of *alcohol* (90 percent). Digest the extracted litmus with 250 ml of water.

Litmus paper, blue - Boil 10 parts of coarsely powdered litmus under reflux for one hour with 100 parts of *alcohol*, decant the *alcohol* and discard. Add to the residue a mixture of 45 parts of alcohol and 55 parts of water. After two days decant the clear liquid. Impregnate the strips of filter paper with the extract and allow to dry the paper complies with the following test.

Sensitivity - Immerse a strip measuring 10 mmX60 mm in 100 ml of a mixture of 10 ml of 0.02 *N hydrochloric acid* and 90 ml of *water*. On shaking the paper turns red within forty five seconds.

Liquid paraffin- General reagent grade.
Liquid paraffin is a mixture of liquid hydrocarbons obtained from petroleum.

A transparent, colourless, oily liquid, free or nearly free from fluorescence by day light; odourless and tasteless when cold, and develops not more than a faint odour of petroleum when heated.

Solubility - Practically insoluble in *water*, and in *alcohol*, soluble in *chloroform*, in *solvent ether* and in volatile oils.

Wt. per ml - At 25^0, 0.860 to 0.904 g Appendix 3.1.8

Litmus paper, red - To the extract obtained in the preparation of blue litmus paper add 2 *N hydrochloric acid* drop-wise until the blue colour becomes red. Impregnate strips of filter paper with the solution and allow to dry.

The paper complies with the following test:

Sensitivity- Immerse a strip measuring 10 mmX60mm in 100 ml of 0.002 *N Sodium hydroxide*. On shaking the paper turns blue within forty-five minutes.

Magenta Basic: CI 42510: Funchsin; Rosaniline hydro-chloride;

$[(H_2NC_6H_4)_2C{:}C_6H_3(CH_3){:}\ NH_2{+}]CI=337.85$

The hydrochloride of rosaniline of such a purity that when used in the preparation of Decolourised solution of Magenta, a nearly colourless solution is obtained.

Description - Dark red powder, or green crystals with a metallic lustre.

Solubility - Soluble in *water*, giving a deep reddish-purple solution.

Sulphated Ash - Not more than 5 percent, Appendix 2.3.6

Magenta solution, Decolorized- Dissolve 1 g of *basic magnenta* in 600 ml of *water* and cool in an ice-bath; add 20 g of *sodium sulphite* dissolved in 100 ml of *water*; cool in an ice-bath and add, slowly with constant stirring, 10 ml of *hydrochloric acid*; dilute with *water* to 1000 ml.

If the resulting solution of turbid, it should be filtered and if brown in colour, it should be shaken with sufficient *decolourising charcoal* (0.2 to 0.3 g) to render it colourless and then filtered immediately. Occasionally it is necessary to add 2 to 3 ml of *hydrochloric acid*, followed by shaking, to remove the little residual pink colour. The solution resulting from any of the foregoing modifications should be slowed to stand over-night before use.

Decolourised Magenta Solution should be protected from light.

Magnesium Carbonate - Light hydrated basic grade of commerce containing 42 to 45 percent of MgO and complying with the following test.

Ammonia - Dissolve 0.50 g in 4 ml of 2 M hydrochloric acid, boil to remove carbon dioxide, and dilute with water to 95 ml. Add 5 ml of 5 M Sodium hydroxide and allow to stand for one hour. Dilute 40 ml of the clear liquid to 50 ml with water and add 2 ml of alkaline potassium-mercuric iodide solution. Any yellow colour produced is not deeper than that produced by adding 2 ml of alkaline potassium mercuric iodide solution to a mixture of 44 ml of water, 2 ml of ammonium chloride solution, 2 ml of 2 M hydrochloric acid, and 2 ml of 5 M sodium hydroxide.

Magnesium Sulphate: $MgSO_4$. $7H_2O$-246.47

Description - Colourless, crystals, usually needle-like, odourless, taste, cool, saline and bitter. Efflorescence in warm dry air.

Solubility - Freely soluble in *water*; sparingly soluble in *alcohol*. Dissolves slowly in *glycerin*.

Acidity Or Alkalinity - 1 g dissolved in 10 ml of water is neutral to *litmus solution.*

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Iron - 2 g dissolved in 20 ml of *water* complies with the *limit test for iron*, Appendix 2.3.4.

Heavy Metals - Not more than 10 parts per million, determined by method A on a solution prepared by dissolving 2 g in 10 ml of *water*, 2 ml of *dilute acetic acid* and sufficient water to make 25 ml. Appendix 2.3.3.

Zinc - Dissolve 2 g in 20 ml of *water* and acidity with 1 ml of *acetic acid*. No turbidity is produced immediately on the addition of few drops of *potassium ferrocyanide solution.*

Chloride - 1 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Loss on Ignition : Between 48 percent and 52 percent determined on 1 g by drying in an oven at 105^0 for two hours and igniting to constant weight at 400^0.

Assay - Weigh accurately about 0.3 g and dissolve in 50 ml of *water*. Add 10 ml of *strong ammonia-ammonium chloride solution*, and titrate with 0.05 *M disodium ethylenediaminetertraacetate* using 0.1 g of *mordant black II mixture as indicator*, until the

pink colour is discharged from the blue. Each ml of 0.05 *M disodium ethylenediaminetertraacetate* is equivalent to 0.00602 g of $MgSO_4$.

Storage - Store in well-closed container.

Magnesum Sulphate - $MgSO_4$. $7H_2O$ -246.8

Analytical reagent grade of commerce.

Magnesium Sulphate, Dried, $MgSO_4aq$

Dried, general reagent grade of commerce.

Magnesium sulphate solution, ammonical - Dissolve 20 g of *magnesium sulphate* and 20 g of *ammonium chloride* in 80 ml of *water,* and add 42 ml of 5 *M ammonia*. Allow to stand for a few days in a well-closed container; decant and filter.

Mercuric chloride: $HgCI_2$=271.50

Contains not less than 99.5 percent of $HgCI_2$;

Description - Heavy, colourless are white, crystalline masses, or a white crystalline a powder.

Solubility - Soluble in *water*; freely soluble in *alcohol*.

Non-Volatile Matter - When volatilized, leaves not more than 0.1 percent of residue.

Assay - Weigh accurately about 0.3 g and dissolve in 85 ml of *water* in a stopperedflask, add 10 ml of *calcium chloride solution,* 10 ml of *potassium iodide solution,* 3 ml of *formaldehyde solution* and 15 ml of *sodium hydroxide solution,* and shake continuously for two minutes. Add 20 ml of *acetic acid* and 35 ml of 0.1 *N iodine*: Shake continuously for about ten minutes, or until the precipitated mercury is completely redissolved, and titrate the excess of iodine with 0.1 *N sodium thiosulphate.* Each ml of 0.1 *N iodine* is equivalent to 0.01357 g of $HgCI_2$.

Mercuric chloride, 0.02 M

Dissolve 54.30 g of *mercuric chloride* in sufficient *water* to produce 1000 ml.

Mercuric chloride solution - A 5 percent w/v solution of *mercuric chloride* in *water*.

Mercuric oxide, Yellow: HgO = 216.59.

Contains not less than 99 percent of HgO, calculated with reference to the substance dried at 105^0 for one hour.

Description - Orange-yellow, heavy, amorphous powder; odourless, stable in air but becomes discoloured on exposure to light.

Solubility - Practically insoluble in *water* and in *alcohol*; freely soluble in dilute *hydrochloric acid* and in *dilute nitric acid*, forming colourless solutions.

Acidity for Alkalinity - Shake 1 g with 5 ml of *water* and allow to settle; the supernatant liquid is neutral to *litmus solution*.

Mercurous Salts - A solution of 0.5 g in 25 ml of *dilute hydrochloric acid* is not more than slightly turbid.

Chloride - To 0.2 g add 1g of *zinc powder* and 10 ml of *water*. Shake occasionally during ten minutes and filter; the solution complies with the *limit test for chlorides*; Appendix 2.3.2.

Sulphated Ash - When moistened with *sulphuric acid* in a silica dish and heated strongly to constant weight, leaves not more than 0.5 percent of residue.

Assay - Weigh accurately about 0.4 g dissolve in 5 ml of *nitric acid* and 10 ml of *water* and dilute with *water* to 150 ml. Titrate with 0.1 *N ammonium thiocyanate*, using *ferric ammonium sulphate solution* as indicator. Carry out the titration at a temperature not above 20^0. Each ml of 0.1 *N ammonium thiocyante* is equivalent to 0.01083 g of HgO.

Storage - Preserve yellow mercuric oxide in well-closed container, protected from light.

Mercuric Potassium Iodide

See Potassio-Mercuric iodide solution.

Mercuric Sulphate - Mercury (II) Sulphate $HgSO_4$=296.68

Contains not less than 99 percent of $HgSO_4$.

Description - A white; crystalline powder, Hydrolysis in water.

Solubility - Soluble in *dilute sulphuric acid.*

Chloride - Dissolve 2 g in a mixture of *dilute sulphuric acid* and 10 ml of *water*. Add 2 g of *zinc powder*, shake frequently for five minutes and filter. The filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Nitrate - Dissolve 0.40 g in a mixture of 9 ml of *water* and 1 ml of *dilute sulphuric acid*, add 1 ml of indigo carmine solution and 10 ml of *nitrogen free sulphuric acid* and heat to boiling, the blue colour is not entirely discharged.

Assay- Dissolve 0.6 g in a mixture of 10 ml of *dilute nitric acid* and 40 ml of *water*. Titrate with 0.1 *N ammonium thiocyanate*, using *ferric ammonium sulphate solution* as indicate. Each ml of 0.1 *N ammonium thiocyanate* is equivalent to 0.01483 g of $HgSO_4$.

Mercury Sulphate Solution - Mix 5 g of *yellow mercuric oxide* with 40 ml of *water*, and while stirring add 20 ml of *sulphuric acid*, and 40 ml of *water*, and stir until completely dissolved.

Methyl Alcohol - Methanol: CH_3OH=32.04

Description - Clear, colourless liquid with a characteristic odour.

Solubility - Miscible with *water,* forming a clear colourless liquid.

Specific Gravity - At 25^0C, not more than 0.791, Appendix 3.1.8.

Distillation Range - Not less than 95 percent distils between 64.5^0C and 65.5^0C, Appendix 3.1.1.

Refractive Index - At 20^0C, 1.328 to 1.329, Appendix 3.1.7

Acetone - Place I ml in a *Nessler Cylinder*, add 19 ml of *water*, 2 ml of a 1 percent w/v solution of 2-*nitrobenzaldehyde* in *alcohol* (50 percent), 1 ml of 30 percent w/v solution sodium hydroxide and allow to stand in the dark for fifteen minutes. The colour developed does not exceed that produced by mixing 1 ml of standard acetone solution, 19 ml of water, 2 ml of the solution of 2-*nitrobenzaldehyde* and 1 ml of the *solution of sodium hydroxide* and allowing to stand in the dark for fifteen minutes.

Acidity - To 5 ml of *carbon dioxide-free water*, and titrate with 0.1 N *sodium hydroxide* using *bromothymol blue solution* as indicator; not more than 0.1 ml is require.

Non-Volatile Matter - When evaporated on a water-bath and dried to constant weight at 105^0, leaves not more than 0.005 percent w/v of residue.

Mythyl alcohol, dehydrated - Methyl alcohol which complies with the following additional requirements. *Water* -Not more than 0.1 percent w/w.

Methylene Blue- $C_{16}H_{18}ClN_3S$, $3H_2O$. Tetramethylthionine chloride.

A dark green or bronze crystalline powder, freely soluble in water, soluble in alcohol.

Loss on drying: Not less than 18 percent and not more than 22 percent, determined by drying in an oven at 100^0 C to 105^0C.

Methylene Blue Solution - Dissolve 0.18 g of *methylene blue* in 100 ml of *water*. To 75 ml of this solution, add 5 ml of 0.1 *N sodium hydroxide* and 20 ml of *water*.

Methyl Orange - Sodium-p-dimethylamineazobenzene sulphate, $C_{14}H_{14}O_3N_3$ Sna.

An orange-yellow powder or crystalline scales, slightly soluble in cold water; insoluble in alcohol, readily soluble in hot water.

Methyl Orange Solution - Dissolve 0.1 g of *methyl orange* in 80 ml of *water* and dilute to 100 ml with alcohol.

Test for sensitivity - A mixture of 0.1 ml of the methyl orange solution and 100 ml of freshly boiled and cooled water is yellow. Not more than 0.1 of 0.1 N hydrochloric acid is required to change the colour to red.

Colour change: pH 3.0 (red) to pH 4.4 (yellow)

Methyl Red – p -Dimethylaminoazobenzene-o-carboxylic acid, $C_{15}H_{15}O_2N_3$.

A dark red powder or violet crystals, sparingly soluble in water; soluble in alcohol.

Methyl Red Solution - Dissolve 100 mg in 1.86 ml of 0.1 *N Sodium hydroxide* and 50 ml of *alcohol* and dilute to 100 ml with water.

Test for sensitivity - A mixture of 0.1 ml of the *methyl red solution* and 100 ml of freshly boiled and cooled *water* to which 0.05 ml of 0.02 *N hydrochloric acid* has been added is red.

Not more than 0.01 ml of 0.02 N sodium hydroxide is required to change the colour to yellow.

Colour change: pH 4.4(red) to pH 6.0 (yellow).

Molish's Reagent - Prepared two solutions in separate bottles, with ground glass stoppers:

A. Dissolve 2 g of ∞–naphthol in 95 percent *alcohol* and made upto 10 ml with alcohol (∞-naphthol can be replaced by *thymol* or *resorcinol*). Store in a place protected from light. The solution can be used for only a short period. B. Concentrated sulphuric acid.

Mordant Black II - See Eriochrome black T.

Mordant Balck II Mixture - *Mordant black mixture.*

A mixture of 0.2 part of mordant black 11 with 100 parts of sodium chloride. Mordant Black II Mixture should be recently prepared.

∞-**Naphthol**: I-Naphthol; $C_{10}H_7OH$=144.17

Description - Colourless or white crystals or a white, crystalline powder; odour, characteristic.

Solubility - Freely soluble in alcohol yielding not more than slightly opalescent, colourless or almost colourless solution, with no pink tint.

Melting Range - 90^0C to 96^0 C, Appendix 3.1.4.

Sulphated Ash - Not more than 0.05 percent, Appendix 2.2.11 ∞-**Nephthol**
Solution - I-Naphthol solution.

Dissolve 1 g of ∞-naphthol in a solution of 6 g of *sodium hydroxide* and 16 g of *anhydrous sodium carbonate* in 100 ml of water.

∞- naphthnol solution must be prepared immediately before use.

I-Naphthylamine - $C_{10}H_9N$=143.2-Analytical reagent grade.
Almost colourless crystals, or a white crystalline powder; melting point, about 50^0.

Naphthylamine-Sulphanilic Acid Reagent - Immediately before use mix equal volumes of solutions A and B prepared as follows.

Solution A - Dissolve 0.5 g of *sulphanilic acid* in 30 ml of 6 M *acetic acid* and dilute to 150 ml with water.

Solution B - Dissolve 0.15 g of *I-naphthylamine* in 30 ml of 6M *acetic acid* and dilute to 150 ml with water.

Nitric Acid - Contains 70 percent w/w of HNO_3 (limits, 69 to 71). About 16 N in strength.

Description - Clear, colourless, fuming liquid.

Wt. per ml. - At 20^0 C, 1.41 to 1.42 g, Appendix 3.1.8.

Copper and Zinc - Dilute I ml with 20 ml of *water*, and add a slight excess of *dilute ammonia solution*; the mixture does not become blue. Pass *hydrogen sulphide*; a precipitate is not produced.

Iron - 0.5 ml complies with the *limit test for iron*, Appendix 2.3.4.

Lead - Not more than 2 parts per million, Appendix 2.3.5.

Chloride - 5 ml neutralized with *dilute ammonia solution*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - To 2.5 ml add 10 mg of *sodium bicarbonate* and evaporate to dryness on a water-bath the residue dissolved in water, complies with the *limit test for sulphates*, Appendix 2.3.6

Sulphated Ash - Not more than 0.01 percent w/w, Appendix 2.2.11

Assay - Weigh accurately about 4 g into a stoppered flask containing 40 ml of *water*, and titrate with *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.06301 of HNO_3.

Nitric Acid, XN - Solutions of any normality XN may be prepared by diluting 63x ml of *nitric acid* to 1000 ml with *water*.

Nitric Acid, Dilute- Contains approximately 10 percent w/w of HNO_3. Dilute 106 ml of *nitric acid* to 1000 ml with *water*.

2-Nitrobenzaldehyde - 0-Nitrobenzaldehyde $NO_2C_6H_4CHO$=151.12

Description - Yellow needles, odour, resembling that of benzaldehyde.

Solubility - Soluble in *alcohol.*

Melting range - 40^0Cto 45^0C Appendix 3.1.4.

Sulphated Ash - Not more than 0.1 percent, Appendix 2.2.11

Oxalic Acid - $(CO_2H)_2$, $2H_2O$=126.07.

Contains not less than 99.5 percent of $C_2H_2O_4$, $2H_2O$, as determined by both parts of the Assay.

Description - Colourless crystals.

Solubility - Soluble in *water* and in *alcohol.*

Chloride - To 1 g dissolved in 20 ml of *water* add 5 ml of *dilute nitric acid* and 1drop of *silver nitrate solution*; no turbidity is produced.

Sulphated Ash - Not more than 0.05 percent, Appendix 2.2.11

Assay - (A) Weigh accurately about 3 g and dissolve in 50 ml of *carbon dioxide* free *water* and titrate with *N sodium hydroxide*, using *phenolphthalein solution* as indicator. Each ml of *N sodium hydroxide* is equivalent ot 0.06304 g of $C_2H_2O_4$, $2H_2O$.

(B) Weigh accurately about 3 g dissolve in *water*, and add sufficient *water* to produce 250 ml. To 25 ml of this solution add 5 ml of *sulphuric acid* previously diluted with a little *water*, and titrate at a temperature of about 70^0 with 0.1 *N potassium permanganate.* Each ml of 0.1 *N potassium permanganate* is equivalent to 0.006303 g of $C_2H_2O_4$, $2H_2O$.

Oxalic Acid, O.IN - $H_2C_2O_4$, $2H_2O$=1,6,07, 6.303 g in 100 ml.

Dissolve 6.65 g of oxalic acid in sufficient water to produce 1000 ml and standardize the solution as follows:
Pipette 30 ml of the solution into a beaker, add 150 ml of *water*, 7 ml of *sulphuric acid* and heat to about 70^0C. Add slowly from a burette freshly standardized 0.1 *N potassium permanganate* with constant stirring, until a pale-pink colour, which persists for fifteen seconds, is produced. The temperature at the conclusion of the titration should not be less than 60^0C. Each ml 0.1 *N Potassium permanganate* is equivalent to 0.006303 g of $H_2C_2O_4$, $2H_2O$.

Petroleum light - Petroleum Spirit

Description - Colourless, very volatile, highly flammable liquids obtained from petroleum, consisting of a mixture of the lower members of the paraffin series of hydrocarbons and complying with one or other of the following definitions:

Light Petroleum - (Boiling range, 30^0Cto 40^0C)
Wt. per ml. - At 20^0C, 0,620 to 0.630 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 40^0 Cto 60^0 C)
Wt. per ml. - At 20^0C, 0,630 to 0.650 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 60^0C to 80^0 C).
Wt. per ml. - At 20^0 C, 0,670 to 0.690 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 80^0 C to 100^0 C).
Wt. per ml. - At 20^0 C, 0,700 to 0.720 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 100^0 C to 120^0 C).
Wt. per ml. - At 20^0 C, 0,720 to 0.740 g, Appendix 3.1.8

Light Petroleum - (Boiling range, 120^0 C to 160^0 C).
Wt. per ml. - At 20^0 C, about 0.75g, Appendix 3.1.8

Non-Volatile Matter- When evaporated on a water-bath and dried at 105^0, leaves not more than 0.002 percent w/v of residue.

Phenacetin, $C_{10}H_{13}O_2N$=179.2

Analytical reagent grade.

White, glistening, crystalline seeds, or a fine white, crystalline powder; odourless; taste, slightly bitter
Melting range - 134^0 C to 136^0 C

Phenol - C6H5OH=94.11.

Analytical reagent grade.

Caustic, deliquescent crystals with a characteristic odour; freezing point, about 41^0 C.

Phenol Liquified - General reagent grade

A solution in water containing about 80 percent w/w of C_6H_6O.

Phenol Red - $C_{19}H_{14}O_5S$. Phenolsulphonphthalein.

A light to dark red crystalline powder, very slightly soluble in water, slightly soluble in alcohol soluble in dilute alkaline solutions.

Phenol Red Solution - Dissolve 0.01 g of *phenol red* in 2.82 ml of o.1 *N sodium hydroxide* and 20 ml of *alcohol* and dilute to 100 ml with *water*. Test for sensitivity: A mixture of 0.1 ml of the *phenol red solution* in 100 ml of freshly boiled and cooled water is yellow. Not more than 0.1 ml of 0.02 *N sodium hydroxide* is required change the colour to red-violet.

Colour change- pH 6.8 (yellow) to pH 8.4 (red-violet).

Phenolphthalein - $C_{20}H_{14}O_4$.

A white to yellowish-white powder, practically insoluble in *water*, soluble in alcohole.

Phenolphthalein Solution –Disolve, 0.10g in 80 ml of alcohol and dilute to 100 ml with water.

Test for sensitivity - To 0.1 ml of the *phenolphthalein solution* add 100 ml of freshly boiled and cooled water, the solution is colourless. Not more than 0.2 ml of 0.02 *N sodium hydroxide* is required to change the colour to pink.

Colour change- pH 8.2 (colourless) to pH 10.0 (red).

Phloroglucinol - 1:3:5- Trihydroxybenzene, $C_6H_3(OH)_3$, $2H_2O$.

Description - White or yellowish crystals or a crystalline powder.

Solubility - Slightly soluble in water; soluble in alcohol, and in solvent ether.

Melting Range - After drying at 110^0C for one hour, 215^0C to 219^0C, Appendix 3.1.4.

Sulphated Ash - Not more than 0.1 percent, Appendix 2.2.11

Phloroglucinol Solution of - A I percent w/v solution of *phloroglucinol* in *alcohol* (90 percent).

Phosphoric Acid - H_3PO_4=98.00

(Orthophosphoric Acid; Concentrated Phosphoric Acid).

Description - Clear and colourless syrupy liquid. Corrosive.

Solubility - Miscible with water and with *alcohol*.

Hypophosphorous and Phosphorous Acids - To 0.5 ml add 10 ml of water and 2 ml of *silver nitrate solution* and heat on a water-bath for five minutes; the solution shows no change in appearance.

Alkali Phosphates - To 1 ml in a graduated cylinder add 6 ml of *solvent ether* and 2 ml of *alcohol*; no turbidity is produced.

Chloride - 1 ml complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 0.5 ml complies with the *limit test for sulphate*, Appendix 2.3.6

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 10 parts per million, determined by Method A on a solution prepared by diluting 1.2 ml with 10 ml of *water*, neutralizing with *dilute ammonia solution*, adding sufficient *dilute acetic acid* to render the solution acidic and finally diluting to 25 ml with water, Appendix 2.3.3.

Iron - 0.1 ml complies with the limit test for iron, Appendix 2.3.4.

Aluminium and Calcium - To 1 ml add 10 ml of water and 8 ml of *dilute ammonia solution* the solution remains clear.

Assay - Weigh accurately about 1 g and mix with a solution of 10 g of *sodium chloride* in 30 ml of water. Titrate with *N sodium hydroxide*, using *phenolphthalein* solution as indicator. Each ml of N sodium hydroxide is equivalent to 0.049 g of H_3PH_4.

Storage - Store in a well-closed glass containers.

Phosphoric Acid, xN

Solutions of any normality, xN may be prepared by diluting 49Xg of *phosphoric acid* with water to 1000 ml.

Phosphoric Acid, Dilute
Contains approximately 10 percent w/v of H_3PO_4.

Dilute 69 ml of *phosphoric acid* to 1000 ml with water.

Piperazine Hydrate - $C_4H_{10}N_2$, $6H_2O$=194.2.

General reagent grade of commerce.

Colourless, glossy, deliquescent crystals, melting point, about 44^0.

Potassium Antimonate - KSb_{03}, $3H_2O$=262.90
Contains not less than 40 percent of Sb.

Description - White, crystalline powder.

Solubility - White, crystalline Sparingly soluble in *water* very slowly soluble in cold, but rapidly soluble on boiling.

Assay - Weigh accurately about 0.3 g, and dissolve in 100 ml of water, add 2 ml of dilute hydrochloric acid, and pass in *hydrogen sulphide* until the antimony is completely precipitated. Add 2 ml of *hydrochloric acid* and again pass in *hydrogen sulphide*. Boil, filter, was the precipitate with hot water saturated with *hydrogen sulphide*, and dissolve the precipitate in 25 ml of *hydrochloric acid*. Boil to remove *hydrogen sulphide*, and dilute to 50 ml with *water*. Add 2 g *of sodium potassium tartrate*, neutralize carefully with *sodium carbonate*, add 2 g sodium bicarbonate, and titrate with 0.1 *N iodine*, using *starch solution* as indicator. Each ml of 0.1 *N iodine* is equivalent to 0.006088 g Sb.

Potassium Antimonate Solution - Boil 2 g of *potassium antimonate* with 95 ml of *water* until dissolved. Cool rapidly and add 50 ml of *potassium hydroxide solution* and 5 ml of *N sodium hydroxide*. Allow to stand twenty-four hours, filter and add sufficient water to produce 150 ml.

Sensitivity to Sodium - To 10 ml add 7 ml of 0.1 *M sodium chloride*, a white, crystalline precipitate is formed within fifteen minutes.

Potassium Antimonate Solution should be freshly prepared.

Potassium Bisulphate - Potassium Hydrogen Sulphate; $KHSO_4$=136.16.

Contains not less than 98.0 percent and not more than the equivalent of 102 percent of $KHSO_4$.

Description - Fused, white lumps, hygroscopic.

Solubility - Very soluble in *water*, giving an acid solution.

Iron - 2 g complies with the *limit test for iron*, Appendix 2.3.4.

Assay - Weigh accurately about 4.5 g, dissolve in 50 ml of *water* and titrate with *N sodium hydroxide* using *methyl red solution* as indicator. Each ml of *N sodium hydroxide* is equivalent to 0.1362 g of $KHSO_4$.

Potassium Bromate - $KbrO_3$=167.00

Contains not less than 99.8 percent of $KbrO_3$, calculated with reference to the substance dried to constant weight at 105^0C.

Description - White, crystalline powder.

Solubility - Soluble in *water*, freely soluble in boiling *water*, almost insoluble in *alcohol*.

Acidity or Alkalinity - A 5 percent w/v solution in *water* is clear and colourless and neutral to *litmus solution*.

Sodium - A warm 10 percent w/v solution in *water*, tested on platinum wire, imparts no distinct yellow colour to a colourless flame.

Bromide - To 20 ml of a 5 percent w/v solution in *water*, add 1 ml of 0.1 N *sulphuric acid*: no yellow colour develops within one minute, comparison being made with a control solution to which no acid has been added.

Sulphate - 1 g complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1 g, dissolve in *water* and dilute to 250 ml. To 25 ml of this solution add 3 g of *potassium iodide* and 10 ml of *hydrochloric acid*, dilute with 100 ml of water and titrate with 0.1 *N sodium thiosulphate*, using starch solution as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.002783 g of $KBrO_3$.

Potassium Bromide - Kbr=119.0.

Analytical reagent grade.

Potassium Bromide - 0.001 N.

Dissolve 0.1190 g of *potassium bromide* in sufficient *water* to produce 1000 ml.

Potassium Carbonate - K_2CO_3=138.21.
Contains not less than 98 percent of K_2CO_3.

Description - White, granular powder, hygroscopic.

Solubility - Very soluble in water, forming a clear solution.

Iron - 1 g with the addition of 1.5 ml of *hydrochloric acid*, complies with the *limit test for iron*, Appendix 2.3.4.

Chloride - 1 g with the addition of 5 ml of *nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 1 g, with the addition of 5 ml of *hydrochloric acid*, complies with the *limit test for sulphates*, Appendix 2.3.6

Chromium - To 25 ml of a 2 percent w/v solution in *water*, add about 0.2 g of *sodium peroxide* and boil gently for five minutes, cool, acidify with dilute sulphuric acid and add 2 drops of *diphenylcarbazide solution*; no violet colour is produced.

Assay - Weigh accurately about 3 g, dissolve in 50 ml of *water*, and titrate with *N hydrochloric* acid using *bromophenol blue solution* as indicator. At the first colour change, boil the solution, cool, and complete the titration. Each ml of *N hydrochloric acid* is equivalent to 0.06911 g of K_2CO_3.

Potassium Carbonate, Anhydrous - Potassium carbonate dried at 135^0C for two hours spread in a thin layer and then cooled in a desiccator.

Potassium Chlorate - $KC10_3$=122.55.
Contains not less than 99 percent of $KC10_3$.

Description - White powder or colourless crystals. In admixture with organic or readily oxidisable substances, it is liable to explode if heated or subjected to percussion or trituration.

Solubility - Soluble in *water*, and in *glycerin*, practically insoluble in alcohol.

Lead - Not more than 10 parts per million, Appendix 2.3.5.

Chloride - 0.5 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 0.5 g complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 0.3 g and dissolve in 10 ml of *water* in a stopperedflask, add 1 g of *sodium nitrate*, dissolved in 10 ml *water* and then 20 ml of *nitric acid*; stopper the flask and allow to stand for ten minutes; add 100 ml of water and sufficient *potassium permanganate* solution to produce a permanent pink colour; decolorise by the addition of trace of *ferrous sulphate* and add 0.1 g of *urea*. Add 30 ml of 0.1 *N silver nitrate*, filter, wash with water and titrate the filtrate and washing with 0.1 *N ammonium thiocyanate* using *ferric ammonium sulphate solution* as indicator. Each ml of 0.1 *N silver nitrate* is equivalent to 0.01226 g of $KC10_3$.

Potassium Chloride - KC1=74.55 Analytical reagent grade.

Potassium Chromate - K_2CrO_4=194.2 Analytical reagent grade.

Potassium Chromate Solution - A 5 percent w/v solution of potassium chromate.

Gives a red precipitate with *silver nitrate* in neutral solutions.

Potassium Cupri-Tartrate Solution - Cupric Tatrate Alkaline Solution: Fehling's Solution.

A. **Copper Solution** - Dissolve 34.66 g of carefully selected small crystals of **copper sulphate**, showing no trace of efflorescence or of adhering moisture, in sufficient water to make 500 ml. Keep this solution in small, well-stoppered bottles.
B. **Alkaline Tartrate Solution** - Dissolve 176 g of sodium *potassium tartrate* and 77 g of *sodium hydroxide* in sufficient water to produce 500 ml.

Mix equal volumes of the solutions No. 1 and No. 2 at the time of using.

Potassium Cyanide - KCN=65.12.

Contains not less than 95 percent of KCN.

Description - White, crystalline powder, gradually decomposing on exposure to air.

Solubility - Readily soluble in *water*, forming a clear, colourless solution.

Heavy Metals - To 20 ml of a 5 percent w/v solution in *water*, add 10 ml of *hydrogen sulphide solution*; no darkening is produced immediately or on the addition of 5 ml of *dilute hydrochloric acid.*

Assay - Weigh accurately about 0.5 g and dissolve in 50 ml of *water*, add 5 ml of *dilute ammonia solution* and 1 drop of *potassium iodide solution*; titrate with 0.1 *N silver nitrate* until a faint permanent turbidity appears. Each ml of 0.1 *N silver nitrate* is equivalent to 0.01302 g of KCN.

Potassium Cyanide Solution - A 10 percent w/v solution of *potassium cyanide* in *water*.

Potassium Cyanide Solution, Lead-free - Weigh accurately about 10 g of *potassium cyanide* and dissolve in 90 ml of water, add 2 ml of *hydrogen peroxide solution*, allow to stand for twenty-four hours, and make up to 100 ml with *water*. It complies with the following tests:

Mix 2 ml with 5 ml of *lead-free ammonia solution* and 40 ml of water, and add 5 ml of standard lead solution; no darkening is produced.

Potassium Dichromate - $K_2Cr_2O_7$=294.18.

Contains not less than 99.8 percent of $K_2Cr_2O_7$.

Description - Orange-red crystals or a crystalline powder.

Solubility - Soluble in *water*.

Chloride - To 20 ml of a 5 percent w/v solution in *water* and 10 ml *nitric acid*, warm to about 50^0C and add a few drops of *silver nitrate solution*; not more than a faint opalescence is produced.

Assay - Carry out the Assay described under Potassium Chromate, using 2 g. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.004904 g of $K_2Cr_2O_7$.

Potassium Dichromate Solution - A 7 percent w/v *solution of potassium dichromate* in *water*.

Potassium Dichromate Solution, 0.1N: $K_2Cr_2O_7$=294.18, 4.903 g in 1000 ml.

Weigh accurately 4.903 g of *potassium dichromate* P.S. previously powdered and dried at 20^0 for four hours and dissolve in sufficient *water* to produce 1000 ml.

Potassium Dihydrogen Phosphate - KH_2PO_4=136.1

Analytical reagent grade of commerce.

Potassium Ferricyanide - $K_3Fe(CN)_6$=329.25

Contains not less than 99 percent of $K_3Fe(CN)_6$.

Description - Ruby-red crystals.

Solubility - Very soluble in *water*.

Ferrocyanide - Rapidly wash 1 g with *water*, then dissolve in 100 ml of water and add 1 drop of *ferric ammonium sulphate solution*; no blue colour is produced.

Assay - Weigh accurately about 1 g and dissolve in 50 ml of *water* add 5 g of *potassium iodide* and 3 g of *zinc sulphate*, and titrate the liberated iodine with 0.1 N *sodium thiosulphate*, using *starch solution*, added towards the end of the titration, as indicator. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.03293 g of $K_3Fe(CN)_6$.

Potassium Ferricyanide Solution - Wash about 1 g of potassium ferricyanide crystals with a little water, and dissolve the washed crystals in 100 ml of water.

Potassium Ferricyanide solution must be freshly prepared.

Potassium Ferrocyanide - $K_4Fe(CN)_6, 3H_2O$=422.39

Contains not less than 99 percent of $K_4Fe(CN)_6, 3H_2O$.

Description - Yellow, crystalline powder.

Solubility: Soluble in water.

Acidity or Alkalinity: A 10 percent w/v solution in *water* is neutral to litmus paper.

Assay: Weigh accurately about 1 g and dissolve in 200 ml of *water*, add 10 ml of *sulphuric acid* and titrate with 0.1 *N Potassium permanganate*. Each ml of 0.1 *N potassium permanganate* is equivalent to 0.04224 g of $K_4Fe(CN)_6, 3H_2O$.

Potassium Ferrocyanide Solution: A 5 percent w/v solution of *potassium ferrocyanide* in *water*.

Potassium Hydrogen Phthalate: $CO_2H.C_6H_4.CO_2K$=204.22.

Contains not less than 99.9 percent and not more than the equivalent of 100.1 percent of $C_8H_5O_4K$ calculated with reference to the substance dried at 110^0C for one hour.

Description: White, crystalline powder.

Solubility: Slowly soluble in *water*, forming clear, colourless solution.

Acidity: A 2 percent w/v solution in *carbon dioxide-free water* gives with *bromophenol blue solution* the grey colour indicative of pH 4.0.

Assay: Weigh accurately about 9 g, dissolve in 100 ml of *water* and titrate with *N sodium hydroxide* using phenolphthalein solution as indicator. Each ml of *N. sodium hydroxide* is equivalent to 0.2042 g of $C_8H_5O_4K$.

Potassium Hydrogen Phthalate, 0.02 M

Dissolve 4.084 g of *potassium hydrogen phthalate* in sufficient *water* to produce 1000 ml.

Potassium Hydrogen Phthalate, 0.2 M

Dissolve 40.84 g of potassium hydrogen phthalate in sufficient water to produce 1000 ml.

Potassium Hydroxide: Caustic Potash: KOH=56.11

Contains not less than 85 percent of total alkali, calculated as KOH and not more than 4 percent of K_2CO_3.

Description - Dry, white sticks, pellets or fused or fused mass; hard, brittle and showing a crystalline fracture; very deliquescent; strongly alkaline and corrosive.

Solubility - Freely soluble in *water*, in *alcohol* and in *glycerin*; very soluble in boiling *ethy alcohol*.

Aluminium, iron and matter insoluble in hydrochloric acid - Boil 5 g with 40 ml of *dilute hydrochloric acid*, cool, make alkaline with *dilute ammonia solution*, boil, filter, and wash the residue with a 2.5 percent w/v solution of *ammonium nitrate*; the insoluble residue, after ignition to constant weight, weighs not more than 5 mg.

Chloride - 0.5 g dissolved in water with the addition of 1.6 ml of *nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Heavy Metals - Dissolve 1 g in a mixture of 5 ml of *water* and 7 ml of *dilute hydrochloric acid*. heat to boiling, add 1 drop of *phenolphthalein solution* and *dilute ammonia solution*

dropwise to produce a faint pink colour. Add 2 ml of *acetic acid* and *water* to make 25 ml; the *limit of heavy metals* is 30 parts per million, Appendix 2.3.3.

Sulphate - Dissolve 1 g in *water* with the addition of 4.5 ml of *hydrochloric acid*; the solution complies with the *limit test for sulphates*, Appendix 2.3.6

Sodium - To 3 ml of a 10 percent w/v solution add 1 ml of water, 1.5 ml of *alcohol*, and 3 ml of *potassium anti-monate solution* and allow to stand; no white crystalline precipitate or sediment is visible to the naked eye within fifteen minutes.

Assay - Weigh accurately about 2 g, and dissolve in 25 ml of *water*, add 5 ml of *barium chloride solution*, and titrate with *N hydrochloric acid*, using *phenolphthalein solution* as indicator. To the solution in the flask add *bromophenol blue solution*, and continue the titration with *N hydrochloric acid*. Each ml of *N hydrochloric acid*, used in the second titration is equivalent to 0.06911 g of K_2CO_3. Each ml of *N hydrochloric acid*, used in the combined titration is equivalent to 0.05611 g of total alkali, calculated as KOH.

Storage - Potassium Hydroxide should be kept in a well-closed container.

Potassium Hydroxide, xN

Solution of any normality, xN, may be prepared by dissolving 56.11x g of *potassium hydroxide* in *water* and diluting to 1000 ml.

Potassium Hydroxide Solution - Solution of Potash.

An aquous solution of *potassium hydroxide* containing 5 percent w/v of total alkali, calculate as KOH (limits, 4.75 to 5.25).

Assay - Titrate 20 ml with *N sulphuric acid*, using solution of methyl orange as indicator. Each ml of *N sulphuric acid* is equivalent to 0.05611 g of total alkali, calculated as KOH.

Storage - *Potassium hydroxide* solution should be kept in a well-closed container of lead-free glass or of a suitable plastic.

Potassium Iodate - KIO_3=214.0

Analytical reagent grade.

Potassium Iodate Solution - A 1 percent w/v solution of potassium iodate in water.

Potassium Iodate, 0.05M: KIO_3=214.00; 10.70 g in 1000 ml.

Weigh accurately 10.700 g of *potassium iodate* P.S., previously dried at 110^0 to constant weight, in sufficient water to produce 1000 ml.

Potassium Iodide - KI=166.00

Description - Colourless crystals or white powder; odourless, taste, saline and slightly bitter.

Solubility - Very soluble in *water* and in glycerin; soluble in *alcohol*.

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 10 parts per million, determined on 2 g by Method A, Appendix 2.3.3.

Barium - Dissolve 0.5 g in 10 ml of *water* and add 1 ml of *dilute sulphuric acid*; no turbidity develops within one minute.

Cyanides - Dissolve 0.5 g in 5 ml of warm water, add one drop of *ferrous sulphate solution* and 0.5 ml of *sodium hydroxide solution* and acidify with *hydrochloric acid*; no blue colour is produced.

Iodates - Dissolve 0.5 g in 10 ml of freshly boiled and cooled *water*, and add 2 drops of *dilute sulphuric acid* and a drop of *starch solution*; no blue colour is produced within two minutes.

Assay - Weigh accurately about 0.5 g dissolve in about 10 ml of *water* and add 35 ml of *hydrochloric acid* and 5 ml of *chloroform*. Titrate with 0.05 *M potassium iodate* until the purple colour of iodine disappears from the *chloroform*. Add the last portion of the iodate solution drop wise and agitate vigorously and continuously. Allow to stand for five minutes. If nay colour develops in the chloroform layer continue the titration. Each ml of 0.05 *M potassium iodate* is equivalent to 0.0166 mg of KI.

Storage - Store in well-closed containers.

Potassium Iodide, M - Dissolve 166.00 g of *potassium iodide* in sufficient *water* to produce 1000 ml.

Potassium Iodide and Starch Solution - Dissolve 10 g *potassium iodide* in sufficient water to produce 95 ml and add 5 ml of *starch solution*.

Potassium iodide and *starch solution* must be recently prepared.

Potassium Iodide Solution - A 10 percent w/v solution of *potassium iodide* in *water*.

Potassium Indobismuthate Solution - Dissolve 100 g of tartaric acid in 400 ml of *water* and add 8.5 g of *bismuth oxynitrate*. Shake during one hour, add 200 ml of a 40 percent w/v solution of potassium iodide, and shake well. Allow to stand for twenty four hours and filter.

Potassium Iodobismuthate Solution, Dilute - Dissolve 100 g of *tartaric acid* in 500 ml of *water* and add 50 ml of *potassium iodobismuthate solution*.

Potassium Mercuri-Iodide Solution - Mayer's Reagent.

Add 1.36 g of *mercuric chloride* dissolved in 60 ml of *water* to a solution of 5 g of *potassium iodide* in 20 ml of *water* mix and add sufficient water to produce 100 ml.

Potassium Mercuri-Iodide Solution, Alkaline (Nessler's Reagent)

To 3.5 g of *potassium iodide* add 1.25 g of *mercuric chloride* dissolved in 80 ml of *water*, add a cold saturated solution of *mercuric chloride* in *water*, with constant stirring until a slight red precipitate remains. Dissolve 12 g of *sodium hydroxide* in the solution, add a little more of the cold saturated solution of *mercuric chloride* and sufficient *water* to produce 100 ml. Allow to stand and decant the clear liquid.

Potassium Nitrate - KNO_3=101.1 Analytical reagent grade.

Potassium Permanganate - KM_nO_4=158.03
Anti-infective (topical)

Description - Dark purple, slender, prismatic crystals, having a metallic lustre, odourless, taste, sweet and astringent.

Solubility - Soluble in *water*; freely soluble in *boiling water.*

Chloride and Sulphate - Dissolve 1 g in 50 ml of *boiling water*, heat on a water-bath, and add gradually 4 ml or a sufficient quantity of *alcohol* until the meniscus is colour-less; filter. A 20 ml portion of the filtrate complies with the *limit test for chloride*. Appendix 2.3.2. and another 20 ml portion of the filtrate complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 0.8 g, dissolve in *water* and dilute to 250 ml. Titrate with this solution 25 ml of 0.1 *N oxalic acid* mixed with 25 ml of water and 5 ml of *sulphuric*

acid. Keep the temperature at about 70^0 throughout the entire titration. Each ml of 0.1 *N oxalic acid* is equivalent to 0.00316 g of KM_nO_4.

Storage - Store in well-closed containers.

Caution - *Great care should be observed in handling potassium permanganate, as dangerous explosions are liable to occur if it is brought into contact with organic or other readily oxidisable substance, either in solution or in the dry condition*.

Potassium Permanganate Solution - A 1 percent w/v solution of potassium permanganate in water.

Potassium permanganate 0.1 N Solution - 1158.03; 3.161 g in 1000 ml.

Dissolve about 3..3 g of *potassium permanganate* in 1000 ml of *water*, heat on waterbath for one hour and allow to stand for two days. Filter through glass wool and standardize the solution as follows:-

To an accurately measure volume of about 25 ml of the solution in a glass stoppered flask add 2 g of *potassium iodide* followed by 10 ml of N Sulphuric acid. Titrate the liberated iodine with standardized 0.1 *N sodium thiosulphate*, adding 3 ml of *starch solution* as the end point is approached. Correct for a blank run on the same quantities of the same reagents. Each ml of 0.1 *N sodium thiosulphate* is equivalent to 0.003161 g of KM_nO_4.

Potassium Tetraoxalate - $KH_3 (C_2O_4) 2H_2O$=254.2

Analytical reagent grade of commerce.

Potassium thiocyanate - KCNS=97.18

Analytical reagent grade.

Purified water - H_2O=18.02

Description - Clear, colourless liquid, odourless, tasteless.

Purified water is prepared from potable water by distillation, ion-exchange treatment, reverse osmosis or any other suitable process. It contains no added substances.

pH: Between 4.5 and 7.0 determined in a solution prepared by adding 0.3 ml of a saturated solution of *potassium chloride* to 100 ml of the liquid being examined, Appendix 3.1.3.

Carbon Dioxide - To 25 ml add 25 ml of *calcium hydroxide solution*, no turbidity is produced.

Chloride - To 10 ml add 1 ml of dilute *nitric acid* and 0.2 ml of *silver nitrate solution*; no opalescence is produced.

Sulphate - To 10 ml add 0.1 ml of *dilute hydrochloric acid* and 0.1 ml of *barium chloride solution*: the solution remains clear for an hour.

Nitrates and Nitrites - To 50 ml add 18 ml of acetic acid and 2 ml of *naphthylaminesulphanilic acid* reagent. Add 0.12 g of *zinc* reducing mixture and shake several times. No pink colour develops within fifteen minutes.

Ammonium - To 20 ml add 1 ml of *alkaline potassium mercuri-iodide solution* and after five minutes view in a Nessler cylinder placed on a white tile; the colour is not more intense than that given on adding 1 ml of *alkaline potassium mercuri-iodide solution* to a solution containing 2.5 ml of *dilute ammonium chloride solution* (Nessler's) and 7.5 ml of the liquid being examined.

Calcium - To 10 ml add 0.2 ml of *dilute ammonia solution* and 0.2 ml of *ammonium oxalate solution*; the solution remains clear for an hour.

Heavy Metals - Adjust the pH of 40 ml to between 3.0 and 4.0 with *dilute acetic acid*, add 10 ml of freshly prepared *hydrogen sulphide solution* and allow to stand for ten minutes; the colour of the solution is not more than that of a mixture of 50 ml of the liquid being examined and the same amount of *dilute acetic acid* added to the sample.

Oxidisable matter - To 100 ml add 10 ml of *dilute sulphuric acid* and 0.1 ml of 0.1 *N potassium permanganate* and boil for five minutes. The solution remains faintly pink.

Total Solids - Not more than 0.001 percent w/v determined on 100 ml by evaporating on a water bath and drying in an oven at 105^0C for one hour.

Storage - Store in tightly-closed containers.

Resorcional - Benzene-1, 3 diol; $C_6H_4 (OH)_2$=110.1 Analytical reagent grade.
Colourless crystals or crystalline powder, melting point about 111^0C.

Resorcinol Solution - Shake 0.2 g of resorcinol with 100 ml of toluene until saturated and decant.

Safranine - CI 50240: Basic red 2 Microscopical staining grade.

A reddish-brown powder.

Safranine Solution - Saturated solution of *Safranine O* in *ethanol* (70 percent). Seasame oil

Description - A pale yellow oil.

Solubility - Slightly soluble in alcohol; miscible with *chloroform*, with solvent *ether with light petroleum* (b.p. 40^0C to 60^0C) and with carbon disulpide.

Refractive Index - At 40^0C, 1.4650 to 1.4665, Appendix 3.1.7

Wt. per ml. - At 25^0C, 0.916 to 0.921 g; Appendix 3.1.8

Storage - Preserve seasame oil in a well-closed container protected from light, and avoid exposure to excessive heat.

Silver Carbonate - $Ag_2 CO_3$=214

Prepared from *silver nitrate* and soluble *carbonate solution*. Light yellow powder when freshly precipitated, but becomes darker on drying and on exposure to light.

Silica Gel - Partially dehydrated, polymerized, colloidal silicic acid containing cobalt chloride as an indicator.

Description - Blue granules, becoming pink when the moisture absorption capacity is exhausted.

Silica Gel absorbs about 30 percent of its weight of water at 20^0 C. Its absorptive capacity may be regenerated by heating at 150^0 C for two hours.

Silver Nitrate - $AgNO_3$=169.87

Description - Colourless crystals or white crystalline powder; odourless, taste, bitter and metallic.

Solubility - Very soluble in *water*, sparingly soluble in *alcohol*; slightly soluble in *solvent ether*.

Clarity and colour of solution - A solution of 2 g in 20 ml of water is clear and colourless.

Bismuth, copper and lead - To a solution of 1 g in 5 ml of *water*, add a slight excess of *dilute ammonia solution*: the mixture remains clear and colourless.

Foreign substances - To 30 ml of a 4 percent w/v solution add 7.5 ml of 2N *hydrochloric acid*, shake vigorously, filter and evaporate 10 ml of the filtrate to dryness on a water-bath; the residue weighs not more than 1 mg.

Assay - Weigh accurately about 0.5 g and dissolve in 50 ml of water, add 2 ml of nitric acid, and titrate with 0.1 *N ammonium thiocyanate*, using ferric *ammonium sulphate solution* as indicator. Each ml 0.1 *N ammonium thiocyanate* is equivalent to 0.01699 g of $AgNO_3$.

Storage - Store in tightly-closed, light-resistant containers.

Silver Nitrate Solution - A freshly prepared 5 percent w/v solution of silver nitrate in water.

Silver Nitrate - 0.1N: $AgNO_3$=169.87; 16.99 g in 1000 ml. Dissolve about 17 g in sufficient *water* to produce 1000 ml and standardize the solution as follows.

Weigh accurately about 0.1 g of *sodium chloride* P.S. previously dried at 110^0C for two hours and dissolve in 5 ml of *water*. Add 5 ml of *acetic acid*, 50 ml of *methyl alcohol* and three drops of eosin solution is equivalent to 1 ml of 0.1 *N silver nitrate*.

Sodium Bicarbonate - $NaHCO_3$=84.01

Description - White, crystalline powder or small, opaque, monoclinic crystals; odourless, taste saline.

Solubility - Freely soluble in *water*; practically insoluble in *alcohol*.

Carbonate - pH of a freshly prepared 5 percent w/v solution in *carbon dioxide-free water*, not more than 8.6, Appendix 3.1.3.

Aluminium, calcium and insoluble matter - Boil 10 g with 50 ml of *water* and 20 ml of *dilute ammonia solution*, filter, and wash the residue with *water*; the residue, after ignition to constant weight, not more than 1 mg.

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Iron - Dissolve 2.5 g in 20 ml of *water* and 4 ml of *iron-free* hydrochloric *acid*, and dilute to 40 ml with *water;* the solution complies with the *limit test for iron*, Appendix 2.3.4.

Heavy Metals - Not more than 5 parts per million, determined by Method A on a solution prepared in the following manner:

Mix 4 g with 5 ml of *water* and 10 ml of *dilute hydrochloric acid*, heat to boiling, and maintain the temperature for one minute. Add one drop of phenolphthalein solution and sufficient ammonia solution drop wise to give the solution a faint pink colour. Cool and dilute to 25 ml with *water*, Appendix 2.3.3.

Chlorides - Dissolve 1 g in *water* with the addition of 2 ml of *nitric acid*; the solution complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphates - Dissolve 2 g in water with the addition of 2 ml of *hydrochloric acid*; the solution complies with *the limit test for sulphates*, Appendix 2.3.6

Ammonium Compounds - 1 g warmed with 10 ml of *sodium hydroxide solution* does not evolve ammonia.

Assay - Weigh accurately about 1 g dissolve in 20 ml of *water*, and titrate with 0.5 *N sulphuric acid* using *methyl orange solution* as indicator. Each ml of 0.5 *N sulphuric acid* is equivalent to 0.042 g of $NaHCO_3$.

Storage - Store in well-closed containers.

Sodium Bicarbonate Solution - A 5 percent w/v *solution of sodium bicarbonate* in water.

Sodium Bisulphite - Consists of *sodium bisulphite* ($NaHSO_3$) and *sodium metabisulphite* ($Na_2S_2O_3$) in varying proportions. If yields not less than 58.5 percent and not more than 67.4 percent of SO_2.

Description - White or yellowish-white crystals or granular powder, odour of sulphur dioxide. It is unstable in air.

Solubility - Freely soluble in *water*, slightly soluble in *alcohol*.

Assay - Weigh accurately about 0.2 g and transfer to a glass-stoppered flask and 50 ml of 0.1 *N iodine* and insert the stopper of the flask. Allow to stand for five minutes, add 1 ml of *hydrochloric acid*, and titrate the excess of iodine with 0.1 *N sodium thiosulphate*, using *starch solution* as indicator added towards the end of the titration. Each ml of 0.1 *N iodine* is equivalent to 0.003203 g of SO_2.

Storage: Preserve *Sodium Bisulphite* in tightly-closed containers in a cool place.

Sodium Bisulphite Solution - Dissolve 10 g of sodium bisulphite in sufficient *water* to make 30 ml.

Sodium Bisulphite Solution must be freshly prepared.

Sodium Carbonate - Na_2CO_3. $10H_2O$=286.2
Analytical reagent grade.

Sodium Chloride - NaCI=58.44

Analytical reagent grade.

Sodium Cobaltinitrite - $Na_2CO(NO_2)_6$=403.94

Description - An orange-yellow powder.

Solubility - Readily soluble in *water*, forming a clear orange-red solution.

Potassium - Dissolve 3 g in 10 ml of *water*, add the solution to a mixture of 5 ml of water and 2 ml of dilute *acetic acid*, and allow to stand for one hour; no precipitate is produced.

Sodium Cobaltinitrite Solution - A 30 percent w/v solution of *sodium cobaltinitrite in water*.

Sodium Diethyldithiocarbamate - $(C_2H_5)_2$, N. CS.SNa, $3H_2O$=225.30

Description - White or colourless crystals.

Solubility - Readily soluble in water, yielding a colourless solution.

Sensitivity - Add 10 ml of a 0.1 percent w/v solution to 50 ml of *water* containing 0.002 mg of copper previously made alkaline with *dilute ammonia solution*. A yellowishbrown colour should be apparent in the solution when compared with a blank test containing no copper.

Sodium Diethyldithiocarbamate Solution - A 0.1 percent w/v solution of *sodium diethyldithiocarbamate* in *water*.

Sodium Hydroxide - NaOH=40.00

Description - White sticks, pellets, fused masses, or scales; dry, hard brittle, and showing a crystalline fracture, very deliquescent; strongly alkaline and corrosive.

Solubility - Freely soluble in water and in alcohol.
Aluminium, iron and matter insoluble in hydrochloric acid: Boil 5 g with 50 ml of *dilute hydrochloric acid*, cool, make alkaline with *dilute ammonia solution*, boil, filter, and wash

with a 2.5 percent w/v solution of *ammonium nitrate*; the insoluble residue after ignition to constant weight weighs not more than 5 mg.

Arsenic - Not more than 4 parts per million, Appendix 2.3.1.

Heavy Metals - Not more than 30 parts per million, determined by Method A, Appendix 2.3.3. on a solution prepared by dissolving 0.67 g in 5 ml of *water* and 7 ml of 3 *N hydrochloric acid*. Heat to boiling, cool and dilute to 25 ml with water.

Potassium - Acidify 5 ml of a 5 percent w/v solution with *acetic acid* and add 3 drops of *sodium cobaltinitrite solution*, no precipitate is formed.

Chloride - 0.5 g dissolved in water with the addition of 1.8 ml of *nitric acid*, complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 1g dissolved in water with the addition of 3.5 ml of *hydrochloric acid* complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1.5 g and dissolve in about 40 ml of *carbon dioxidefree water*. Cool and titrate with *N sulphuric acid* using *phenolphthalein solution* as indicator. When the pink colour of the solution is discharged, record the volume of acid solution required, add methyl orange solution and continue the titration until a persistent pink colour is produced. Each ml of *N sulphuric acid* is equivalent to 0.040 g of total alkali calculated as NaOH and each ml of acid consumed in the titration with *methyl orange* is equivalent to 0.106 g of Na_2CO_3.

Storage - Store in tightly-closed containers.

Sodium Hydroxide, xN - Solutions of any normality, xN may be prepared by dissolving 40 xg of *sodium hydroxide* in *water* and diluting to 1000 ml.

Sodium Hydroxide Solution - A 20 percent w/v solution of *sodium hydroxide* in *water*.

Sodium Hydroxide Solution, Dilute

A 5 percent w/v solution of sodium hydroxide in water.

Sodium Nitrite - $NaNO_2$-69.00, Analytical reagent grade.

Sodium Nitroprusside - (Sodium penta cyano nitrosyl ferrate (iii) dihydrate; $Na_2[Fe(CN)_5(NO)]$, $2H_2O$=298.0

Analytical reagent grade of commerce.

Sodium Peroxide - Na_2O_2=77.98

Analytical grade reagent.

Sodium Potassium Tartrate: Rochelle Salt COONa.CH(OH). CH(OH), COOK,

$4H_2O$=282.17

Contains not less than 99 percent and not more than the equivalent of 104 percent of $C_4H_4O_6Kna$, $4H_2O$.

Description - Colourless crystals or a white, crystalline powder; odourless, taste saline and cooling. As it effloresces slightly in warm, dry air, the crystals are often coated with a white powder.

Solubility - Soluble in *water*; practically insoluble in *alcohol*.

Acidity or Alkalinity - Dissolve 1 g in 10 ml of recently boiled and cooled *water*, the solution requires for neutralization not more than 0.1 ml of 0.1 N sodium hydroxide or of 0.1 *N hydrochloric acid*, using *phenolphthalein solution* as indicator.

Iron - 0.5 g complies with the *limit test for iron*, Appendix 2.3.4.

Chloride - 0.5 g complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate - 0.5 g complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 2 g and heat until carbonized, cool and boil the residue with 50 ml of *water* and 50 ml of 0.5 *N sulphuric acid*, filter, and wash the filter with *water*; titrate the excess of acid in the filtrate and washings with 0.5 *N sodium hydroxide*, using *methyl orange solution* as indicator. Each ml of 0.5 *N sulphuric acid* is equivalent to 0.07056 g of $C_4H_4O_6$ KNa, $4H_2O$.

Sodium Sulphide - Na_2Saq.

Analytical reagent grade. Deliquescent, crystalline masses turning yellow on storage.

Sodium Sulphide Solution - Dissolve with heating, 12 g of *sodium sulphide* in a mixture of 10 ml of *water* and 25 ml of *glycerol* cool and dilute to 100 ml with the same mixture.

Sodium Sulphite, Anhydrous: Na_2 SO_3=126.06

Description - Small crystals or powder.

Solubility - Freely soluble in *water*, soluble in *glycerin*; almost insoluble in *alcohol*.

Sodium Thiosulphate - $Na_2S_2O_3$, $5H_2O$=248.17

Description - Large colourless crystals or coarse, crystalline powder; odourless, taste, saline, deliquescent in moist air and effloresces in dry air at temperature above 33^0C.

Solubility - Very soluble in *water*; insoluble in *alcohol*.

pH - Between 6.0 and 8.4, determined in a 10 percent w/v solution, Appendix.3.1.3

Arsenic - Not more than 2 parts per million, Appendix 2.3.1.

Heavy metals - Not more than 20 parts per million, determined by Method A. Appendix 2.3.3. on a solution prepared in the following manner: Dissolve 1 g in 10 ml of *water*, slowly add 5 ml of *dilute hydrochloric acid* and evaporate the mixture to dryness on a water-bath. Gently boil the residue with 15 ml of *water* for two minutes, and filter. Heat the filtrate to boiling, and add sufficient *bromine solution* to the hot filtrate to produce a clear solution and add a slight excess of *bromine solution*. Boil the solution to expel the *bromine* completely, cool to room temperature, then add a drop of *phenolphthalein solution* and *sodium hydroxide solution* until a slight pink colour is produced. Add 2 ml of dilute acetic acid and dilute with *water* to 25 ml.

Calcium - Dissolve 1 g in 20 ml of *water*, and add a few ml of *ammonium oxalate solution*; no turbidity is produced.

Chloride - Dissolve 0.25 g in 15 ml of 2 N *nitric acid* and boil gently for three to four minutes cool and filter; the filtrate complies with the *limit test for chlorides*, Appendix 2.3.2.

Sulphate and Sulphite - Dissolve 0.25 g in 10 ml of water, to 3 ml of this solution add 2 ml of *iodine solution*, and gradually add more *iodine solution*, drop wise until a very faintpersistent yellow colour is produced; the resulting solution complies with the *limit test for sulphates*, Appendix 2.3.6

Sulphide - Dissolve 1 g in 10 ml water and 10 ml of a freshly prepared 5 percent w/v solution of *sodium nitroprusside*; the solution does not become violet.

Assay: Weigh accurately about 0.8 g and dissolve in 30 ml of water. Titrate with 0.1 N iodine, using 3 ml of *starch solution* as indicator as the end-point is approached. Each ml of 0.1 N iodine is equivalent to 0.02482 g of $Na_2S_2O_3$. $5H_2O$.

Storage - Store in tightly-closed containers.

Sodium Thiosulphate - 0.1 N; $Na_2 S_2O_3. 5H_2O$=248.17, 24.82 g in 1000 ml.

Dissolve about 26 g of *sodium thiosulphate* and 0.2 g of *Sodium Carbonate* in *carbon dioxide-free water* and dilute to 1000 ml with the same solvent. Standardize the solution as follows:

Dissolve 0.3 g of *potassium bromate* P.S. in sufficient *water* to produce 250 ml. To 50 ml of this solution, add 2 g of *potassium iodide* and 3 ml of 2 *N hydrochloric* acid and titrate with the *sodium-thiosulphate solution* using starch solution, added towards the end of the titration, as indicator until the blue colour is discharged. Each 0.002784 g of potassium bromate is equivalent to 1 ml of 0.1 *N Sodium thiosulphate*. Note-Re-standardize 0.1 *sodium thiosulphate* frequently.

Stannous Chloride - $SnCl_2, 2H_2O$=225.63
Contains not less than 97 percent of $SnCl_2, 2H_2O$.

Description - Colourless crystals.

Solubility - Soluble in *dilute hydrochloric acid.*

Arsenic - Dissolve 5 g in 10 ml of *hydrochloric acid*, heat to boiling and allow to stand for one hour; the solution shows no darkening when compared with a freshly prepared solution of 5 g in 10 ml of *hydrochloric acid*.

Sulphate - 5 g, with the addition of 2 ml of *dilute hydrochloric acid*, complies with the *limit test for sulphates*, Appendix 2.3.6

Assay - Weigh accurately about 1 g and dissolve in 30 ml of *hydrochloric acid* in a stoppered flask. Add 20 ml of *water* and 5 ml of *chloroform* and titrate rapidly with 0.05 *M potassium iodate* until the chloroform layer is colourless. Each ml of 0.05 *M potassium iodate* is equivalent to 0.02256 g of $SnCl_2, 2H_2O$.

Stannous chloride solution - May be prepared by either of the two methods given below:

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 ceased to be evolved; add sufficient *water* to produce 100 ml allowing the undissolved tin to remain in the solution

Starch Soluble - Starch which has been treated with *hydrochloric acid* until after being washed, it forms an almost clear liquid solution in hot water.

Description - Fine, white powder.

Solubility - Soluble in hot *water*, usually forming a slightly turbid *solution*.

Acidity or Alkalinity - Shake 2 g with 20 ml of *water* for three minutes and filter; the filtrate is not alkaline or more than faintly acid to litmus paper.

Sensitivity - Mix 1 g with a little cold *water* and add 200 ml of *boiling water*. Add 5 ml of this solution to 100 ml of *water* and add 0.05 ml of 0.1 *N iodine*. The deep blue colour is discharged by 0.05 ml of 0.1 *N sodium thiosulphate*.

Ash - Not more than 0.3 percent, Appendix 2.2.3.

Starch, Solution - Triturate 0.5 g of *soluble starch*, with 5 ml of *water*, and add this, with constant stirring to sufficient water to produce about 100 ml. Boil for a few minutes, cool and filter.

Solution of *starch* must be recently prepared.

Sudan Red G - Cl 26100; Sudan III; Solvent Red 23; 1-(4-phenylazophenylazo)-2naphthol; $C_{22}H_{16}N_4O$=352.40

Description: Reddish-brown powder.

Solubility - Insoluble in *water*; soluble in *chloroform*, in glacial acetic acid; moderately soluble in *alcohol*, in solvent *ether* and in *acetone*.

Sulphamic Acid - NH_2SO_3H=97.09.

Contains not less than 98 percent of H_3NO_3S.

Description - White crystals or a white crystalline powder.

Solubility - Readily soluble in *water*.

Melting Rang - 203^0C to 205^0C, with decomposition, Appendix 3.1.4.

Sulphuric Acid - H_2SO_4=98.08

When no molarity is indicated use analytical reagent grade of commerce containing about 98 percent w/w of *sulphuric acid*. An oily, corrosive liquid weighing about 1.84 g per ml and about 18 M in strength.

When solutions of molarity xM are required, they should be prepared by carefully adding 54 x ml of sulphuric acid to an equal volume of water and diluting with water to 1000 ml.

Solution of sulphuric acid contain about 10 percent w/v of H_2SO_4.

Sulphuric Acid, Dilute: Contains approximately 10 percent w/w of H_2SO_4. Dilute 57 ml of *sulphuric acid* to 1000 ml with *water*.

Sulphuric Acid, Chlorine free - Sulphuric acid which complies with the following additional test:

Chloride -Mix 2 ml with 50 ml of *water* and add 1 ml of solution of *silver nitrate* no opalescence is produced.

Sulphuric Acid Nitrogen-free - Sulphuric acid which contains not less than 98 percent w/w of H_2SO_4 and compiles with the following additional test:

Nitrate - Mix 45 ml with 5 ml of *water*, cool and add 8 mg of *diphenyl benezidine*; the solution is colourless or not more than very pale blue.

Tartaric Acid - $(CHOH.COOH)_2$=150.1

Analytical reagent grade.

Thioglycollic Acid Mercapto Acetic Acid - HS. CH_2. COOH=92.11.

Contains not less than 89 percent w/w of $C_2H_4O_2S$, as determined by both parts of the Assay described below:

Description - Colourless or nearly colourless liquid, odour strong and unpleasant.

Iron - Mix 0.1 ml with 50 ml of *water* and render alkaline with *strong ammonia solution*; no pink colour is produced.

Assay - (1) Weigh accurately about 0.4 g and dissolve in 20 ml of water and titrate with 0.1 *N sodium hydroxide* using cresol *red solution* as indicator. Each ml of 0.1 *N sodium hydroxide* is equivalent to 0.009212 g of $C_2H_4O_2S$.

(2) To the above neutralized solution add 2 g of sodium bicarbonate and titrate with 0.1 *N iodine*. Each ml of 0.1 *N iodine* is equivalent to 0.009212 g of $C_2H_4O_2S$.

Thymol-2-Isoprophy-5-Methyl phenol; $C_{10}H_{14}O$=150.2

General reagent grade.

Colourless crystals with an aromatic odour; freezing point not below 49^0C.

ThymolBlue-6,6'-(3H-2,1Benzoxathil-3-ylidene)dithymolSS-dioxide; $C_{27}H_{30}O_5S$=466.6.

Gives a red colour in strongly acid solutions a yellow colour in weakly acid and weakly alkaline solutions, and a blue colour is more strongly alkaline solutions (pH range, 1.2 to 2.8 and 2.0 to 9.6).

Thymol Blue Solution - Warm 0.1 g of *thymol blue* with 4.3 ml or 0.05 M sodium hydroxide and 5 ml of *ethanol* (90 percent); after solution is effected add sufficient *ethanol* (20 percent) to produce 250 ml.

Complies with the following test:

Sensitivity - A mixture of 0.1 ml and 100 ml of Carbon dioxide-free water to which 0.2 ml of 0.02 *N sodium hydroxide* has been added is blue. Not more than 0.1 ml of 0.2 *N hydrochloric acid* is required to change the colour to yellow.

Titanous Chloride Solution - General reagent grade of commerce containing about 15 percent w/v $TiC1_3$.

Weight per ml, about 1.2 g.

Dull purplish liquid with a strongly acid reaction.

Titanous Chloride - 0.1N: $TiC1_3$=154.26; 15.43g in 1000 ml.

Add 103 ml of *titanous chloride solution* to 100 ml of *hydrochloric acid*, dilute to 1000 ml with recently boiled and cooled water, and mix, standardize, immediately before use, as follows:

Place an accurately measured volume of about 30 ml of standardized 0.1 *N ferric ammonium sulphate* in a flask and pass in a rapid stream of *carbon dioxide* until all the air has been removed. Add the *titanous chloride solution* from a burette and in an atmosphere of *carbon dioxide* until near the calculated endpoint then add 5 ml of ammonium thiocyanate solution, and continue the titration until the solution is colourless. Each ml of 0.1*N ferric ammonium sulphate* is equivalent to 0.01543 g of $TiC1_3$.

Water - See purified water.

Water Ammonia-free - Water which complies with the following additional test.

To 50 ml add 2 ml of *alkaline potassium mercuri-iodide solution* (Nessler's reagent); no colour is produced.

Water, Carbon Dioxide-free - Water which has been boiled vigorously for a few minutes and protected from the atmosphere during cooling and storage.

Xylenol orange - [3H-2, 1-Benzoxathiol-3-ylidene bis (6-hydroxy-5-methyl-mphenylene) methyl-lenenitril] tetra acetic acid SS-dioxode ($C_{31}H_{32}O_2O_{13}S$) or its tetra sodium salt.

Gives a violet colour with mercury, lead zinc and contain other metal ions in acid solution. When metal ion are abscent, for example in the presence of an excess of disodium ethylene diamine tetraacetate, this solution is yellow.

Xylenol Orange Solution - Shake 0.1 g of *xylenol orange* with 100 ml of water and filter, if necessary.

Zinc, Granulated - Zn=65.38.

Analytical reagent grade of commerce.

Zinc Powder - Zn=65.38.

Analytical reagent grade of commerce.

Zinc Sulphate - $ZnSO_4$, $7H_2O$=287.6.

Analytical reagent grade of commerce.

APPENDIX 5

5.1 GENERAL INFORMATION

5.1.1 Definition and Method of Preparing of Joshanda or Decoction

Joshanda is the decoction obtained by boiling Coarse powder of drugs in proportion of 4,8,16 times of water reduced to one fourth and strained in cloth.

5.1.2 Tasfia (Decontamination)

Tasfia is a process of decontamination with specified drugs for removal of impurities and potentiation of drugs. The process of Tasfia may be divided under the following processes:

1. Daq-wa-Sahaq 2. Ghasl-e-Adviyah and 3. Tasweel-e-Adviyah.

1. Daq-Wa-Sahaq (Pounding and Grinding)

In the preparation of many compound formulations, single drugs are used in the form of coarse of fine powder. The process of powdering, by pounding or grinding, is called Daqwas-Sahaq (Kootna-aur-Peesna).

Drugs are generally powdered in a mortar and pestle, made of stone, iron, wood, porcelain or glass. Sometimes, they are rubbed on a sil-batta (flat grinding stone). Some drugs are pounded only in an iron or stone mortar. In large scale manufacture of drugs, pulverizing machines are now used.

(i) Powdering of hard drugs

Tough, hard or fibrous drugs are first dried in shade, Sun or over low fire to evaporate their moisture contents and pounded in an iron mortar. Initially, gentle pounding is employed to avoid drug pieces being scattered outside the mortar. When the drugs are initially broken into small pieces by gentlre pounding, vigorous pounding is then employed till they are finely powdered. The powder is sieved through sieves of the prescribed meshes. The coarse particles left in the sieve are again pounded and resieved. The remaining pieces of drugs which can no longer be pounded are ground on a sil-batta with a little water to form a fine paste which is then dried and ground to powder form in a porcelain or glass mortar.

(ii) Powdering of Nuts and Dry Fruits

Kernels of Nuts and Dry fruits are ground only on a sil-batta or in a Kharal. The powder of these drugs is not sieved.

(iii) Powdering of precious stones and minerals

Precious stones and minerals are first ground in an iron mortar or Kharal of hard stone and then sieved through sieves of 100 Mesh. The sieved powder is put in the same mortar or Kharal and ground with Arq-e-Gulab for three hours till the Arq is completely absorbed. The powder is then tested between the fingers for its fineness. If coarseness is still felt, more Arq-e-Gulab is added and ground till the coarseness disappears. The fine powder is then sieved through a piece of fine muslin cloth.

(iv) ***Powder of Mushk, Ambar, etc.***

Drugs like Mushk, Ambar, Jund-e-Badastar, etc., are ground either dried or with a suitable Arq or Raughan and then used as required in the respective formula.

(v) ***Powdering of Zafran, Kafoor, etc.***

Drugs like Zafran, Kafoor are ground only in a dry mortar (Kharal), with slow and light movements of the pestle to avoid sticking of the drug with the mortar. It is also ground with a few drops of alcohol. Lastly, these drugs are added to the powder of other drugs and mixed well in a mortar.

(vi) Powdering of Toxic Drugs

Poisonous or Toxic drugs are first purified or detoxicated (mudabbar) and then ground to fine powder. Kuchla (Nux-Vomica), besides being toxic (poisonous), is also very hard and difficult to powder. It is, therefore, ground immediately when it is soft. In case it gets hard on drying, it is powdered by frying in Raughan Zard or any other suitable oil by which the drug is cripsed.

(vii) Powdering of Abresham

Silk Cocoons (Abresham) are cut into small pieces and roasted in an iron pan over low fire, care being taken to ensure that they are not burnt. It is then ground in a mortar and pestle to fine powder form.

(viii) Powdering of moist and resinous drugs

Drugs like Afyun, Ushaq, Muqil, Anardana, Narjeel Daryaee, etc. are first dried over a low fire to evaporate the moisture content, care being taken to ensure that they are not burnt. They are then powdered.

(ix) Powdering of Khurma Khushk

In case of Khurma Khushk (Dry Date) the seeds are first removed and then dried over a low fire in a frying pan before powdering. In some formulations, dates (Khurma Khushk) are soaked in the prescribed liquids. In such cases they are ground on silbatta, with a little water to form a fine paste and then mixed with other drugs coming in the respective formula.

(x) Powdering of Mastagi

Mastagi is powdered in a porcelain mortar by slow and light motion. It is also dissolved in any oil over a low fire and added to the other drugs in the formula.

(xi) Powdering of Abrak

The layers of Abrak are first separated by pounding in an iron mortar. The small pieces of Abrak are kept in a bag of thick cloth along with small pebbles, Cowrie shells, Data seeds or Dhan (Paddy) and tied. The bag is then dipped in hot water and rubbed vigorously with both hands. Small particles of Abrak are then squeezed out of the bag. The process of dipping the bag in hot water and rubbing is repeated till all the particles of Abrak are squeezed out ofthe bag. The particles of Abrak are allowed to settle down at the bottom of the vessel and the water is decanted. The Abrak particles are removed and then allowed to dry. The dry particles are called Abrak Mahloob.

(xii) Powdering of Tukhm-e-Imli

Tukhm-e-Imli is soaked in water for four to five days. The brownish outer covering (testa) of the seeds is removed and the seed are ground to powder. The outer covering can also be removed by roasting the seeds.

(xiii) Powdering of Sang-e-Surma

Sang-e-Surma is ground in a mortar and pestle (Kharal). The process of powdering is continued till the shine of the particles disappears and the powder is tested between the fingers for its fineness. If it is still coarse then the process is repeated till the highest degree of fineness is obtained. Similarly, all other drugs which are to be applied in the eyes are ground to the highest degree of fineness for which it is sieved through a piece of silk cloth to obtain the finest quality of Surma.

2. Ghasl-e-Adviyah (Cleaning of Drugs)

In order to prepare the drugs of moderate properties and action the drugs of plant, animal and mineral origin are washed with special method. This special method of washing is called Ghasl-e-Adviyah. The drugs which undergo this process are suffixed with the term Maghsool (washed) in respective formulae. A few of the drugs which are processed by this method are described below.

(i) Aahak (Choona)

Aahak (edible lime) is soaked in a large quantity of water, stirred well and allowed to settle down at the bottom. After settling down of the particles of Choona the water is decanted. Fresh water is again added to the sediment and stirred well. The process of addition of water to fine particles of Choona and decantation is repeated 7 to 8 times and the fine particles of the Choona are collected tin the end. The product thus obtained is called Choona Maghsool or Aahak Maghsool.

(ii) Hajriyat

Precious stones, like Shadjanj Adsi, Lajward, etc., are used after they are purified. The stone is ground to fine powder. Sufficient quantity of water is then added to be powder, stireed and allowed to settle down. The finer particles of the stone still suspended in the water will come out when decanted. The coarse particles will settle down at the bottom. These coarse particles are removed the ground till all the particles pass through the process of decantation. The decanted water is left undistrubed so that the finest particles are settled down at the botoom. Water is then removed and the particles when dried are finely powdered.

The drugs treated by the above method are called "Maghsool" viz. Shadnaj Adsi Maghsool, Sang-e-Surma Maghsool and Lajward Maghsool.

(iii) Raughan Zard or Ghee

Ghee is taken in a tin-coated metallic plate or Kansa (a metallic alloy) plate and water is poured over it. The Ghee is then rubbed with the hands for five minutes and the watery part is decanted. This process is repeated many times as indicated in the particular formula to obtain the Raughan Zard Maghsool.

(iv) Luk

First of all the visible impurities are removed from Luk. 30 gms. of Luk is finely powedered and ground in the decoction prepared by 15 gms. each of Rewand Chini and Izkhar Makki. The mixture is sieved through a piece of clean fine cloth, and when the fine particles of Luk settle down in the decoction, it is then decanted and the fine a particles of Luk are washed with water and dried to obtain the Luk Maghsool.

3. Tasweel-e-Adviyah (Sieving)

Sieves of different meshes are used in the process of powdering the drugs. Each sieve has a particular mesh number. The mesh number depends on the number of holes in the mesh in an area of 2.5 sq.cm. (1 square inch). If there are 20 holes, the mesh number is 40, if there are 30 holes, the mesh number is 60, for 50 holes the mesh number is 100. If coarse powder is required then sieve number 40 is used. For fine powders, sieves of highest number are used. Sieve of 100 mesh gives the finest powder. Powders are also sieved through a piece of muslin or thin silk cloth when the highest degree of fineness is required as in the case of preparation of Surma.

Joshandas (Decoctions) and Sharbats (Syrups) are filtered through a piece of clean thick cloth. Joshanda prepared for Sharbats are filtered through cotton pads to ensure a greater degree of homogenity and purity of the end product. Uniformly thick layers of cotton wool or double layered flannel cloth is spread over the sieve and the decoction is passed slowly through it. When a small quantity of fluid drug is required to be filtered, then a filter paper or a flannel cloth is used. The pulpy drugs like Maweez Munaqqa, Anjeer etc., are first cleaned by washing and then soaked in water and boiled till they become a soft mass. They are then removed from the water, allowed to cool, squeezed and the pulp is sieved through a metallic sieve or a piece of cloth.

Turanjabeen is first socked or boiled in water. When dissolved completely the solution is filtered through a piece of clean fine cloth and kept in a vessel to allow the impurities to settle down. The solution is then decanted into another container without disturbing the sediments.

5.1.3 Tadbir-e-Adviyah (Detoxification of Drugs)

Some of the plant, animal and mineral origin drugs are naturally toxic in their properties and actions. Therefore, these drugs before making the medicines are detoxicated or purified in order to enhance their therapeutic action and reduce their toxicity. The process of detoxification of the drug is called Tadbir-e-Adviyah and the drugs which undergo this process are suffixed with the term "Musaffa". Different processes of detoxification are employed for different drugs. Details of these processes for a few important drugs are described below. These should be referred along with the process prescribed in the original texts.

(i) Afyun

Dissolve Afyun in Arq-e-Gulab and filter it. The filtrate is heated till it became thick for making the Habb (Pills).

(ii) Sibr (Aloe)

Keep sibr in Apple or Bahi or Shalgham, cover it by the process of Kapoorti, heat it, till it turn brown. Now take out the elva, dry it and use.

(iii) Bhang

Soak the Bhang in Arq-e-Ajwain and dry it. Now keep it in an earthen pot, heat it to roast.

(iv) Zeera Siyah

Dip Zeera Siyah is sirka (the level of sirka should be 2 inch above the level of Zeera Siyah) for three days. After three days, Zeera Siyah is taken out and dry it to use.

(v) Rasaut

Rasaut is cut into small pieces and soaked in Araq-e-Gulab for 24 hours. It is then stirred well and sieved through a clean piece of fine cloth into a big cylindrical glass jar and the sediments are allowed to settle down. The liquid is then decanted into another vessel without disturbing the sediment and boiled till it becomes a thick mass. The purified Rasaut is called Rasaut Musaffa.

(vi) Anzaroot

Anzaroot powder is mixed with Mother's Milk or Donkey's milk to form a paste. The paste is smeared over a piece of Jhao wood (Tamarix wood) and dried directly over a charcoal fire.

(vii) Bhilawan

After removing the cap (thalamus) of the Bhilawan fruits, the juicy contents (Asal-eBhilawan) are squeezed out completely with the help of a red hot tongs. Thereafter, Bhilawan fruits are boiled in fresh water at least for three times. Lastly, the fruits are boiled in milk, washed with water and dried. Precaution must be taken not to touch the juice with hands as the juice is toxic.

(viii) Habb-us-Salateen (Jamalgota)

25 grams of the kernels of Jamalgota is tied in a cloth bag and boiled in one litre of Cow's milk giving sufficient time till the milk becomes dense. When cooled, the kernels are taken out from the bag and the embryo part (pitta) of the seeds is removed to obtain jamalgota Mudabbar.

(ix) Chaksu

Chaksu is kept in a cloth bag and tied from the mouth. It is then soaked in a vessel of water containing Badiyan (Fennel) equal tohalf the weight of Chaksu or Barg-e-Neem Taza (fresh Neem leaves) equal in weight of Chaksu. The water is boiled for half an ahour and then the

cloth bag is removed and allowed to cool. Chaksu is then removed from the bag and rubbed between the palms to remove the outer coverings to get Chaksu Mudabbar.

(x) Azaraqi

70 grams of Azaraqi is buried in Peeli Matti (yellow clay) and water is poured over it daily for ten days. The Azaraqi is then removed and washed. The outer covering (testa) is peeled off with knofe and the cotyledons of Azaraqi are separated after removing the embryo part (pitta). Only the healthy Azaraqi is sorted out for use. It is then washed with hot water and tied in a clean cloth bag. The bag is immersed in a vessel containing two litres of milk. The milk is then boiled till it evaporates, care being taken that the bag does not touch the bottom of the vessel. Thereafter, Azaraqi is removed from the bag and washed with water to obtain Azaraqi Mudabbar.

(xi) Kibreet (Gandhak)

One part of Gandhak Amlasar and two parts of Raughan (Ghee) are taken in a Kadeha (laddle) and kept on a low fire. When Gandhak is melted, four parts of the milk is added. This process is repeated at least three times changing the fresh Ghee and Milk each time to obtain Gandhak Mudabbar.

(xii) Samm-ul-Far (Sankhiya)

Fine powder of Sankhiya is immersed in sufficient quantity of fresh Aab-e-Leemu (Lemon juice) and ground in a mortar of China clay or glass till the juice is completely absorbed. This process is repeated seven times to obtain Samm-ul-Far or Sankhiya Mudabbar.

(xiii) Shingraf

Shingraf is ground with fresh Aab-e-Leemu (Lemon Juice) till it is absorbed and a fine powder is obtained. This process is repeated three times to obtain Shingraf Mudabbar.

(xiv) Seemab

There are three following methods of purifying Seemab:

A. Seemab is ground with half burnt brick pieces for 12 hours. It is then washed with water and Seemab is separated. The whole process is repeated three times.
B. Seemab is kept in a four layered thick cloth bag (50 count) and squeezed out by pressing with hands. This process is repeated till the blackish tinge of Seemab is completely disappeared.
C. Seemab is ground with Turmeric Powder as long as the powder does not change its original colour. The resultant product is called Seemab Mudabbar.

(xv) Khabs-ul-Hadeed

A. Small pieces of Khabs-ul-Hadeeb are heated red hot in Charcoal fire and then immersed in Aab-e-Tirphala or Sirka Naishakar (Sugarcane Vinegar) by holding each piece with a tongs. The whole process is repeated seven times.

B. In this process Khabs-ul-Hadeeb is ground to powder form and kept immersed in Sirka Naishakar (Sugarcane Vinegar) or Sharab-e-Angoori (Brandy). The level of either of the two should be 5 cms. above the level of the powder. After 14 days, the Sirka Naishakar or Sharab-e-Angoori is decanted, the powder is dried and fried in Raughan-e-Badam.

(xvi) Beesh (Bachnak or Meetha Telia)

30gms. of Beesh is cut into small pieces, tied in a bag of clean fine cloth and dipped in a vessel containing milk so that the bag is completely immersed without touching the bottom. When the milk is completely evaporated, the pieces of Beesh are removed and washed well with water to obtain Beesh Mudabbar.

(xvii) Hartal

Juice of 5 Kg. of Petha (White Gourd Melon) is taken and kept in a vessel. Sixty grams of Hartal (small pieces) is put in clean, soft cloth bag and immersed in Petha juice without touching the bottom of the vessel and boiled. When the Petha juice is completely evaporated the Hartal pieces are removed and washed with water thoroughly to obtain purified Hartal or Hartal Mudabbar.

(xviii) Sang-e-Surma

There are four following methods of purifying Sang-e-Surma:

A piece of Sang-e-Surma is covered with the goat's fat and kept on a low fire till all the fat is completely burnt into fumes. The pieces of Sang-e-Surma is then removed from the fire with a tongs and immersed in Araq-e-Gulab or ice water. The whole process is repeated three times.

(i) A piece of Sang-e-Surma is immersed in Araq-e-Gulab or Araq-eBadiyan and heated till the Araq evaporates. This process is repeated seven times.

(ii) Sang-e-Surma is immersed in Aab-e-Triphala and boiled for 12 hours.

(iii) Sang-e-Surma is kept immersed in rain water (Aab-e-Baran) for 21 days.

(xix) Ajwayin and Zeera

Either of the above drugs are soaked in Sirka Naishakar (Sugarcane Vinegar) for 72 hours. The level of sugarcane vinegar in the container should be 5 cms. above the level of the drug. The drug is then removed and allowed to dry and then roasted over a low fire before use. Besides purifying, Sirka naishakar (Sugarcane Vinegar) also enhances the efficacy of the drug.

5.1.4 Neem-Kob (Bruising)

Neem-Kob is the process by which hard and fibrous drugs (roots, stems, seeds etc.) are crushed to small pieces in an iron mortar and softened in order to obtain the maximum efficacy, when used in the preparation made by the process of decoction or infusions. The word "Neem Kofta" is suffixed to the name of the drug in the recipe/formula which has to undergo this process.

5.1.5 Tahmiz-o-Biryan-e-Adviyah (Roasting or Parching)

(a) Tahmiz (Roasting or Parching with a medium)

Tahmiz is a process in which the drugs like Chana (Gram), Jau (Barley) etc., are roasted with some medium e.g. when Chana or Jau is roasted with sand til they get swelled.

(b) Biryan (Roasting or Parching without medium)

In the process of Biryan, drugs are parched or roasted without medium e.g. drugs like Shibb-e-Yamani, Tankar, Tootiya-e-Sabz, etc. are directly put over fire in any vessel or frying pan and roasted.

5.1.6 Tarviq-e-Adviyah

In this process the juice of the fresh herb is poured in a tin-coated vessel and heated over low fire till a green froth appears on the surface. The juice is then slowly sieved through a piece of fine cloth leaving behind the froth on the surface of the cloth. The watery juice thus obtained is called Aab-e-Murawwaq.

In case of dry herbs, a decoction is first made to which a small quantity of fresh Lemon or Alum powder is added. This will separate the green contents from the decoction. The aquous portion is decanted and stored.

WEIGHT AND MEASURE

METRIC EQUIVALENTS OF UNANI CLASSICAL WEIGHT

1 Chawal	=	15 mg
1 Ratti	=	125 mg
1 Dang	=	500 mg
1 Masha	=	1 g
1 Dirham	=	3.5 g
1 Misqal	=	4.5 g
1 Tola	=	12 g
1 Dam	=	21 g
1 Chhatank	=	60 g
1 Pao	=	240 g
1 Ser	=	960 g
1 Man Tabrizi	=	2 Kg 900 g
1 Oqia	=	32 g
1 Astar	=	1 Kg
1 Surkh	=	125 mg
1 Ratal Tibbi	=	420 g
1 Qeerat	=	250 mg

In case of liquid the metric equivalents would be the corresponding litre and millitre.

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