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Composed by **: Life Center**
House 93, Road 1, Mohammadia Housing Society
Mohammadpur, Dhaka-1207
Cell: +88 01711 450 350
E-mail: lifecenterbd@gmail.com

Design, planning & Edited by **: Dr. Abu Bakar Siddique,**
Deputy Program Mamager (Unani)
Alternative Medical Care (AMC)
Directorate General of Health Services (DGHS),
Health Service Division (HSD)
Mohakhali, Dhaka-1212.

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House 93, Road 1, Mohammadia Housing Society
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02. Dr. Shariq H. Khan

Co-Team leader, Pharmacopoeia preparatory committee
Associate Professor(A.C) and Head Department of Unani Medicine.
Government Unani and Ayurvedic Medical College and Hospital,
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05. S M Mahedi Hasan
Director, Life Center Unani Pharmacopoeia preparatory committee

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AAQARQARHA

(Root)

The drug Aaqarqarha consists of dried roots of *Anacyclus pyrethrum* DC. (Asteraceae). A perennial, procumbent herb. Leaves bipinnatisect, segments linear, ray florets white, purplish beneath. The plant is indigenous to North Africa and occurs throughout the year. Flowering and fruiting take place during winter season.

Naam-e-Degar (Other names):

a) Botanical name name: *Anacyclus pyrethrum* DC.

b) Family: Asteraceae

c) Bengali name : Akarkara

d) English name : Spanish Pellitory, Pellitory

Tafseel (Description) :

Aam (General): It is perennial herb with numerous spreading, prostrate or ascending, branched stems, more or less hairy in their upper positions, nearly smooth below, and coming from the crown of a long, tapering, vertical, brown, slightly branched root.

Leaves: Leaves alternate, the ones at the root crown long stalked, ovate or oblong in outlines, deeply bipinnatisect, segments linear, acute, often again 2 or 3 fid, more or less hairy or nearly glabrous. Heads terminal, large, 1-1.5 inch or more wide, with a wide disk; involving in width, blunt or subacute, smooth, pale green, bordered with an edge of brown; receptacle slightly convex, with large ovate rounded transparent scales beneath the flowers.

Flowers: Disk-flowers bisexual, corolla tubular, contracted below, with 5 equal traianglular spreading teeth, yellow; anthers apiculate, not tailed at the base, included in corolla; style

exerted, stigma bifid, with two linear branches. Ray flowers female, in a single row, corolla liguate, the limb broadly oval, trifid at the apex, white above, tinged with bright pink below.

Figure: Root of Aaqarqarha

Klaa Beeni (Macroscopic): The roots are 8-12 cm long and 0.5-1 cm thick, more or less cylindrical. They are brown in colour, roughly shrivelled, sometimes bear bristly remains of the leaves on the upper end and a few rootlets below.

Khurd Beeni (Microscopic): The transverse section of the root is more or less circular in outline and bounded by several layers of tangentially flattened cork cells composed of thick walls. Stone cells are also found in the outer bark. The cork cambium on inner side have a few layers of parenchyma cells constituting the secondary cortex. It is followed by a single layer of endodermis. After the secondary growth takes place major portion of the stellar region is occupied by radiating secondary xylem in discrete strands capped with a few layers of secondary phloem on outer side. The secondary wood is interrupted by broad layers of secondary phloem on outer side. The secondary wood is interrupted by broad rays. The xylem and phloem are made up of usual components. A small stony pith is often present in young roots about 25-30 strands of secondary xylem are observed. Vessels are mostly in tangential bands and fibres are found in small groups associated with vessels. Schizogenous intercellular spaces form the special structures, the secretory ducts, each lined by cell to cell and their distribution is most common in the middle cortical layers and secondary xylem and phloem. Crystals of varying shape and sizes abundantly occur in the parenchyma cells of phloem, xylem, ray and pith region.

Powder: Powder greyish brown in colour, gine to touch bears a characteristic aromatic odour and pungent taste. The powder under the microscope after cleaning with 75% chloral hydrate revealed that it is made up of abundance of stone cells, fibres and crystals of calcium oxalate of varying shape and sizes. In addition, vessels type of parenchyma and sieve tube cells also constitute the root powder.

Juz-e-Mustamil (Part used): The Flowers, leaves and rootparts are used as drug purpose.

Maskan (Habitat): It is indigenous to North Africa, where it has been introduced to south Europe. It does not grow wild in Europe and is commonly found the higher plans of Algeria

in at some distance of the coast and also cultivated in Algeria. In India it is found in rainy season in the eastern districts of Uttar Pradesh especially in Peeli Bheet and other than India it is also found in Africa, Algeria, Syria (Sham). Native to the Mediterranean region. Cultivated in Algeria.

Jwoher'e Nabatati (Phytoconstituents): Alkaloids, proteins, sugars, volatile oils, aluminium, iron, magnesium and potassium.

Mizaj (Temperament): Hot 3^{o} Dry 3°

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 6.5 %	Appendix 2.2.3
Acid insoluble ash	Not more than 2.5 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 4 %	Appendix 2.2.6
Water soluble extractive	Not less than 16 %	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*
Benzene: Pet. Ether (2:3)	1_2 vapours	1	0.94

Aa'maal-e-Adviya (Pharmacological action): Mukhaddir (Anaesthetics), Muqawwi-e-Bah (Aphrodasiac), Moharrik (stimulant), Musakkin, Jali (detergent), Mudire Baul , Mudire Haiz (emmenogogue), Mudire Luabe Dahan, Mudire Sheer, Muhallil, Muhammir (Rubefacient), Mumsik, Munaqi Fuzlat Dimagh, Musakkhin'e Akhlat, Mushtahi (Appetizer) , Muqawwi

Aam (General tonic), Mukhrij'e Balgham (Expectorant), Mu'arriq, Mufattih Sudad, Mukhaddir'e Kharji.

Mahall-e-Istemalat (Therapeutic use): Waj-Ul-Asnan (Toothache) , Falij (Paralysis), Surfa (Cough), Bohat-Us-Saut (Hoarseness), Zof-E- Bah (Sexual weakness), Isterkhae Lihat, Buhha Al-Sawt (Hoarseness) Due To Balgham, Recurrent Cold, Sar'a (Epilepsy), Khasham (Loss of sense of smell), Amraz-e-Baridah Such As Laqwa (Facial palsy), Istirkha (flaccidity), Ra'sha(trembling), Luknat (stammering), Wajaul Mafasil (Joint pain), Irq Al-Nasa Istisqa (Ascites), Istirkha-I-Qazib Surat'e Inzal (Premature ejaculation).

Meqdar-e-Khorak (Dose): 2 to 3g

Muzir (Side-effects / adverse-effects): It is Muzir'e Riyah. The powdered root is an irritant to the mucus membrane of the intestine if used in large quantity causing bloody stool and tetanus like spasm and profound stupor, contact dermatitis occurs if handled incorrectly.

Musleeh (Corrective): Kateera, Rubbus soos, Samagh e arabi (Gum Acacia).

Badal (Proximal substitute): Dare Filfil (Piper Longum), Daroonaj and Fotinaj Jabali.

Aaham Nukhsajat (Important formulations): Anqaruya-e-Kabir, Barshasha, Jawarish-Zarooni Sada, Luboob Sagheer, Majoon-e-Baladur, Majoon-e-Salab, Raughan-e-Seer, Raughan-e-Sudab, Tila-e-Mulazziz, Sunoon-e-Mukrij-e-Rutubat, Sunoon-e-Muluk, Habb-e-Falij Mulayin, Habb-e-Mumsik**,** Roghane Qust, Majoon Zabeeb, Majoon Aqer Qerha, Habbe Qoqaya, Habbe Ayarij, Majun Abi Muslim, Majoon Sara, Majoon Seesaleyoos, Majoon

baladuri, Ancardia, Khameera Gaozuban Ambary Jadwar Ood Saleeb Wala, and Barshasha are used for the treatment of epilepsy. Roghane Aqer Qerha, Majun khoozi, Habbe munshit, Habbe mushkil kusha, Habbe muqawi bah, Majun feroznosh, Sanun Mukhrije Ratoobat, Sanun Mujallie Dandan, Arastoon sagheer, Arastoon kabeer, and Jawarish fandadiqoon.

Arastoon Kabeer Arastoon Sagheer, Bad Mahraj, Majoone Asfar Saleem, Majoone Aswad Saleem, Majoon Abi Muslim, Falooniyae Roomi Tarsoosi, Falooniyae Farsi, Majoone Feeroznosh, Dawa Atiyatullah Majoon Ameeri, Barshasha, Tiryaqi-Aqrab, Tiryaqul Isnan, Jawarish-i-Buqrat, Jawarish-i-Qaisar, Jawarish Zarooni, Jawarish-i-Zarooni Ambari Ba Nuskha Kalan, Jawarish Bakarmajit, Jawarish Zafran, Jawarish Hazrat Suleman, Jawarish Luluwi, Anqaroya-e-Kabir, Laboob Sagheer, Majoon-e-Baladur, Majoone Salab, Roghan-e-Seer, Raughan-e-Sudab, Tilae-Mulazziz, Sunoo-e-Muluk, Habb-e-Falij Mulayin, Habb-e-Mumsik Qawi, Majoon-e Zabeeb, Raughan-e-Qust, Sunoon-e-Mujalli, Qairooti-e-Arad-e-Karsana.

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ABHAL
(Fruit)

Abhal is a medicinal plant which is used for the remedy of different diseases in the system of Unnni medicine since long time. Different parts of this plant is used for the preparation of Unani medicine. Ripe dried fruit is taken into account for the discussion here.

Naam-e-Degar (Other names):

a. Botanical name: *Juniperus communis* Linn
b. Family : Cupressaceae
c. Bengali name : Hayusha, Aowbel
d. English name : Juniper Berry, Common Juniper

Tafseel (Description):

Aam (General): The plant Abhalis very variable in form, ranging from 10 meter to 16 meter tall to a low, often prostrate spreading shrub in exposed locations. It has needle-like leaves in whorls of three; the leaves are green, with a single white stomatal band on the inner surface. It never attains adult foliage. It is dioecious, with male and female cones, which are wind pollinated, on separate plants.

Figure : Fruit of Abhal

Klaa Beeni (Macroscopic) : The fruits are berry-like cones, initially green, ripening in 18 months to purple-black with a blue waxy coating; they are spherical, 4 to 12 mm in diameter, and usually have three to six fleshy fused scales, each scale with a single seed. The seeds are dispersed when birds eat the cones, digesting the fleshy scales and passing the hard, unwinged seeds in their droppings. The male cones are yellow, 2–3 mm in long, and fall soon after shedding their pollen in March to April.

Khurd Beeni (Microscopic) : Outer layer of fruit shows 3-4, large, cubic or tabular cells having thick, brown porous walls externally covered by single layered, colourless cuticle; sarco-carp consists of large, elliptical, thin-walled, loosely coherent cells, containing drops of essential oil and prismatic crystals of calcium oxalate; oval to elongated, elliptical, triangular or irregular shaped cells abundant in this region. Seed coat shows 2 or 3 layers of tabular, thin-walled cells covered externally by a thin cuticle and followed internally by a wide zone of thick-walled polygonal sclerenchymatous cells. En-dosperm and embryo not distinct.

Powder: Brown, shows oval to elongated, elliptical and irregular shaped, thick-walled stone cells;

rectangular to hexagonal, straight, thick walled epidermal cells in surface view; prismatic crystals of

calcium oxalate and oil globules.

Juz-e-Mustamil (Parts used): Leaves, root bark and fruit.

Maskan (Habitat) : The plant Abhal is found in the Himalayas from Kumaon westwards ranging from the altitude of 1500 meter to 4250 meter . It is mainly distributed in Manimahesh in Chamba, Kullu, Churdhar in Sirmour, Chhota and Bara Bhnghal in Kangra, and Kinnaur and Pattan valley in Lahaul-Spiti districts. It also grows in Europe south-western Asia, and North America.

Jwoher'e Nabatati (Phytoconstituents): The juniper berry is composed Essential oil (Largely monoterpene hydrocarbons such as α-pinene, myrcene, sabinene, limonene and β-pinene), flavonoids and coumarins.

Mizaj (Temperament): Hot 2^0 and Dry 2^0

Musleh (Correction): Sahad/Asal (Honey), Rowghan-e-Zard (Ghee), Fresh Butter.

Badal (Proximal substitute): Daruchini (Cinnamomum zeylanicum Blume)

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 0.55 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 9 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) three fluorescent zones at Rf. 0.11 (light blue), 0.20 (light blue) and 0.58 (blue). On exposure to Iodine vapour ten spots appear at Rf. 0.17, 0.25, 0.30, 0.36, 0.46, 0.58, 0.64, 0.67, 0.90 and 0.96 (all yellow). On spraying with Va-nillin Sulphuric acid and heating the plate for ten minutes at 110°C twelve spots appear at Rf. 0.11, 0.17, 0.25, 0.30 (all brown), 0.36 (light brown), 0.46, 0.52 (both brown), 0.58 (dirty yellow), 0.64 (brown), 0.73 (light brown), 0.90 (light brown) and 0.96 (brown). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mohallil-e-Qawi, Mujaffif (Dessicant), Mulattif (Demulcent), Jali (detergent), Mufatteh, Qabiz (astringent), Khafeef, Kasir-e-Riyah (carminative), Muqawwi-e-Meda (Gastic Tonic), Mudirr, Musqite-Janeen (Abortificient), Qatil-e-Kirm-e-Shikam (Anthelmintic).

Mahall-e-Istemalat (Therapeutic uses): Ehtabas-e-Baul wa Haiz (Anuria and amenorrhea), Falij (paralysis), Istirkha, Usr-e-Tanaffus, Qaraqar-e-Shikam, Sangrehni, Deedan-e-Ama.

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

Muzir (Side-effects / adverse-effects): Using *Abhal* on the skin can cause some irritation, burning, redness, and swelling. It should be avoided using on large skin wounds. Taking *it*

by mouth long-term or in a high dose is likely unsafe as it can cause kidney problems, seizures, and other serious *side effects*.

Aaham Nukhsajat (Important formulations): Majoon Mudirr-e-Tams, Sharbat Mudirr-e-Tams.

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AFSANTEEN
(Stem)

The drug Afsanteen is a stem pieces of *Artemisia absinthium* Linn Syn. *Absinthium vulgare* Gaertn. *A. officinale* Lam (Asteraceace). It is an aromatic, bitter, shrubby plant.

Naam-e-Degar (Other names):

a) Botanical name : *Artemisia absinthium* Linn Syn. *Absinthium vulgare* Gaertn. *A. officinale* Lam.

b) Family : Asteraceace

c) Bengali name : Mastaru

d) English name : Absinth, Wormwood

Tafseel (Description):

Aam (General):It is grown as an ornamental plant and is used as an ingredient in the spirit absintine as well as some other alcoholic drinks.Afsanteen is herbaceous, perennial plant with fibrous roots. Leaves are spirally arranged. Basal leaves are upto 25 cm long, bipinnate or tripinnate with long petioles, uppermost leave can be both simple and sessile. Its flowers are pale yellow tubular, and clustered in spherical bent down heads.The leaves of a plant, probably the best-known species, have been used in medicines and such beverages. It is a shrubby, perennial, silky plant. This plant grows from 60 to 120 cm in height with woody, hardy round High branch bearing stem. A perennial herb of tufted habit with tall, erect furrowed and angled stems, usually woody at the base and alternate, silvery green finely divided leaves. The hemispherical, yellow rayless drooping flowerheads are arranged in long racemose panicles. The fruit is cylindrical, slightly flattened achene, with no pappus. All

parts of the plant are covered with a silvery white down.The stems are erect, angular and Leafy.The stem branch twigs are having prominent ridges and furrows covered by white hairs.

Figure : Dry Afsanteen

Klaa Beeni (Macroscopic): Dried sample of the drug consists broken stem, twigs, leaves and flower heads. The stem and twigs have prominent ridges and furrows covered by white hairs. Leaves and twigs are silvery hoary on both surfaces. Flowers heads show the receptacle with long white hairs.

Khurd Beeni (Microscopic): The stem in transverse section shows a prominent wavy outline. The young stern and twigs show outer single layer of epidermis which consists of cubical cells. Many of the epidermal cells are extended outwards to form trichomes. The trichomes are formed of cells, arranged in single row. The epidermis followed by the cortical portion 4-6 layers of collenchymatous cells the endodermis is of parenchymatous cells. The cork of mature stem is 2-3 layered thick and phelloderm remains of 1-3 layers of thick cells.

Powder: The powdered drug is brownish yellow in colour. On examining the characteristic, nonlignitied hairs were found to be T shaped. The hairs have 1-4 celled stalk and are collapsed twisted and broken,glandular hairs, stalk 1-2 celled, the glandular portion consisting of 4-8 secreting glands surrounded by membrane. Few simple hairs from flowers are long and upto 0.09 mm wide. The trichomes of the leaf fragments are either with a single celled stalk and withbicellular head or the multicellular stalk is with the unicellular head. The epidermal fragments are with elliptical stomata fragments of mesophyll and palisade cells containing chloroplastids, tracheids are mostly spiral upto0.05 mm in width. Some sclerenchymatousfibres are with thick usually lignified walls and simple pores.

Juz-e-Mustamil (Part used): The stem, twigs, leaves and flower are used as drugs purpose.

Maskan (Habitat): Afsanteen(*Artemisia absinthium*or worm wood) is a species of artimisia, native to temperate regions of Eurasia and Northern Africa and Northern United States. Also

found in Afghanistan, westward to the Atlanticand throughout Europe, the Midwest, the Great Plains, and Canada. It also grows in North Asia- Kashmir, Nepal and Mountainous district of India 5000-7000 ft.

Jwoher'e Nabatati (Phytoconstituents): Phenols/tannins, glycosides, carbohydrates, lead, aluminium, iron, calcium, magnesium, potassium and sodium.

Mizaj (Temperament): Hot 1^0 Dry 3^0

Musleeh (Corrective): Anisoonand Mustagi, Sharbate-e Anar.

Badal (Proximal substitute): Gafis, Halelah zard

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 8 %	Appendix 2.2.3
Acid insoluble ash	Not more than 3 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 9 %	Appendix 2.2.6
Water soluble extractives	Not less than 18 %	Appendix 2.2.7

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

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet. ether: Diethyl ether (2:3)	1_2 vapours	4	0.34, 0.43, 0.78 0.87

Aa'maal-e-Adviya (Pharmacological action): Mudir-e-Baul (Diuretic), Daf-e-Humma (Antipyretic), Qatil-e-Kirm-e-Shikam, Mufatteh Sudad, Muqawwi-e-Meda (Gastic Tonic), Mohallil-e-Waram (Anti-inflammatory).

Mahall-e-Istemalat (Therapeutic use): Deedan-e-Ama (intestinal worm), Waram-e-Kabid (Hepatitis), Waram-e-Tahal, Zof-e-Dimagh, Sara (Epilepsy), Humma (Fever), Rasha (Tremor), Falij (paralysis), Laqwa (Facial palsy), Istrirkha, Bawaseer (Hemorrhoid).

Meqdar-e-Khorak (Dose): 4 to 9 g

Muzir (Side-effects / adverse-effects): The plant is contra indicated in pregnancy.The internal administration of large doses can lead to vomiting, stomach and intestinal cramps, headache, dizziness, and disturbance of central nervous system. Long term use may cause Absinthinism which can lead to hallucination nervousness, and mental deterioration. It has adverse effect on stomach. Anisoon and Mastagi are commonly being used in unani medicine as corrective for adverse effects.

Musleeh (Corrective): Anisoon and Mastagi are commonly being used in Unani medicine as corrective for adverse effects.

Aaham Nukhsajat (Important formulations): Itrifal-e-Didan, Arq Afsanteen, Joshanda afsanteen, Qurs Afsanteen, Arq Baraye warme jigar, Zimad kabid, Roghan-e-kala, Qurs-e-Aelaoos

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AMBA HALDI
(Rhizome)

The plant Aamba is being used as medicine for its different biological properties for ages. Its rhizomes are taken to prepare medicine in Unani system for the alleviation of different diseases.

Naam-e-Degar (Other names):

a. Botanical name: *Curcuma amada* Roxb.

b. Family : Zingiberaceae

c. Bengali name : Aamaa Aadaa

d. English name : Mango-ginger

Tafseel (Description):

Aam (General) : Mango ginger is a plant of the ginger family Zingiberaceae which is 60-90 cm high and is closely related to turmeric (*Curcuma longa*). The taxonomy of the species is a subject of some confusion as some authorities have considered the name C. mangga as identical while others describe it as a distinct species with C. mangga being found in southern India while C. amada is of east Indian origin. The rhizome of this plant is very similar to common ginger. Though mango ginger is similar to common ginger but it is different in some cses for its particular pharmacological as well as therapeutic acrivities.

Figure : Rhizome of Amba Haldi

Figure : Rhizome of dried Amba Haldi

Klaa Beeni (Macroscopic) : Rhizome laterally flattened, longitudinally wrinkled, 2 to 6 cm long, 0.5 to 2 cm in diameter, branched, remnant of scaly leaves arranged circularly giving the appearance of growth rings; cut pieces 1.5 to 3.5 cm in diameter, circular, punctate scars on the surface, branching sympodial, horizontal; roots long, unbranched, tapering, thread like, yellowish-brown; rhizome buff coloured with short and smooth fracture; odour and taste like raw mango.

Khurd Beeni (Microscopic) : : T.S. of rhizome circular in outline; epidermal cells rectangular-oval; cuticle thick, long unicellular trichomes present, storied suberized cork cells interrupted by lysigenous oil glands; a wide cortex having irregularly scattered vascular bundles, each vascular bundle with a prominent fibrous sheath; inner limit of cortex marked by endodermis followed by pericycle; vascular bundles devoid of sheath, arranged in a ring; schizogenous canals and abundant oil cells with suberized walls found in cortex and in central region; most of the parenchymatous cells filled with starch grains, which are

ovalellipsoidal, sometimes polygonal in shape, 10 to 60 □m, simple, hilum circular or a 2 to 5 rayed cleft, lamellae distinct and concentric; vascular bundles in the central cylinder are similar to those in the cortex, scattered, closed, collateral, surrounded by sheath of thick walled cells; secondary wall thickening reticulate; fibres thin walled lignified, lumen narrow.

Powder : Powder light yellow, sweet, raw mango like odour; shows fragments of storied cork, xylem vessels with reticulate thickenings, lignified xylem fibres, oil cells, patches of parenchymatous cells filled with starch grains which are oval-ellipsoidal, sometimes polygonal in shape, 10 to 60 mm, simple, hilum circular or a 2 to 5 rayed cleft, lamellae distinct and concentric. Powder when treated with 1N aqueous NaOH becomes green with yellowish tinge under UV 254 nm; with 1N HCl and nitrocellulose in amylacetate added one after the other, powder becomes orange in daylight.

Juz-e-Mustamil (Parts used): Rhizome

Maskan (Habitat): The plant Amba Haldi is found in Bangladesh,India, China, Indonesia and all over the indo-pak subcontinent.

Jwoher'e Nabatati (Phytoconstituents): The major chemical components include starch, phenolic acids, volatile oils, curcuminoids and terpenoids like difurocumenonol, amadannulen and amadaldehyde.

Mizaj (Temperament): Hot 1^0 and Dry 1^0.

Musleh (Correction) : Sekenjabeen (Vinegar, Rain water

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

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

Foreign matter	: Not more than 1 percent, Appendix 2.2.2.
Total ash	: Not more than 12 percent, Appendix 2.2.3.
Acid insoluble ash	: Not more than 2 percent, Appendix 2.2.4.
Alcohol soluble extractive	: Not less than 9 percent, Appendix 2.2.6.
Water-soluble extractive	: Not less than 14 percent, Appendix 2.2.7.
Essential oil	: Not less than 1 percent, Appendix 2.2.13
Starch	: Not less than 16 percent, Appendix 2.2.14

TLC behavior of chloroform extract:

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using toluene :

ethyl acetate : methanol (5 : 0.5 : 0.05) shows fluorescent zones at Rf. 0.10 (green) and 0.34 (blue) under UV (366 nm). On spraying with anisaldehyde- sulphuric acid reagent and heating the plate for ten minutes at 1200C, spots of purple colour appear at Rf. 0.16, 0.32, 0.72 and 0.97. Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mohallil (Resolvent), Musakkin, Musaffi-e-Khoon (Blood purifier).

Mahall-e-Istemalat (Therapeutic uses): Zarba wa Sakta, Amraz-e-Jildiya (Skin diseases)

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

Muzir (Side-effects / adverse-effects): No known side-effect/adverse effect is reported after the use of this plant.

Aaham Nukhsajat (Important formulations): Takmeed Bara-e-Majlooq.

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BAD RANJBOYA
(Leaf)

The drug Badranjboya is a dried leaves of *Nepeta hindostana* (Roth.) Haines Syn. *N. ruderalis* Hook, melissa parviflora benth,*Melissa officinalis* L. It is a perennial herb usually aromatic in nature, mildly bitter in taste. Cats love its smell after seeing it they do strange activities and due to this it is also known as Billi'lotan.

Naam-e-Degar (Other names):

a) Botanical name : *Nepeta hindostana* (Roth.) Haines, Syn. *N. ruderalis* Hook, *Melissa parviflora* benth., *Melissa officinalis* L.

b) Family: Lamiaceae, Labiatae

c) Bengali name : -

d) English name: Mountain balm, sweet balm or Lemon balm

Tafseel (Description):

Aam (General): Badranjboya is a grass fragrant, greenish black and bitter in nature. It is called as Billi lotan because the cat loves to play on it. It is an aromatic perennial, erect, pubescent or glabrate herb ascending upto 15-40 cm high.

Figure : Leaves of Bad Ranjboya

Klaa Beeni (Macroscopic): Leaves are broadly ovate or ovate-lanceolate, base acute round or cordate; opposite, rarely whorled or alternate, simple to pinnately dissected or compound.

Petioles are 6-25 mm, slender. Whorls are numerous or few or many. The petiole varies in length from1-1.2 cm while the lamina is about 2.5x1-3.5x1.2 cm. The raw drug occurs in broken pieces of 1-2 cm long and admixed with other plant parts. The proximal portion is thick which gradually gets thinner towards distal side. Small, thin branches emerge out from the tap root. Root is dull greyish black in colour and is easily broken. Taste is slight bitter without any smell.

Khurd Beeni (Microscopic): In transverse section the leaf shows single layered upper and lower epidermis provided with glandular and non-glandular hairs. The glandular hairs are characterized by the presence of unicellular circular head and uni to multi-celled tail. The non-glandular hairs are unbranched, uniseriate, multi-cellular, with the outermost cells tapering. These are ornamented with small bristles.Upper epidermal cells are mostly larger than the lower ones, while both are with small bristles: Upper epidermal cells are mostly larger than the lower ones, while both are covered with thick cuticle. The epidermis is followed by single layered palisade tissue continuous to lamina whereas it discontinues at the veins or midrib which is replaced by 3 to 4 layered collenchymatous tissue on the upper side and 3-6 layered on the lower side of the leaf. The collenchyma is followed by circular parenchyma tissues with large intercellular spaces. The vascular bundle is kidney shaped and is collateral. The vessel members are mostly with spiral to recticulate thickenings with simple perforation plates and tracheids are mostly pitted. The stomata are indistinct.

Powder: The powder under the microscope consists of fragments of parenchymatous tissue with intercellular spaces, collcnchyma and strands of vascular bundles. The multicellular, uniseriate non-glandular trichomes together with glandular trichomes with globular

unicellular head and uni-or multicellular uniseriate tail. Palisade tissue and spongy tissue arc also met with . The colour is dull green and taste slightly bitter.

Juz-e-Mustamil (Part used): The leave / whole plant.

Maskan (Habitat): Melissa is a native of southern Europe, Western Asia, Northern Africa, east as far as the Caucasus and northern of Iran but now it grows throught the world, In India it is found in temperate Himalaya from Garhwal to Sikkim and Khassia mountains. Badranjboya in India, is found to grow on sandy, scrubby area, damp wasteland, at elevations ranging from sea level to the mountains.

Jwoher'e Nabatati (Phytoconstituents): Glycosides, flavonoids, sesquiterpene, tannins, magnesium, sodium, potassium and iron.

Mizaj (Temperament): Hot 2° Dry 2^{o}

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 19 %	Appendix 2.2.3
Acid insoluble ash	Not more than 12 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 15 %	Appendix 2.2.6
Water soluble extractive	Not less than 8 %	Appendix 2.2.7

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

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Benzene: Pet.ether (1:1)	4% Ethanolic H_2SO_4	2	0.12, 0.31

Aa'maal-e-Adviya (Pharmacological action): Mufarreh (Exhilarent), Muqawwi-e-Qalb (Cardiotonic), Munzij-e-Sauda, Musaffi-e-Dam (Blood purifier), Mohallil-e-Warm, Musakkin.

Mahall-e-Istemalat (Therapeutic use): Zof-e-Qalb (Cardiac weakness), Khafqan (Papitation), Sara (Epilepsy), Laqwa, Falij (Paralysis), Waja-ul-Mafasil.

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

Muzir (Side-effects / adverse-effects): Adverse effects on Kidney and Liver.

Musleeh (Corrective):

Following drugs have been recommended to be used along with it,so as to avoid its adverse effects: Samag-e- arabi, Kundur, Badiyan, Poste Anar, Rebas

Badal (Proximal substitute): Abrashem, Poste Turanj, Faranj mushak, Marzanjosh.

Aaham Nukhsajat (Important formulations): Majoon-e-Khadar, Jawarish Ood Tursh, Jawarish Fawaq, Jawarish Mastagi, Dawaul Mushk Haar Sada, Dawaul Mushk Motadil Jawhar Wali, Dawaul Mushk Motadil Sada, Sharbat Ahmad Shahi, Sharbate Gauzaban, Sharbate Mushil, Sharbate Abrashem Sada, Arq'e Fawaq, Arq'e Maa-ul Ambri, Arq'e Mako Kasni Wala, Majoone Kundur, Mufarhe Azam, Muffarhe Yaquti Moatadil, Muffarhe Dilkhusha, Khameera Abresham Sada, Khameera Gauzaban Ambri, Khameera Abreshem Ood'e Mastagi Wala, Khameera Marwarid

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BAI KHUMBI
(Seed)

Different parts of the plant Bai Khumbi are used as medicine for its particular biological actions. The dried seeds of this plant are taken to prepare medicine in Unani system.

Naam-e-Degar (Other names):

a. Botanical name: *Careya arborea* Roxb.
b. Family : Lecythidaceae
c. Bengali name : Kumbhi
d. English name : Kumbi, Slow Match Tree

Tafseel (Description):

Aam (General) : *Careya arborea* is a deciduous tree that grows up to 5 to 12 meter high. Its leaves turn red in the cold season. Flowers are yellow or white in color that become large green berries.

Figure : Fruits of Bai Khumbi

Figure : Seeds of Bai Khumbi

Klaa Beeni (Macroscopic) : Seeds, exalbuminous, dark brown, oval ellipsoid, 1.5 to 2 cm long, upto one cm or slightly above in width; indehiscent; testa hard and wrinkled; odour, pleasant; taste, astringent.

Khurd Beeni (Microscopic) : Testa sclerenchymatous followed by a zone of collapsed cells of outer integument, inner integument lined by cuticle on both sides; outer layers of both integuments filled with dark brown material; cotyledons of many layered, thin walled, polygonal parenchymatous cells, filled abundantly with starch grains and occasionally with oil.

Powder: Creamish-yellow to light-brown, shows fragments of cotyledon cells; scattered stone cells of testa, abundant starch grains, simple and round, about 5 µ.

Juz-e-Mustamil (Parts used): Roots, leaves, flowers, fruits and seeds.

Maskan (Habitat): The plant grows in forests and grasslands throughout the world including Bangladesh, India, Mayanmar, Afghanistan and Indonesia upto an altitude of 1,500 meter.

Jwoher'e Nabatati (Phytoconstituents): Seeds contain triterpenoid sapogenols (five sapogenols-careyagenol A, B, C, D & E), Saponins, and sterols, spinosterol and spinosterone).

Mizaj (Temperament): Moderate towards Hotness and Dryness.

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

Badal (Proximal substitute): *Careya sphaerica* Roxb. or another species of same plant, if available.

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

Foreign matter	: Not more than 2 percent, Appendix 2.2.2
Total ash	: Not more than 4 percent, Appendix 2.2.3.
Acid-insoluble ash	: Not more than 1 percent, Appendix 2.2.4.
Alcohol-soluble extractive	: Not less than 7 percent, Appendix 2.2.6.
Water-soluble extractive	: Not less than 15 percent, Appendix 2.2.7.

TLC behavior of chloroform extract:

T.L.C. of the hexane extract on recoated silica gel 'G' plate (0.2 mm thick) using petroleum ether : diethyl ether : acetic acid (9:1:0.1) shows spots at Rf. 0.14 (purple), 0.26 (brown), 0.32 (light pink), 0.44 (pink) and 0.77 (purple) on spraying with vanillin-sulphuric acid reagent and heating the plate at 105 °C for about ten minutes. Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Kasire Riyah (Carminative), Mulaiyin (Laxitive), Munzij (Concoctive).

Mahall-e-Istemalat (Therapeutic uses): Nafakhe Shikam (Flatulance), Qabz

Meqdar-e-khorak (Dose): 500 mg - 1 gm.

Muzir (Side-effects / adverse-effects): No adverse effect is reported after the normal use of this plant.

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BAKAYIN
(Fruit)

This drug is a dried, mature fruit 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 MahanimFol

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):

Aam (General): 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.

Figure : Fruits of Bakayin

Klaa Beeni (Macroscopic): Drupes ovoid to globose, upto 15mm long and 12 mm wide, yellowish brown to chocolate brown, skin wrinkled, pericarp hard and creamish in colour; single stone present, upto 5.0 mm, long, ovoid or globose, brown, slightly flat at apex, 5 ridged, endocarp hard to break, 5 chambered and each chamber contains a single seed; reddish-brown in colour, 2.5 to 3.5 mm long and 1.0 to 2.5 mm broad, shiny, lanceolate; taste of the seed slightly bitter than pericarp but agreeable; odour unpleasant.

c) Khurd Beeni (Microscopic): Transactional view of the fruit wall shows a cuticle followed by a single layer of epicarp consisting of rectangular to squarish, thick walled parenchymatous cells with slightlyirregular walls containing yellowish-brown pigments; the mesocarpic region is of 3 or 4 layers in depth and is composed of rectangular to tangentially elongated, thick walled parenchymatous cells which contain oil globules; lower region of mesocarp parenchymatous cells, gradually reducing in size nearer the endocarp; a very few cells in the lower region possess rosette crystal of calcium oxalate. At few places in the mesocarpic region secretory cavities present. The endocarp is mainly composed of highly lignified cells; contents of the cells give positive test for tannins.

Cross section of seed shows a cuticle and a testa which is generally made up of twolayers of cells. The outer consists of rectangular to slightly elongated, thin walled Parenchymatous cells, and inner comprised of slightly radially elongated, thick and straight walled cells possessing yellowish-brown contents; beneath this there are 5 or 6 layers of tegmen consisting of compact, hexagonal to polygonal, thin walled Parenchymatous cells with pigments; cells of the endosperm are compact, large, tangentially elongated thin-walled Parenchymatous filled with aleurone grains and oil globules.

Powder : Powder brown, coarse and free-flowing, taste slightly bitter but agreeable with unpleasant odour, fragments of epicarp, mesocarp, testa, tegmen, endospermic cells, parenchymatous cells containing aleurone grains and oils globules in abundance, fibre and vessels are also seen but less in number. Rosette crystals of calcium oxalate are occasionally found, some elongated fibres and fibre-tracheids are also present. The fibres are quite long upto 600 μin length and 13.0 μ in width, thick walled lignified with narrow lumen and ends tapering; sclereids present, 40 to 120 μbroad. Vessels are short, broad, lignified and have annular or spiral thickenings.

Juz-e-Mustamil (Part used): The Fruit or berry, seeds, flowers, Bark, leaves oils and gum of Bakayintreeare used as drugs purpose.

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

Jwoher'e Nabatati (Phytoconstituents): Bitter principle- Bakayanin, Alkaloid azridine (Margosine), a brown resinous substance, a non-bitter acidic substance, a sterol and tannins.

Mizaj (Temperament): Hot 2^{o}, Dry 2^{0}

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 8 %	Appendix 2.2.3
Acid insoluble ash	Not more than 2 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 16 %	Appendix 2.2.6
Water soluble extractive	Not less than 25 %	Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Ethyl Acetate (93:7)	On spraying plate with 5% Ethanolic cone H_2SO_4	5	0.27 0.50 0.58 0.74 0.74 0.94

Aa'maal-e-Adviya (Pharmacological action): Musafti-e-Dam (Blood purifier), Mohalil-e-waram, Musakkin-e-Alam, Munaqqi, Qatil-e-Kirm-e-ama (Antihelmintic), Dafa-e-Humma (Anti-pyretic), Qabiz (astringent), Mudirr-e-Baul, Daf-e-Bawaseer (Anti-haemorrhoid), Qatel-e- Jaraseem, Daf-e-Tayaffun

Mahall-e-Istemalat (Therapeutic use): Niqras (Gout), Jaryan (Spermatorrhoea) , Waj-ul-Mafasil (Arthritis), Bawaseer(Hemorrhoid), Waj-ul-Uzn (Otalgia),Tayaffun

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

Musleeh (Corrective): Not required.

Badal (Proximal substitute): No proximal substitute identified

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

Refrences:

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BALADUR
(Fruit)

Mature ripe fruit of the plant Baladur is used for the preparation of Unani medicine which is being used for the treatment of various diseases for its different pharmacological as well as theraputical activities.

Naam-e-Degar (Other names):

a. Botanical name: *Semecarpus anacardium* Linn
b. Family : Anacardiaceae
c. Bengali name : Bhela
d. English name : Marking nut tree, Phobi nut tree, Varnish tree

Tafseel (Description):

Aam (General): It is a deciduous tree. Like the closely related cashew, the fruit is composed of two parts, a reddish-orange accessory fruit and a black drupe that grows at the end. The nut is about 25 millimetres (1 in) long, ovoid and smooth lustrous black. The accessory fruit is edible and sweet when ripe, but the black fruit is toxic and produces a severe allergic

reaction if it is consumed or its resin comes in contact with the skin. The seed inside the black fruit, known as godambi is edible when properly prepared.

Figure : Fruit of Baladur

Klaa Beeni (Macroscopic) : Fruit laterally flattened, drupe, dark brown, 2.5-3 cm long, obliquely ovoid, smooth, shining with residual receptacle.

Khurd Beeni (Microscopic) :

Fruit– Pericarp differentiated into epicarp, mesocarp and endocarp; in longitudinal section pericarp shows outer epicarp consisting of single layer of epidermal cells which are elongated radiameter lly and lignified, characteristic glands found in pericarp which exude oil globules are arise as small protuberances in epircarp and due to pressure exerted by cells of mesocarp, some of epidermal cells and cuticle rupture and oil globules exude from oil glands; mesocarp a very broad zone, 30-40 layers thick, composed mostly of parenchymatous cells having lysigenous cavities and fibro-vascular bundles, below

epidermis a few outer cells of parenchyma smaller as compared to rest; rosette crystals of calcium oxalate found scattered in parenchymatous cells, some cells get dissolved and form lyscgenous cavities which increase in size with maturity of fruit, cavities do not have any special lining and contain an acrid and irritant yellowish oily secretion; endocarp consists of two distinct layers, innermost prismatic, very much elongated radiameter l walls, being highly thickened, outer layer shorter and thinner than prismatic layer but cells similar to the former; number of mesocarp parenchyma contain rosette crystals of Calcium oxalate and oil drops in oil glands; lysigenous cavities of mesocarp contain oily vesicating substance, insoluble in water and soluble in alcohol, ether and chloroform.

Juz-e-Mustamil (Parts used): Fruits, pericap

Maskan (Habitat) : It is found in moist deciduous forests all over the country and also in the Indian subcontinent.

Jwoher'e Nabatati (Phytoconstituents): The important chemical constituents of this plant are anacardic acid, non-volatile alcohol (cardol), bhilwanols, phenolic compounds, biflavonoids, sterols and glycosides etc.

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

Musleh (Correction) : Alu Bokhara, Thankuri (Centella asiatica), Shitawar, Sandal Surkh

Badal (Proximal substitute): Easily available, So, no alternative is required.

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 4 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 11 per cent, Appendix 2.2.6
Water-soluble extractive	: Not less than 05 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): Muqawwi-e-Asab(Nervine tonic), Muqawwi-e-Zahn wa Hafiza, Muqawwi-e-Qalb, Daf-e-Amraz-e-Balghami.

Mahall-e-Istemalat (Therapeutic uses): Zof-e-Asab (Neurasthenia), Zof-e-bah(Sexual debility), Zof-e-Hafiza(Poor memory), Zof-e-Qalb (Cardiac weakness), Falij (paralysis), Laqwa(Facial palsy)

Meqdar-e-khorak (Dose): 125 mg

Muzir (Side-effects / adverse-effects): No toxicity or side effects were observed. Apart from its medicinal properties, it is also poisonous without any purification and the oil from its seeds can give blisters and painful wounds.

Aaham Nukhsajat (Important formulations): Anqaroya Kabir, Anqaroya Sagheer, Majoon Baladur.

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8. Mohanta T.K., Patra J.K., Rath S.K., Pal D.K. and Thatoi H.N., *Evaluation of Antimicrobial Activity and Phytochemical Screening of Oils and Nuts of Semicarpus Anacardium*, Scientific Research and Essay, 2007, 11, 486–490.

BARG-E-SUDAB
(Leaf)

Dried leaves of Barg-e-Sudab are being used for the treatment of different diseases in Unani system of medicine for rheir pharmacological and therapeutical activities.

Naam-e-Degar (Other names):

a. Botanical name: *Ruta graveolens* Linn.

b. Family : Rutaceae

c. Bengali name : Ermul, Ispund

d. English name : Garden rue, Herb-of-grace

Tafseel (Description):

Aam (General): Garden rue or Herb-of-grace is a species of *Ruta* grown as medicinal and ornamental plant throughout the world. It is also cultivated as a condiment and to a lesser extent as an insect repellent. In the ancient Roman world, the naturalists Pedanius Dioscorides and Pliny the Elder recommended that rue be combined with the poisonous shrub oleander to be drunk as an antidote to poisonous snake bites. The plant grows during August-November and flowering and fruiting take place during October-November.

Figure : Leaves of Bag-e-Sudab

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

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

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

thickenings.

Juz-e-Mustamil (Parts used): Leaves

Maskan (Habitat) : It is native to the Balkan Peninsula. It is now grown throughout the world including Bangladesh and Indian sub-continent. It is also cultivated in the gardens especially for its bluish leaves and sometimes for its tolerance of hot and dry soil conditions.

Jwoher'e Nabatati (Phytoconstituents): Alkaloids, coumarins, resins, carbohydrate, glycosides, saponins, steroids, flavonoids,volatile oils, phenolic acid, iron, sodium, potassium and magnesium.

Mizaj (Temperament): Hot and Dry

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

Badal (Proximal substitute): *Ruta chalepensis or a*nother species of same plant, if available.

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

Foreign matter	: Not more than 2 percent (Appendix 2.2.2)
Total ash	: Not more than 14 percent (Appendix 2.2.3)

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

TLC behavior :

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

Aa'mal-e-Advia (Pharmacological action): Mukharrish (Irritants), Mohallil, Kasir-e-Riyah (Carminative), Mujaffif, Mudirr-e-Haiz (Emmenagogue), Moharrik-e-Asab.

Mahall-e-Istemalat (Therapeutic uses): Bahaq (Pityrisis), Bars (Vitiligo), Nafkh-e-Shikam (Flatulence in the stomach), Ehtebas-e-Tams (Amenorrhoea), Ikhtenaq-ur-Rahem (Hysteria), Um-us-Sibyan (Infantile Epilepsy), Waj-ul-Meda (Stomachache).

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

Muzir (Side-effects / adverse-effects): Long time use or use of too much doses it can cause stomach irritation, changes in mood, sleep problems, dizziness, spasms, serious kidney and liver damage and even death. When applied to the skin it can cause rash and increased sensitivity to the sun.

Aaham Nukhsajat (Important formulations): Jawarish Kamooni, Zimad-e-Kibreet, Zimad-e-Tehal

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7. Zobel, Alicja M.; Brown, Stewart A. (1988). "Determination of Furanocoumarins on the Leaf Surface of Ruta graveolens with an Improved Extraction Technique". Journal of Natural Products. **51** (5): 941–946

BED MUSHK
(Flower)

The drug Bed Mushk consists of dried flowers (catkins) of *Salix caprea* Linn. (Salicaceae).

Naam-e-Degar (Other names):

a) Botanical name : *Salix caprea* Linn.

b) Family: Salicaceae

c) Bengali name :

d) English name : Sallow, Goat Willow, Musk Willow

Tafseel (Description):

Aam (General): It is a deciduous shrub or small tree, reaching a height of 8–10 m (26–33 ft), rarely to 13 m. The leaves are 3–12 cm long and from 2–8 cm wide, broader than most other willows. The flowers are soft silky, and silvery 3-7-cm-long catkins are produced in early spring before the new leaves appear; the male and female catkins are on different plants (dioecious). The male catkins mature yellow at pollen release, the female catkins mature pale green.

The fruit is a small capsule 5–10 mm long containing numerous minute seeds embedded in fine, cottony hairs. The seeds are very small (about 0.2 mm) with the fine hairs aiding dispersal; they require bare soil to germinate.

Figure : Flowers of Bed Musk

Klaa Beeni (Macroscopic): Catkins are 4-5 cm long, thick, cylindrical bright yellow, fragrant; bracts oblong small; scales obovate, blackish, hairy, nectary obovate, papillary; stamens longer than the scales, with oblong, yellow anthers; stigma oblong, thick, undivided. Staminate catkins sub-sessile, densely silky cottony about 2.5 cm long, erect, oblong ovoid, bracts dark, stamens two free. The smell is spicy.

Khurd Beeni (Microscopic): Microscopically the drug is characterized by the polygonal epidermal cells from which arise numerous long cylindrical, thick walled, unicellular, simple trichomes with small lumen. Some globular scars left by broken trichomes are also seen. These trichomes deeply stain with safranin. The transverse section of the catkin is some difficult owing to bittleness. However, numerous thick walled deep orange crystals,

numerous globular pollen grains and vascular bundles mostly composed of helical vessel members are some of microscopic characters by which the crude drug can be easily identified.

Powder: The drug powder is brown, cottony, with bitter taste and spicy smell. It is composed of fragments of light yellowish epidermal tissue from which numerous, elongated thick walled unicellular simple trichomes with small lumen arise. Certain trichomes scars are also visible in the tissue. Among other fragments are deep orange coloured slightly thick walled parenchyma tissue containing rosette crystals of calcium oxalate. Prismatic crystals are also met with. Numerous spherical pollen grains also characterise the drug powder.

Juz-e-Mustamil (Part used): Flower is mainly used as drugs purpose.

Maskan (Habitat): Native to Europe and western and central Asia. Also Found in Kashmir, Punjab, Himachal Pradesh and Uttar Pradesh.

Jwoher'e Nabatati (Phytoconstituents): Presence of alkaloids in addition to g!ycosides and saponins is reported in male infloresence. The fragrant flowers on distillation yield essential oil. Astragalin. quercimeritrin and quercetin-3,7-di-O-glucoside isolated from pollens.

Mizaj (Temperament): Cold 1^0 Dry2°

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 3 %	Appendix 2.2.4

Alcohol soluble extractive	Not less than 2 %	Appendix 2.2.6
Water soluble extractive	Not less than 5 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet. ether: Diethyl ether (3:1)	2% Ethanol H_2SO_4	4	0.11, 0.17, 0.38 0.75

Aa'maal-e-Adviya (Pharmacological action): Muqawwi-e-Qalb (Cardiotonic), Mulattif (Demulcent), Mufarreh (Exhilarent)

Mahall-e-Istemalat (Therapeutic use): Zof-e-Qalb (Cardiac weakness), Khafqan (Palpitation), Zof-e-Meda (Weakness of Stomach), Zof-e-Kabid (Weakness of liver)

Meqdar-e-Khorak (Dose): 5gm

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

Musleeh (Corrective): Not identified.

Badal (Proximal substitute): No proximal substitute is identified

Aaham Nukhsajat (Important formulations): Araq-e-Bed Mushk

Refrences:

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BEESH
(Root)

Beesh is a perennial growing poisinous plant which has been being used in traditional medicine since long time. Despite serious concerns about safety some people take this plant for the remedy of particular diseases like Laqua, Waza-ul-Mafasil, Nuqras, Damah etc.

Naam-e-Degar (Other names):

a. Botanical name: *Aconitum chasmanthum* Stapf.
b. Family : Ranunculaceae
c. Bengali name : Kathvish
d. English name : Indian Nepellus

Tafseel (Description):

Aam (General) : The species of Beesh is hermaphrodite (has both male and female organs) and is pollinated by Bees. It is suitable for sandy, loamy and heavy soils and can grow in heavy clay soil. It can grow in semi-shade (light woodland) or no shade. The plant *Aconitum*

chasmanthum is 0.5 m high. It prefers moist soil. It is in flower in September and its roots are collected in September to October.

Figure : Plant of Beesh

Figure : Dried root of Beesh

Klaa Beeni (Macroscopic): Root usually paired, occasionally separated due to breakage, ovoid, conical, small portions of stem sometimes attached, tapering downwards to a point, 2-4.5 cm, rarely 5 cm long, 0.4- 1.8 cm thick, gradually decrease in thickness towards tapering end; wrinkled longitudinally and transversely, rough due to root scar; dark brown to blackish-brown. Fracture hard and white within the cambium ring and brownish outside, coriaceous, cambium. Odour indistinct, taste slightly bitter followed by a strong tingling sensation, poisonous.

Khurd Beeni (Microscopic) : Root shows epidermis 1-3 layered, suberised, papillose on outside. Primary cortex consisting of 8-10 layers of oval to tangentially elongated, thin-walled parenchymatous cells, without or with a few intercellular spaces, a few rectangular stone cells in singles found scattered in this zone. Primary cortex separated by distinct endodermis; inner bark parenchymatous, consisting of round to oval cells, containing a few groups of phloem strands, occupying more than half the radius. Cambium having 6-10 angles; xylem vessels arranged almost in a ring, some scattered, often forming 'V' shaped

structure, enclosing xylem parenchyma in older portions; bundles compact often wedge-shaped having acute apex. Xylem exarch, metaxylem vessels met in center; starch grains simple measuring 6-18 μ in diameter and compound grains consisting of 2-5 components with hilum in center, present in cortical cells, phloem parenchyma and xylem parenchyma.

Juz-e-Mustamil (Parts used): Roots and aerial *parts*

Maskan (Habitat) : This plant Beesh has a restricted global distribution occuring in the Himalayan region across Pakistan and India. It has been recorded in the Sub-alpine & alpine zones of Western Himalaya from Chitral & Hazara to Kashmir and Himachal Pradesh in an altitude range of 3500-4000 meter.

Jwoher'e Nabatati (Phytoconstituents): The plant is rich sources of diterpenoid alkaloids and other classes of alkaloids, flavonoids, proteins, free fatty acids, steroids/triterpenes, saponins, carbohydrates, glycosides, cardiac glycosides gums and mucilages (Rahman, 1993, Pala and Mir, 2014). The most important alkaloid of the plant is aconitine.

Mizaj (Temperament): Hot $4^0$and dry 4^0

Musleh (Correction) : Milk, Rain water.

Badal (Proximal substitute): Another species 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 5.5 per cent, Appendix 2.2.3.
Acid-insoluble ash	: Not more than 2 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	: Not less than 8 per cent, Appendix 2.2.6.
Water-soluble extractive	: Not less than 24 per cent, Appendix 2.2.7.

T.L.C. :

T.L.C. of alcoholic extract of the drug on silica gel 'G' plate using Chloroform: Methanol (90:10) shows six spots at Rf. 0.10, 0.20, 0.39, 0.59, 0.74 and 0.96 (all yellow) on exposure to Iodine vapour. On spraying with Dragendorff reagent two spots appear at Rf. 0.39 and 0.96 (both orange). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Daf-e-Bukhar (Antipyretic), Musakkin, Mukhaddir Maqami(Local anaesthetics), Mudirr-e-Baul wa Haiz, Nafa-e-Amraz-e-Saudaviya wa Balghamiya, Muhaiyyij-e-Jild.

Despite serious concerns about safety, some people take aconite by mouth for facial paralysis, joint pain, gout, finger numbness, cold hands and feet, inflammation, painful breathing and fluid in the space surrounding the lungs (pleurisy), certain heart problems (pericarditis sicca), fever, skin diseases, and hair loss. Aconite is also used as a disinfectant, to treat wounds, and to promote sweating. Some people apply aconite to the skin in liniment as a "counterirritant" for treating facial pain, joint pain and leg pain (sciatica).

Mahall-e-Istemalat (Therapeutic uses): Shaqiqa(Migrain), Arqun Nisa, Zat-ul-Janb (Pleurisy), Zat-ur-Riya, Bukhar, Ehtabas-e-Baul wa Haiz (Anuria and amenorrhea), Juzam, Bars (Leucoderma), Zeeq-un-Nafas (Bronchial asthma), Qurooh-e-Khabisa

Meqdar-e-khorak (Dose): 15-30 mg.

Muzir (Side-effects / adverse-effects): The plant contains a strong, fast-acting poison that causes severe side effects such as nausea, vomiting, weakness or inability to move, sweating, breathing problems, heart problems, and even death.Some people use this plant in a cream or lotion that is applied to the skin which is also dangerous and can cause severe side effects.

Aaham Nukhsajat (Important formulations): Habb-e-Rahat, Habb-e-Nuqra, Dawa-e-Jiryan.

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BEKH KHATMI

(Root)

Bekh-e-Khatmi is a medicinal plant which is being used for the treatment of different diseases in the system of Unai Medicine. Though its different parts are used as medicine but here root is taken into account for the puepose of medicine.

Naam-e-Degar (Other names):

a. Botanical name: *Althaea officinalis* Linn.
b. Family : Malvaceae
c. Bengali name : Khetmi
d. English name : Marsh Mallow

Tafseel (Description):

Aam (General): The generic word *Althaea* is derived from the Greek word Althea which means 'to cure' due to its healing properties and the name of the family, Malvaceae, is derived from the Latin *malva*, a generic name for the mallows and the source of the English name common name *mallow* or *marsh mallow*. Basically marsh-mallow is a perennial herb which is used for both food and medicinal purpose.

Figure : Root of Bekh Khetmi

Klaa Beeni (Macroscopic) : Roots 0.2 to 3 cm in diameter, light brown in colour, strongly longitudinally furrowed, often spirally twisted; fracture, short, texture rough, internally yellowish white; odour, pleasant; taste, sweet and mucilaginous.

Khurd Beeni (Microscopic) : T. S. root circular in outline; cork 8 to 12 cells broad, radially arranged flattened cells; cortex broad, loosely arranged, parenchymatous, cells filled with mucilage; small patches of lignified fibres present; large number of schizogenous and lysigenous mucilage canals present; phloem well developed consisting of sieve tubes, companion cells and phloem parenchyma filled with mucilage; cambium 2 to 3 celled, xylem diffuse porous, made up of vessels, tracheids, fibres, and tracheidal fibres, vessels mostly solitary: filled with tyloses at some places, medullary rays 3 to 5 cells deep; rosette crystals of calcium oxalate present in cortical, phloem and xylem region; cells contain mucilage, stained red with 1% ruthenium red, and deep yellow with potassium hydroxide solution; most of the parenchymatous cells contain starch grains, polygonal to rounded, 5 to 20 □m, most grains less than 12 μm in diameter, simple, hilum circular or a 2 to 5 rayed cleft lamellae indistinct.

Powder : Powder white to light yellow, sweet in taste; under the microscope numerous fragments of parenchyma, the cells containing mucilage and starch grains polygonal to rounded, 5-20 □m, most grains less than 12 □m in diameter, simple, hilum circular or a 2-5 rayed cleft lamellae indistinct; occasionally small rosette crystals of calcium oxalate, group of sclerenchymatous cells, vessels measuring 113 to 262 m long, fibres measuring 519 to 1038 μm long and 9 to 19 □m broad; mucilaginous canals; when treated with 50% HNO3 turns yellowish-orange and emits yellow fluorescence under UV 254 nm; with 50% KOH, it emits light yellow fluorescence under UV 254 nm, while with 1 N-NaOH in methanol orangeish brown colour is seen in day light.

Juz-e-Mustamil (Parts used): Root

Maskan (Habitat) : *Althaea officinalis* or marsh-mallow is a perennial species indigenous to Europe, North Africa and Western Asia basically to Kashmir region.

Jwoher'e Nabatati (Phytoconstituents): Constituents of Bekh Khatmi includes altheahexacosanyl lactone (*n*-hexacos-2-enyl-1,5-olide), 2β-hydroxycalamene (altheacalamene) and altheacoumarin glucoside (5,6-dihydroxycoumarin-5-dodecanoate-6β-D-glucopyranoside), along with the known phytoconstituents lauric acid, β-sitosterol and lanosterol and also galacturonic acid, galactose, glucose, xylose, rhamnose, asparaginene, betaine, lecithin and polysaccharides.

Mizaj (Temperament): Hot $1^0$and Moist 1^0.

Musleh (Correction) : Rain water

Badal (Proximal substitute): Kanghi/Berela

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

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

Total ash : Not more than 7 percent, Appendix 2.2.3.

Acid insoluble ash	: Not more than 1.5 percent, Appendix 2.2.4.
Alcohol soluble extractive	: Not less than 8 percent, Appendix 2.2.6.
Water soluble extractive	: Not less than 21 percent, Appendix 2.2.7.
Moisture content	: Not more than 8 percent, Appendix 2.2.9.

TLC behavior of chloroform extract:

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using toluene : ethyl acetate : methanol (80 : 20 : 0.05) shows under UV (366 nm) fluorescent zones at Rf. 0.12, 0.27, 0.33, 0.82. On spraying with anisaldehyde-sulphuric acid and heating for ten minutes at 1200C, shows spots at Rf. 0.12, 0.18, 0.43, 0.47, 0.69 and 0.82. Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Muzliqe Ama, Musakkin, Mohallil (Resolvent)

Mahall-e-Istemalat (Therapeutic uses): Warme Ama (Enteritis), Suddae Ama, Zaheer (Dysentary), Suddae Amai.

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

Muzir (Side-effects / adverse-effects): Marshmallow root is generally well tolerated. In some cases it may cause upset stomach and dizziness.

Aaham Nukhsajat (Important formulations): Habb-e-Marshmallow, Sharbat-e-Marshmallow, Marshmallow capsule, Laooq Sapistan, Sharbat Ejaz, Laooq Nazli.

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BISFAYEJ

(Rhizome)

Bisfayej consist of dried rhizome of *Polypodium vulgare*Lnn. of family Polypodiaceae. It is herbaceous perennial fern found throughout the year. It is native to Europe, also found in Turkey and America. In India, it is imported from other countries

Naam-e-Degar (Other names):

a) Botanical name : *Polypodium vulgare* Linn.

b) Family: Polypodiaceae.

c) Bengali name : -

d) English name : Wall Fern, Adder's Fern, Common polypody, oak fern

Tafseel (Description):

Aam (General): Bisfaij is a perennial, small fern growing up to a height of about 30cm with an underground stem called rhizome. They are epiphytic ferns, with a creeping, hairy, scaly or irregular rhizome bearing fronds at interval along its length. The rhizome is flattened, yellowish-brown in colour externally and green internally. The drug is characterized by an astringent, sweet and nauseous taste and brittleness in fracture. It has a long, dull green, pinnatifid leaves, present in two rows on the upper side of the stem alternately.

Klaa Beeni (Macroscopic): The dried rhizomes are flattened to round in cross section and yellowish brown to dirty brown externally. The upper surface is attached with tubercles of some of which a portion of the base of the fronds still adheres. The under surface is more or

less spinous from the remains of broken radicals. The drug is characterized by a ferry odour, sweet, astringent and nauseous taste and moderately hard and brittle in fracture.

Khurd Beeni (Microscopic): Transverse section of the rhizomes is somewhat oval to round in shape. The whole ground tissue of cortex consists of thick-walled cells arranged parallel to the epidermis. Each vascular bundle is surrounded by a thin-walled barrel shaped, single layered endodermis, followed by a single layer of pericycle containing starch. Various cells of the cortex are provided with dark brown substance probably tannins.

Powder: Mecerate of the powdered rhizome consisted of large number of isodiametric shaped cells, varying in size, these cells contained cell inclusions. Long to very long tracheids, with sclariform thickenings are also very clear. Layers of pigmented parenchyma are also seen.

Juz-e-Mustamil (Part used): The Root and Rhizome parts are of Bisfayej plant used as drugs purpose.

Maskan (Habitat): Distribution: It is herbaceous perennial fern found throughout the year. It is a native to Europe, also found in Turkey and America. In India, it is imported from other countries.

Jwoher'e Nabatati (Phytoconstituents): Resins, tannins, steroids, flavonoids, alkaloids, glycosides, protein, reducing sugar, iron, calcium, magnesium, potassium, sulphur, chloride.

Mizaj (Temperament): Hot 2° Dry 1°

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 9 %	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 17 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene: Chloroform (3:1)	1_2 vapours	3	0.20, 0.36, 0.66

Aa'maal-e-Adviya (Pharmacological action): Mushil-e-Sauda-wa-Balgham

Mahall-e-Istemalat (Therapeutic use): Amraz-e-Balghamiwasaudwi, Juzam(Leprosy), MIalikhuliya, Nafkh-e- Shikam (Flatulance), Qulanj (Colic pain)

Meqdar-e-Khorak (Dose): 10 - 15 g

Muzir (Side-effects / adverse-effects): Harmful for lungs and kidney, also produces nausea.

Musleeh (Corrective): Gul-e-surkh, and Halelazard are used as corrective to avoid its toxicity and adverse effects**.**

Badal (Proximal substitute): Sometime in absence or unavailability of drug Aftimoon, Ayarijfiqracan be used as substitute.

Aaham Nukhsajat (Important formulations): ItrifalGhudadi, ltrifal-e-Ustukhuddus, Jawarish-e-Shahreyaran, Majoon-e-Najah, Majoon-e-Seer AlviKhani, Majoon-e-Ushba, Arq-e-Juzam, Sufoof-e-Chobchini, Sufoof-e-Lajward, ItrifalAftimoon, ItrifalAftimoonMushil, ItrifalKishniz, ItrifalMushil, Itrifal Sanai, Jawarish Qurtum, Majunchobchini.

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CHAKSU
(Seed)

The drug Chaksu consists of dried seeds of *Cassia absus* Linn. It is an erect annual plant, which belongs to family fabaceae. Height of this plant is in the range of 1–2 ft.

Naam-e-Degar (Other names):

a) Botanical name: *Cassia absus* Linn.

b) Family: Fabaceae

c) Bengali name: ChaksuBeej, Ban KulthiBeej

d) English name :Jasmeejaz, Chakanu Seeds

Tafseel (Description):

Aam (General): It is an erect annual herb. The plant occurs during July-November. Flowering and fruiting takes place from September to November.

Figure : Seeds of Chaksu

Figure : Fruits of Chaksu

Klaa Beeni (Macroscopic): Seeds are about 4-4.5 mm. long and 3-3.5 mm. wide, black, highly, glossy, laterally compressed and oval or oblong in shape. They have bitter taste and bear a strong aromatic odour.

Khurd Beeni (Microscopic): In longitudinal section the seed coat is thick and multi-layered. The outer most layer is cuticularized epidermis, composed of radially elongated, compactly arranged palisade like cells. The lumen of these cells is comparatively wider at the base (inner end) than at the top. Cotyledons are parenchymatous but the shape of their cellsvaries from polyhedral to elongated, all filled with a granular proteinaceous mass. Fibres and sclereids are lacking.

Juz-e-Mustamil (Part used): Seeds

Maskan (Habitat): Found throughout Bangladesh, India and everywhere in the tropics of old world.

Jwoher'e Nabatati (Phytoconstituents): Protein, alkaloids, fat, sugars, tannins, and mucilage. Beta- Sitosterol Beta glucoside alpha-D-galacto-D-mannan composed of galactose (1 mole) and mannose (3 mole) isolated from seed. Palmitic, gentisic, 5-0-D glucopyranosylgentisic acids, ethyl-alpha-D- galactopyranoside, apigonin, luteolin, hydrocarpin and isohydrocarpin.

Mizaj (Temperament): Hot 2° Dry 2°

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 1.5 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 7 %	Appendix 2.2.6
Water soluble extractives	Not less than 21 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	4	0.11, 0.18, 0.50, 0.76

Aa'maal-e-Adviya (Pharmacological action): Habis-ud-Dam (Haemostatic), Mohallil (Resolvent), Qabiz, Jali (Detergent), Musaffi-e-Dam (Blood purifier).

Mahall-e-Istemalat (Therapeutic use): Ramad(Conjunctivitis), Nuzool-ul Ma (Cataract), Bars(Vitiligo), Juzam (Leprosy)

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

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

Musleeh (Corrective): Not identified

Badal (Proximal substitute): No proximal substitute is identified

Aaham Nukhsajat (Important formulations): Sufoof-e-Bars

Note: Seeds should be used after proper detoxification (Mudabbar)

Refrences:

1. The Unani Pharmacpoeia of India, P-1, Vol-2, 2007, AYUSH, MHFW, Govt. of India.
2. Awan MH, 1981, KetabulMufraydat, Sheikh Gulam Ali & Sons, Lahore.
3. Saeed Ahmad et. Al., Phytochemistry and pharmacological potential of Cassia absus – a review, Royal Pharmaceutical Society, Journal of Pharmacy and Pharmacology, 70 (2018), pp. 27–41.

CHIRONJI
(Seeds)

The plant Chironji is being used as medicine to the traditional medicine practitioners since time immemorial. Due to the presence of different phytochemical consistituents and pharmacological as well as therapeutical activities it is used for the remedy of particular diseases in Unani system of medicine.

Naam-e-Degar (Other names):

a. Botanical name: *Buchanania lanzan* Spreng.
b. Family : Anacardiaceae
c. Bengali name : Chirangi, Chowl, Satdhan, Piyal, Sarop, Chironji, Charoli.

d. English name : Cheronjee, Almondette tree, Cuddapah almond

Tafseel (Description):

Aam (General): *Buchanania lanzan* is a deciduous tree which produces seeds that are enriched with medicinal properties. The charoli seed is lentil-sized and slightly flattened and has an almond-like flavour. After cracking the hard shell there is stubby seed within it which is as soft as a pine nut.

Figure : Fruits of Chironji

Figure : Seeds of Chironji

Klaa Beeni (Macroscopic) : Seed laterally much compressed, creamish-brown, mottled with darker brown line,0.4- 0.6 cm long, 0.35-0.5 cm wide, funicle stout, micropyle superior, linear. Hilum present at the apex of round edge; slight pressure separates oily cotyledons; odour pleaseant; taste sweetish-oily.

Khurd Beeni (Microscopic) : : Longitudinal section of seed-coat shows epidermis consisting of polygonal cells with scattered, large, pitted, thick-walled, sclerenchymatous cells, occurring mostly in groups followed by remnants of disorganized collapsed cells of integument which are of various size, thin-walled and parenchymatous cells filled with brownish content and form a pigment layer, below which a band of parenchymatous cells present, consisting of elongated or tubular cells. Cotyledons consisting of epidermis and

thin-walled parenchymatous cells, epidermal cells of cotyledons barrel-shaped and the parenchymatous cells polyhedral and filled with aleurone grains of globoid type measuring 2.5-5.0 μ in diameter and oil globules; procambium bundles running longitudinally also occur among these parenchyma cells.

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

Juz-e-Mustamil (Parts used): Stem bark, seed kernel and Chironji nuts.

Maskan (Habitat) : The plant acahironji grows in open and dry forests on poor soils of Indo-Pak Subcontinent. It is also found in lowland forests in southern China at elevations of 100 to 900 metres.

Jwoher'e Nabatati (Phytoconstituents): The seeds of the plant contain fibres, carbohydrates, mineral, fats, vitamin B, B, B, C, calcium, chlorine, copper, iron, magnesium, phosphorus, potassium, sodium, sulfur, fatty oil, β-amyrin, albuminoids and starch.

Mizaj (Temperament): Hot and Moist

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

Badal (Proximal substitute): Another part of the same plant may be substituted, 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 4 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 0.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 10 per cent, Appendix 2.2.6
Water-soluble extractive	: Not less than 07 per cent, Appendix 2.2.7

TLC behavior of chloroform extract: T.L.C of alcoholic extract of the drug on silica gel 'G' plate using Benzene: Ethylacetate (3:1) shows under U.V. (254 nm) two fluorescent zones at Rf. 0.72 and 0.94 (blue). On exposure to Iodine vapour seven spots appear at Rf. 0.08, 0.27, 0.54, 0.72, 0.91, 0.94 and 0.98 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and on heating the plate for ten minutes at 1050C eight spots appear at Rf. 0.08, 0.27, 0.54, 0.72, 0.84, 0.91, 0.94 and 0.98 (all violet.) Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Musammin-e-Badan, Muqawwi-e-Bah (Aphrodasiac), Jali(detergent), Muwallid-e-Mani(Spermatogenic)

Mahall-e-Istemalat (Therapeutic uses): Zof-e-Bah(Sexual debility), Zof-e-Badan(General debility), Riqqat-e-Mani(Low viscosity of semen)

Meqdar-e-khorak (Dose): 6-10 gm.

Muzir (Side-effects / adverse-effects): It should not be used during indigestion problem and constipation.

Aaham Nukhsajat (Important formulations): Luboob-e-Kabir, Laboob Saghir.

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DHATURA
(Seeds)

The drug Dhutura is a short-lived shrubby perennial Medicinal plant whiach is being used in traditional medicine since long time. Inspite of consisting poisonous substance, the plant is used as medicine for its different pharmacological and therapeutical activities.

Naam-e-Degar (Other names):

a. Botanical name: *Datura metel* Linn
b. Family : Solanaceae
c. Bengali name : Dhutura, Dhutra
d. English name : White Thorn Apple

Tafseel (Description):

Aam (General) : The plant Dhutura is an annual herb growing up to 6 ft high. It is slightly pubescent with green to dark violet shoots and oval to broad oval leaves that are often dark violet as well. The pleasantly-scented flowers are immensely varied and can be single or double. Corolla colour can range from white to cream, yellow, red and violet. The seed capsule is covered with numerous conical warts or short, sparse spines.

Figure : Seeds of Dhatura

Klaa Beeni (Macroscopic) : Seed reniform, compressed, flattened, surface finely pitted; 0.6 cm long, 0.4 cm wide; light brown to yellowish-brown in colour; thicker towards the curved edge, which is rugose; large, pale strophiole near micropyle; odourless; taste bitter.

Khurd Beeni (Microscopic) : Shows in outline more or less elongated, irregular or wavy structure having bulgings at either side; testa single layered consists of thick-walled, lignified, sclerenchymatous cells forming clubshaped structure, followed by 3-5 layered more or less tangentially elongated, thin-walled parenchymatous cells; endosperm encloses more or less curved embryo composed of polygonal, thin-walled parenchymatous cells, filled with aleurone grains and abundant oil globules.

Powder: Brown and oily; shows fragments of testa of groups of thick-walled, light brown, sclerenchymatous cells; polygonal, thin-walled parenchymatous cells containing oil globules and aleurone grains.

Juz-e-Mustamil (Parts used): Root barks, leaves, flowers, seeds.

Maskan (Habitat) : The palnt is found throughout the world and frequently cultivated in the gardens and farmlands.

Jwoher'e Nabatati (Phytoconstituents): Chemical constituents includes; Scopalamine, daturadiol, Tropane, Hyoscyamine, Fastudine, Allantoin Niacin, Vitamin C, Tropine, Noratropine, Meteolodine, Hyosine, Fastusic acid, Fixed oil. etc.

Mizaj (Temperament): Cold 4^0(First grade)and Dry 3^0

Musleh (Correction) : Filfil Siyah, Badiyan(Foeniculum vulgare Nill)

Badal (Proximal substitute): Afiyun, Tokhm-e-Lakka.

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 5 per cent, Appendix 2.2.6
Water-soluble extractive	: Not less than 7 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: Diethylamine

(7:2: 1) shows under U.V. (366 nm) three fluorescent zones at Rf. 0.18, 0.33 (both light blue) and 0.93 (blue). On exposure to Iodine vapour three spots appear at Rf. 0.33, 0.47 and 0.93 (all yellow). On spraying with Dragendorff reagent two spots appear at Rf. 0.33 and 0.47 (both orange). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Externally-Musakkin wa Mukhaddir (Anaesthetics)

Internally-Moharrik-e-Dimagh(Brain stimulant), Muskir, Daf-e-Tashannuj Aurooq-e-Khasna, Daf-e-Bukhar (Antipyretic)

Mahall-e-Istemalat (Therapeutic uses): Waja-ul-Mafasil(Arthritis), Niqras (Gout), Sual wa Zeequn Nafas, Nazla (Catarrh), Humma(Pyrexia)

Meqdar-e-khorak (Dose): 1-4 Chawal

Muzir (Side-effects / adverse-effects): *Datura metel* is a very toxic plant and can cause flushed skin, headaches, hallucinations and possibly convulsions or even a coma.

Aaham Nukhsajat (Important formulations): Habb-e-Shifa, Dawa-e-Tatura**,** Roughan Chahar Barg.

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DOODHI KHURD
(Whole plant)

The drug Doodhi is a herbal plant which grows above the ground and is used to make medicine for the remedy of some particular diseases in Unani system of medicine..

Naam-e-Degar (Other names):

a. Botanical name: *Euphorbia prostrata* Aiton.

b. Family : Euphorbiaceae

c. Bengali name : Bara, Kharui, Kerai, Dudiya, Shwet Keruee

d. English name : Ground spurge, Blue weed, Prostrate spurge, Prostrate sandmate.

Tafseel (Description):

Aam (General) : The medicinal plant prostrate spurge consists of whole plant of *Euphorbia prostrata.* It is a small more or less pubescent, much branched annual prostrate found as a naturalized weed in many parts of our country..

Figure : Doodhi plant

Klaa Beeni (Macroscopic) : Branched prostrate with many stems spreading from the roots, slender upto 20 cm long; leaves green but occasionally purplish red, opposite, 2.5 to 5 mm long and 2 to 4 mm broad, oblong or subquadrate, tip mucronate, base symmetric and more or less cordate, margin serrulate in upper portion, glabrous above, slightly pubescent beneath especially on the apex; petiole short, 1 mm or even less in length; tap root 1 to 3 mm in diameter; inflorescence cyathium in short axillary racemiform clusters, involucre lobes 5, deltoid ovate, ciliate; nectary gland 4, minute; ovary tricarpellary, suborbicular, stipitate, narrowly limbed long styles; stigma three branched, each bifid; capsule 1 to 1.5 mm long, densely hairy on ridges, hairs occasionally present on the surface; fruit subglobosely trigamous, long stalked; seeds 0.6 to 0.8 mm long, oblong, 4 angled, smooth with 5 to7 transverse ribs, reddish brown and bluntly pointed; smell oily; no characteristic taste.

Khurd Beeni (Microscopic) :

Root: T. S. of young root circular in outline, endodermis without casparian bands; triarch stele; mature roots phelloderm 6 to 8 layers, outer most layer thickly suberized; cork cells obliterated; cambium indistinct; broad xylem vessels solitary or in a group of 2 or 3, surrounded by a number of radially arranged narrow vessels and tracheids; medullary rays short, one or two seriate and extend upto phloem.

Stem: Cross section of stem circular in outline, thick, non striated cuticle, interrupted by unicellular or multicellular uniseritate trichomes upto 185 □□long and 15 □□broad; paracytic stomata at some places; cortex with a few latex canals; pericyclic fibres in groups; cambium not discernible; medullary rays narrow, 1 or 2 cell wide, parenchymatous pith with intercellular spaces.

Leaf: Two types of hairs present (a) multicellular, multiseriate glandular hairs with single apical cell at leaf margins only, (b) uniseriate 1 to 3 celled hairs on the margins, at abaxial side and in apex; cross section shows dorso-ventral structure, single layered upper and lower epidermis, mesophyll and vascular bundles; in surface view, the abaxial epidermal cells angular with straight cell walls, stomata anomocytic to anisocytic, stomatal indices 17.6 to 26.3 and density 60 to 130; adaxial epidermal cell walls slightly wavy with globular thickening at the angles; stomata anisocytic, stomatal indices 11.4 to 18.7 and stomatal density 25 to 60; palisade ratio 3 to 6; vascular bundles collateral, with bundle sheath; laticiferous canals observed; vein islet 1 to 5 and vein termination numbers is 3 to 13.

Powder: Powder yellowish-green, tasteless with oily odour; on microscopical examination it shows angular and slightly wavy epidermal cells with stomata, uniseriate, 1 to 3 celled trichomes or hairs and some pieces of glandular hairs parenchymatous patches, laticiferous canals, pollen grains, pieces of nectary glands, fragments of vessels, tracheids, fibres and

stomata; when treated with 1N NaOH in methanol shows purple colour with yellowish tinge, and in acetic acid reddish yellow colour under UV – 254 nm.

Juz-e-Mustamil (Parts used): Leaves, whole plants

Maskan (Habitat) : The plant is native to the Caribbean and certain parts of South America. It is widely naturalized in many other parts of the world where it can be found in varied habitat types and in many areas grows as a roadside weed. In Bangladesh it is found abundantly as an weed in the roadsides and fellow lands.

Jwoher'e Nabatati (Phytoconstituents): The various types of phytoconstituents are obtained in *Euphorbia prostrata* Ait. like glucoside, galactoside, β-sitosterol, compesterol, stigmasterol, cholesterol, apigenin, luteolin, apigenin-7-glucoside, luteolin-7-glucoside, gallic acid, ellagic acid and tannins

Mizaj (Temperament): Hot and Dry /Cold & Dry

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 1 percent, Appendix 2.2.2.
Total ash	: Not more than 11 percent, Appendix 2.2.3.
Acid insoluble ash	: Not more than 0.2 percent, Appendix 2.2.4.

Alcohol soluble extractive : Not less than 11 percent, Appendix 2.2.6.

Water-soluble extractive : Not less than 27 percent, Appendix 2.2.7.

TLC behavior of chloroform extract:

T.L.C. of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using toluene : ethyl acetate (80 : 20) shows under UV (366 nm.) fluorescent zones at Rf. 0.05 (Maroon), 0.15 (light blue) and 0.66 (red). On spraying with anisaldehyde-sulphuric acid reagent and heating the plate for ten minutes at 1200C, spots appear at Rf. 0.12 (bright green), 0.23 (pinkish blue), 0.32 (pink), 0.38 (grey), 0.48 (dark greyish blue), 0.52 (pink), 0.61 (magenta), 0.66 (magenta) and 0.94 (blue). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Qabiz-e-Ama (Constipative), Qatil-e-Deedan (Vermicidal), Musakkin, Daf-e-Sual wa Dammah, Habis-e-Ishal, Daf-e-Tashunnuj, Daf-e-Suzak, Musaffi-e- Khoon (Blood purifier).

Mahall-e-Istemalat (Therapeutic uses): Ishal (Diarrhoea), Deedan-e-A'ma (Intestinal worms), Istahaza, Bawaseer (Hemorrhoid), Jiryan (Spermatorrhoea), Fasad-e-Dam, Sual wa Dmah, Sailanur raham (Leuchorrhoea), Surate Inzal, Nafe Ziabetus, Suzak (Gonnorrhoea).

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

Muzir (Side-effects / adverse-effects): The plant may cause nausea, vomitingskin irritation or allergic reactions. In pregnancy it may cause a miscarriage due to uterine contraction.

Aaham Nukhsajat (Important formulations):

References:

1. The Unani Pharmacopoeia of India, Part-1, Volume-5, Pages 25-26, January-2008, Published by AYUSH, Ministry of Health & Family Welfare, New Delhi, India.
2. Bangladesh National Formulary of Unani Medicine, 2nd edition, June-2011, Published by Bangladesh Board of Unani and Ayurvedic System of Medicine, Dhaka, Bangladesh.
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5. Dr. Abdul Ghani, 2003, Medicinal Plants of Bangladesh with chemical constituents and uses, 2nd Edition, Published by Asiatic Society of Bangladesh, Dhaka, Bangladesh.
6. Bakhshi, et al (2008). *"Prospective, Open Label Study of Euphorbia Prostrata Extract 100 mg in the Treatment of Bleeding Haemorrhoids"* . Bombay Hospital Journal. 50 (4): 577–583.
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GANDANA
(Leaf)

The drug Gandana consists of dried leaves of *Asphodelustenuifolius* Cav.

Naam-e-Degar (Other names):

a) Botanical name : *Asphodelustenuifolius*Cav

b) Family: Liliaceae/Asphodelaceae

c) Bengali name : --

d) English name : Shallot**,** Onionweed

Tafseel (Description):

Aam (General): The drug Gandana is a wild, terrestrial, annual stemless, bulbiferous herb /weed with fibrous roots, native to Mediterranean region, Asia and Mascarene Islands, growing commonly as a winter weed. The plant is 15-50 cm tall having erect hollow cylindrical leaves and white flowers with pinkish central stripe. It is used as vegetable. Seeds, roots and whole plant are also used for medicinal purposes

Figure : Gandana leaves

Klaa Beeni (Macroscopic): Leaves radical, linear, cylindrical, 15 to 30 cm long and 2 to 3 mm wide, fistulous, acute apex, sheathing at the base, finely puberlous, taste and odour not specific.

Khurd Beeni (Microscopic): Transverse section of leaf circular in outline, centric, epidermis uniseriate, with strongly cuticularized outer walls, stomata arranged in rows, parallel to the long axis of leaf, mesophyll differentiated into an outer palisade and inner spongy cells; a few cells show rosettes of calcium oxalate crystals; the hollow central part

bordered by inner epidermal cells; vascular bundles small collateral, closed, arranged in a circle in the lower part of mesophyll, having phloem on outer side and xylem towards centre; each bundle surrounded by a parenchymatous bundle sheath; Palisade ratio 4 to 8, stomatal number 20 to 30, stomata! Index 28 to 33.

Powder: Powder light brown without any specific odour or taste; shows fragments of epidermis with stomata, parenchyma and elongated palisade cells, calcium oxalate crystals and tracheids having spiral thickening.

Juz-e-Mustamil (Part used): Leaf**,** Seeds, roots and whole plant also used for medicinal purposes.

Maskan (Habitat): It is widely distributed in Mediterranean region, north Africa, southern Europe, India, and Pakistan.

Jwoher'e Nabatati (Phytoconstituents): Lupeol. Chrysophanol, aloe-emodin.

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

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 20 %	Appendix 2.2.3
Acid insoluble ash	Not more than 6 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 5 %	Appendix 2.2.6
Water soluble extractive	Not less than 25 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Ethyl Acetate	On spraying plate with 2% Ethanol is conc. 0.20 H_2SO_4 and heated for 5 minutes at 105^0 C	6	0.11, 0.20, 0.33, 0.40, 0.66, 0.76

Aa'maal-e-Adviya (Pharmacological action): Mufatteh-e-Sudad, Habis.

Mahall-e-Istemalat (Therapeutic use): Ishal (Diarrhoea)

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

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

Musleeh (Corrective): Not required

Badal (Proximal substitute): No proximal substitute is identified

Aaham Nukhsajat (Important formulations): JawarishFanjnosh, Habb-e-Jalinoos, Habbe-Muqil

Refrences:

1. The Unani Pharmacpoeia of India, P-1, Vol-3,2007, AYUSH, MHFW, Govt. of India.
2. Aslam, N., K. Janbaz, and Q. Jabeen. "Hypotensive and Diuretic Activities of Aqueous-Ethanol Extract of AsphodelusTenuifolius". Bangladesh Journal of Pharmacology, Vol. 11, no. 4, Oct. 2016, pp. 830-7, doi:10.3329/bjp.v11i4.27131)

3. Younis W, Alamgeer, Schini-Kerth VB, Junior AG, Majid M. Cardioprotective effect of Asphodelustenuifolius Cav. on blood pressure and metabolic alterations in glucose-induced metabolic syndrome rats-An ethnopharmacological approach. J Ethnopharmacol. 2018 Mar 25;214:168-178.

GAOZABAN
(Leaf)

The drug Gaozaban is a dried leaves of *Borago officinalis* Linn.

Naam-e-Degar (Other names):

a) Botanical name : *Borago officinalis* Linn.

b) Family: Boraginaceae

c) Bengali name : -

d) English name : Borage

Tafseel (Description):

Aam (General): It is an erect, spreading hispid annual biennial plant. The plant found mostly in Mediterranean region, Europe, Northern Asia, The plant occurs during November to January. In India plant is sparsely distributed in Northenestern Himalayas from Kashmir to Kumaon at altitudes of 3,500-4,500m.

Figure : Leaves of Gaozaban

Klaa Beeni (Macroscopic): The leaf is simple, obovate or ovate in shape, with an obtuse apex and crenate margin. The upper leaves are sessile or shortly stalked, while the lower ones exhibit a decurrent petiole. The leaves have a dark green upper surface with greyish green lower surface due to the prickly hairs.

c) Khurd Beeni (Microscopic): The upper epidermis of lamina is covered with a thin, smooth cuticle and consists of one layer of polygonal cells with almost straight anticlinal walls. Stomata occur fairly frequently and are mainly of the anisocytic type, some are anomocytic. Covering trichomes are numerous, they are unicellular, straight having cellulose walls and tapering apices. The lumen is visible throughout the entire length, the base is somewhat swollen and may contain crystalline inclusions. Glandular trichomes consist of a unicellular stalk and a unicellular, sub-spherical head. The mid-rib has a typical dicotyledonous structure, the diameter of the central bundle increases from the apex to the base of the leaf. Large trichomes have their base surrounded by several small cells and the

walls are sometimes warty. This type of trichomes are not as frequent as those with at the bulbous base. The cortex contains one or two rows of hypodermal collenchyma below the upper epidermis and above lower epidermis. The endodermal sheath is consisting of a single layer of cells containing starch grains. In transverse section this layer is horse-shoe shaped. The meristele is sub-spherical in shape and well defined in transverse section. The pericycle consists of a well defined area of collenchyma above the xylem and below the phloem. The transverse section through the petiole is similar to that of the mid-rib with a exception that cells are slightly large due to the increase in size of the total structure. Some trichomes contain crystalline deposit in their basis.

Powder: The powdered drug is light brown with greenish tinge, and have cucumber like odour and taste. On microscopic study it shows to contain various glandular and non-glandular unicellular trichomes, palisade and spongy mesophylls, collenchyma, and thin layer parenchymatous cells. The tracheidal vessels and vessels with annual and spiral thickenings are also seen scattered with epidermal fragments.

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

Maskan (Habitat): The plant found mostly in Mediterranean region, Europe, Northern Asia, The plant occurs during November to January. In India plant is sparsely distributed in Northenestern Himalayas from Kashmir to Kumaon at altitudes of 3,500-4,500m.

Jwoher'e Nabatati (Phytoconstituents): Alkaloids, mucilage, potassium nitrate, calcium oxalate.

Mizaj (Temperament): Hot 1° Moist 1°

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 21 %	Appendix 2.2.3
Acid insoluble ash	Not more than 6 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 2 %	Appendix 2.2.6
Water soluble extractives	Not less than 16 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Benzene: Chloroform (3:5)	2% Ethanolic H_2SO_4	1	0.79

Aa'maal-e-Adviya (Pharmacological action): Munaffis-e-Balgham (Expectorant), Mulattif (Demulcent), Mohrriq, Muqawwi-e-Qalb (Cardiotonic)

Mahall-e-Istemalat (Therapeutic use): Zeeq-un-Nafas (Bronchial asthma), Yarqan (Jaundice), Zukam-o-Nazla (Coryza and catarrh), Khafqan (Palpitation)

Meqdar-e-Khorak (Dose): 7 -17 g

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

Musleeh (Corrective): Not required

Badal (Proximal substitute): No proximal substitute is identified

Aaham Nukhsajat (Important formulations): Khamira-e-Gaozaban Ambari Jawahirwala, Khamira-e-Gaozaban Sada, Khamira-e-Zahar Mohra, Majoon-e-Azaraqi, Majoon-e-Khadar, Majoon-e-Rahul-Momineen, Dyaqooza, Majoon-e-Ushba, Mufarreh-e-Barid, Mufarreh-e-Sosambri, Mufarreh-e-Barid Jawahir Wali, Mufarreh-e-yaqooti Barid, Mufarreh-e-Yaqooti Motadil, Sharbat-e-Deenar, Zuroor-e-Gaozaban, Arq-e-Chobchini, Arq-e-Gaozaban, A rq-e-Juzam.

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1. The Unani Pharmacpoeia of India, P-1, Vol-2,2007, AYUSH, MHFW, Govt. of India.
2. Awan MH, 1981, KetabulMufraydat, Sheikh Gulam Ali & Sons, Lahore
3. Mayank Gupta, Swati Singh, BoragoOfficinalis Linn. An ImportantMedicinal Plant of Mediterranean Region: A Review, International Journal of Pharmaceutical Sciences Review and Research, Volume 5, Issue 1, November – December 2010; Article-005 ISSN 0976 – 044X.

GHARIQOON
(Fruiting body)

The herb Ghariqoon consists of fruiting body of an edible gilled saprophytic fungus which is commonly known as mushroom. The plant is enriched with different phytochemical constituents for which it is used as medicine in Unani system.

Naam-e-Degar (Other names):

a. Botanical name: *Polyporus officinalis* Fries

b. Family : Polyporaceae

c. Bengali name : -

d. English name : White agaric, Touch wood , Boletus, Larch Agaric, Purging agaric.

Tafseel (Description) :

Aam (General) : Polyporus is a genus of poroid fungi which was first mentioned in the Talmud regarding someone who touched his nose or mouth multiple times and grew Polypus. This was written in approximately 200 B.C

Figure : Fruiting body of Ghariqoon

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

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

Juz-e-Mustamil (Parts used): Fruiting body.

Maskan (Habitat): The plant Ghariqun grows as wild on damp and dead organic substances mainly in Mediterranean regions and in Indo-Pak sub-continent.

Jwoher'e Nabatati (Phytoconstituents): The drug contains Agaric acid (Agaricin), Glucosides, Steroids, Resins, Saponins, Carbohydrates, Proteins, Phenolic Compounds, Tannins, Phofphate etc.

Mizaj (Temperament): Hot 3^0 and Dry3^0

Musleh (Correction): Fresh milk.

Badal (Proximal substitute): No information regarding Polyporus officinalis Fries's substitute is currently available. (Instead of Ghariqun, Majriun may be applied).

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

Foreign matter : Not more than 2 percent , Appendix 2.2.2

Total ash **:** Not more than 2 percent , Appendix 2.2.3

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

TLC behavior: TLC of petroleum ether extracts using Pet.Eth. Diethyl ether (4:1) as mobile phase shows five spots at Rf 0.16, 0.28, 0.37, 0.60, 0.93 (all black in color) when sprayed with 10% perchoric acid and kept the plate in one oven at 1050 for 10 mins.

Aa'mal-e-Advia (Pharmacological action): Habis, Daf-e-Bukhar (Antipyretic), Muqawwi-e-Meda (Gastic Tonic), Musakkin, Daf-e-Dard (Analgesic), Mushil (Purgegative) and Munafise-Balgham (Expectorant)

Mahall-e-Istemalat (Therapeutic uses): Sil, Humma, Yarqan (Jaundice), Zof-e-Meda (Weakness of Stomach), Waja ul mafasil (Arthritis) and Nafs-ud-Dam.

Meqdar-e-khorak (Dose): 5 to 15 grains.

Muzir (Side-effects / adverse-effects): Use of too large doses may create loose motion and vomiting, excessive sweats, convulsions and membranous infection in throat. Some times it may create sneezing, cough, and nausea, when the nostrils are exposed to it.

Aaham Nukhsajat (Important formulations): Itrifal Ghudadi, Majoon-e-Antaki, Majoon-e-Talkh, Sabadaritoos, Hab Ayaraj, Itrifal Anqaruya-i-Kabir Ghudaddi, Ma'jun Murawweh ul-Arwah, Mufarreh Kabir, Sharbat Mushil.

References:

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6. Ahmad, S., Khan, M. A., Ayaz, S., Ahamd, I. (2013). Antibacterial and antifungal studies of the crude extract and solvent fractions of *Onosma khyberianum*. *Pharmacologica* 4 (9), 525–528.
7. Albaqami, J., Myles, L. E., Tiriveedhi, V. (2018). The Effect of *Onosma bracteatum* in cancer cells. *MOJ Bioequiv. Availab.* 5 (6), 321–325.

GUL-E-BABUNA
(Flower)

The drug Gul-e-Babuna consists of dried flowers of *Matricaria chamomilla* Linn. A glabrous much branched aromatic herb.

Naam-e-Degar (Other names):

a) Botanical name : *Matricaria chamomilla* Linn

b) Family: Asteraceae

c) Bengali name : Babun Ful

d) English name : German Chamomile

Tafseel (Description):

Aam (General): True chamomile is an annual plant with thin spindle-shaped roots only penetrating flatly into the soil. The branched stem is erect, heavily ramified, and grows to a height of 10-80 cm. The long and narrow leaves are bi- to tripinnate. The flower heads are placed separately, they have a diameter of 10-30 mm, and they are pedunculate and heterogamous. The golden yellow tubular florets with 5 teeth are 1.5-2.5 mm long, ending always in a glandulous tube. The 11-27 white plant flowers are 6-11 mm long, 3.5 mm wide, and arranged concentrically. The receptacle is 6-8 mm wide, flat in the beginning and conical, cone-shaped later, hollow—the latter being a very important distinctive characteristic of *Matricaria* and without paleae. The fruit is a yellowish brown achene.

Figure : Flowers of Babuna

Klaa Beeni (Macroscopic): The dried flowers heads are 3-5 mm. in diameter, yellowish brown in colour. Peduncle is greenish, striated. The white strap shaped ligules are arranged

in a single row on the periphery of the involucre of bracts. All the florets are borne on a dark central conical receptacle.

c) Khurd Beeni (Microscopic): The receptacle in a longitudinal section shows that it is hollow inside. The wall of the receptacle is quite thin and consists of elongated parenchymatous cells. The vascular strands run longitudinally, small cavities are observed at some places.

Ligulate floret consists of an inferior appendage containing the ovary. The bracteole is thin papery, unevenly dissected into finger like projections at the apex. Androecium is absent. Gynoecium consists of an inferior, unilocular ovary containing a single basal ovule. The style is quite long and swollen near the base. The cells are thick walied in the swollen region. The stigma is bifid and protrudes out of the ligular tube. Two vascular strands run throughout length of the style.

The disc floret consists of separate inferior appendage containing ovary forming a neck. The stamens are borne on corolla tube by curved filaments. The anthers are bilobbed and terminate into a conical structure. The structure of the gynoecium is same as in ligulate florets except the swelling near the base of the style is more prominent hair which appears like a disc. Cross section of the peduncle shows a continuous band of 3-4 rows of chlorenchymatous cells. Vascular bundles are present below ridges portion. The epidermis is single layered followed by 2-3 layered hypodermis only in the ridge portions. No definite endodermis is distinguishable. The cells of the pith region are thin walled and large in size.

Powder: The powder is yellowish brown in colour. It is slightly bitter in taste and has its own characteristic aromatic odour. The powder under microscope shows an abundance of sphaerical pollen grains which show a spiny exine. The measure 21-24.5 microns in diameter. Simple hairs and scales are seen amongst fragment of other floral appendages like corolla, stamens and style etc. isolated pitted xylem elements with reticulate thickenings are also seen.

Juz-e-Mustamil (Part used): Flower

Maskan (Habitat): The plant is a native of Europe, extensively cultivated Hungary, Germany, Russia, and Yugoslavia. In India it grows in Punjab and upper Gangetic plain. The plant is cultivated during winter season and the flowers and fruits occur in the same season.

Jwoher'e Nabatati (Phytoconstituents): Alkaloids, carbohydrates, phenols, proteins, aluminium, iron, potassium, sodium and zinc. Essential oil, glycoside, β-heteroside, chamazulene, apigenin, α-hetroside, salicylic acid and a non-crystalline β-hetroside: pure azulene isolated from the essential oil.

Mizaj (Temperament): Hot 2" Dry 2°

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 4 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 4 %	Appendix 2.2.6
Water soluble extractive	Not less than 26 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet. Ether: Benzene (2:3)	1_2vapours	6	0.12, 0.20, 0.38, 0.54, 0.68, 0.89

Aa'maal-e-Adviya (Pharmacological action): Moharrik (stimulant), Mulattif (Demulcent), Kasir-e-Riyah (carminative)

Mahall-e-Istemalat (Therapeutic use): Suda (Headache), Suzak (Gonorrhoea), Ramad, Waj-us-Sadr, Hasat-e-KuliyaWaMasana, Zof-e-Aam, Ikhtinaq-ur-Rahem (Hysteria), Su-e-Hazm (indigestion), Humma-e-Naubati

Meqdar-e-Khorak (Dose): 5 gm

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

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute is identified

Aaham Nukhsajat (Important formulations): Majoon-e-Fotnaji, Majoon-e-Seer Alvi Khani, Zimad-e-MohalliI, Zimad-e-Sumbul-ut-Teeb, Zimad-e-Waram-e-Unsayain-Muzmin, Raughan-e-Babuna Sada, Raughan-e-Babuna Qawi, Qarooti Bazr-e-Katan.

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GUL-E-GHAFIS
(Flower)

The drug Gul-e- Ghafis consists of dried flowers of *Gentiana olivieri* Griseb. Syn. *G. dahurica* Fisch. (Gentianaceae), a stout herb bearing opposite leaves and flowers in terminal clusters.

Naam-e-Degar (Other names):

a) Botanical name : *Gentiana olivieri* Griseb

b) Family: Gentianaceae

c) Bengali name : -

d) English name : Persian Gentian

Tafseel (Description):

Aam (General): It is a perennial herbaceous plant 10–40 cm tall, grows at an altitude of 350-2300 meters. Linearelliptic to elliptic lanceolate, narrowed leaf with acuminate apex and distinct veins. Perennial stem is erect, slender and glabrous. Flowers (3-5) are arranged in terminal corymbose cymes inflorescences. Pedicel is 3 to 5 cm, calyx tube (4-8 mm) is obconic; lobes are triangular, unequal. Corolla is blue coloured with obconic lobes having entire margin. Stamens are inserted just below middle of corolla tube; filaments are 6-8 mm; long with linear anthers. Capsules type seeds (0.8-1 mm) are brown, ellipsoid with thick reticulate seed coat.

Figure : Flowers of Ghafis

Klaa Beeni (Macroscopic): Flowers complete, bisexual, actinomorphic, dull brown coloured, pedicellate; pedicel cylindrical, 3.5 to 6 cm long; calyx 5-partite, lobes equal; corolla funnel shaped, about 2 cm long, erect, and 5-partite, often with folds between lobes; stamens 5, attached at the middle of the lobes, alternate to corolla segment, included, filament linear, stigma bibbed, style short, ovary superior, one celled, ovule many, odour not specific, taste bitter.

Khurd Beeni (Microscopic): Transverse section of pedicel circular in outline, epidermis single layer, parenchymatous cells of cortex contain abundant calcium oxalate druses and prismatic crystals, xylem forms a complete ring and consists of long thick fibres, about 350 to 450µ long, phloem present; inner to xylem ring a few parenchymatous cells present enclosing a hollow centre; petals show simple parenchymatous cells bounded by epidermis

on either sides having slightly wavy anticlinal walls; the anther wall consists of fibrous endothecial cells; spherical, pollen grains of 14 to 16μ, with three pores, exine smooth:

Powder: Powder dull brown coloured having a bitter taste; consists of abundant smooth pollen grains, fragments of endothecial cells of anther, brownish fragments of petals showing epidermal cells with wavy walls, tracheids with spiral and scalariform thickenings; druses and prismatic crystals of calcium oxalate also found.

Juz-e-Mustamil (Part used): Flowers

Maskan (Habitat): It is abundantly found in Temperate and Tropical Asia including regions of Western Asia, Middle Asia, Indian subcontinent, Afghanistan, Pakistan, Iran, Iraq, Syria, Turkey, Armenia. The plant is also found in temperate region of Gulf countries and some temperate region of China. Also found in Western Himalayas.

Jwoher'e Nabatati (Phytoconstituents): Oleanolic acid, ursolic acid and alkaloids

Mizaj (Temperament): Hot 1°, Dry 2°

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 2 %	Appendix 2.2.4

Alcohol soluble extractive	Not less than 4 %	Appendix 2.2.6
Water soluble extractive	Not less than 7 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) 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 and heated for 5 minutes at 105° C	12	0.12, 0.20 , 0.25, 0.32, 0.45, 0.50 , 0.55, 0.65, 0.68, 0.81, 0.83, 0.95

Aa'maal-e-Adviya (Pharmacological action): Moaddil, Moarriq, Daf-e-Humma (Antipyretic), Mohallil-e-Waram(Anti-inflammatory), Jali(detergent), Mulattif (Demulcent), Muqawwi-e-Meda (Gastic Tonic), Musaffi-e-Khoon (Blood purifier), Mufatteh, Mudirr-e-Baul (Diuretic), Mudirr-e-Haiz, Mudirr-e Laban, Qabiz (astringent)

Mahall-e-Istemalat (Therapeutic use): Humma (Pyrexia), Warm-e-Kabid (Hepatitis), Istisqa, Waram-e-Tehal

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

Muzir (Side-effects / adverse-effects): Muzir for Tihal

Musleeh (Corrective): Anisoon, Asaroon, Afsanteen, Gulab.

Badal (Proximal substitute): Anisoon, Asaroon

Aaham Nukhsajat (Important formulations): Majoon Dabeedul-ward, Sharbat-e-Deenar, Qrs-e- Ghaafis, Habb-e- Ghaafis.

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HABB-UL-NEEL
(Seed)

The drug Habb-ul- Neel consists of dried seeds of *Ipomoea nil* (Linn.) Roth. Syn. *Ipomoea hederacea* auct. Non Jacq. (Convolvulaceae).

Naam-e-Degar (Other names):

a) Botanical name: *Ipomoea nil* Linn.

b) Family: Convolvulaceae

c) Bengali name: Kaladanh, NilKalmi

d) English name: Blue morning glory, Pharbitis Seeds, Japanese Morning Glory

Tafseel (Description):

Aam (General): It is a woody-based creeper from the genus ipomoea, easily climbing other support. Leaves are petioled, orbicular-cordate, alternate, usually entire but sometimes three-lobed, and grow to 3-5 inches long. This gorgeous Morning glory is native to tropical or subtropical area of the world and has been introduced widely.

Flowering and fruiting time: October to December. Distribution: Circum-tropical distribution. In Bangladesh, it is found in Dhaka, Habiganj, Mymensingh and Rangpur districts.

Klaa Beeni (Macroscopic): The seeds are glabrous, black, three sided and plano-convex in shape. The seed coat is smooth with a micropyle on the plane side of the seeds. The seeds are 6-9 mm long and 3-4 mm broad. Fracture hard, difficult, to break.

Khurd Beeni (Microscopic): Transverse section of the outer seed coat shows an epidermis consisting a palisade layer which is 3-4 cells in thickness. These palisade cells are radially elongated thin walled, almost rectangular and devoid of any content. Below the palisade layer is a region of 2-3 layers of large cells. The innermost layer is somewhat tangentially elongated. The inner seed coat is represented by a disintegrated layer which is yellowish brown in colour. Beneath this there is a 2-3 celled thick parenchymatous layers. Cells of endosperm are oval or rectangular and thick walled containing plenty of aleurone grains.

Powder: The powdered drug is light black or grey in colour, odourless and bitter in taste. Powder when passed through 60 mesh shows the presence of cells of palisade layer, parenchymatous cells beneath and palisade, thick-walled cells of the endosperm and aleurone grains. The palisade cells were found either singly or in groups. The cells of cotyledons were also observed. These cells are oval to round or polygonal in shape containing abundant aleurone grains. The aleurone grains are oval to round in shape and give positive test for proteins.

Juz-e-Mustamil (Part used): Seeds

Maskan (Habitat): As an attractive ornamental plant it is very popular to the gardeners of Bangladesh. It is found in Dhaka, Habiganj, Mymensingh and Rangpur districts.

Jwoher'e Nabatati (Phytoconstituents): Steroids/triterpenes, alkaloids, glycosides, flavonoids, amino acids, resins, reducing sugars, tannins, fixed oils, potassium, iron, phosphate and chloride.

Mizaj (Temperament): Hot 3° Dry 3^0

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 2 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 11 %	Appendix 2.2.6
Water soluble extractive	Not less than 24 %	Appendix 2.2.7

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

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Chloroform (100%)	1_2 vapours	1	0.05

Aa'maal-e-Adviya (Pharmacological action): Jali (detergent), Mukharrish, Mushil-e-Qawi, Qatil-e- Deedan-e-Ama (Intestinal worm)

Mahall-e-Istemalat (Therapeutic use): Nazla (Catarrh), Istisqa-e-Ziqqi, Niqras (Gout), Waja-ul-Mafasil (Arthritis), Bars (Vitiligo),

Hikka (Hiccough), Deedan-e-Ama (intestinal worm)

Meqdar-e-Khorak (Dose): 1 - 1.5 gm

Muzir (Side-effects / adverse-effects): Avoid use during pregnancy and breastfeeding as it may cause birth defects. Overdose may cause nausea, vomiting and heamaturea.

Musleeh (Corrective): No Musleeh has been identified

Badal (Proximal substitute): No proximal substitute has been identified

Aaham Nukhsajat (Important formulations): Habb-e-Falij Mulaiyin, Habb-e-Shabyar, Kohal-e-Roshnai, Itrifal-e-Deedan, Jawarish-e-Shahreyaran, Majoon-e-Kakanaj, Majoon-e-Talkh, Habb-e-lyarij.

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IZKHAR
(Whole Plant)

The sweet scented herb Izkhar contains so many phytochemical constituents that have the pharmacological and therapeutical activities to alleviate various diseases in traditional medicine. The whole parts of the plant are used as medicine in Unani system.

Naam-e-Degar (Other names):

a. Botanical name: *Cymbopogon martinii* (Roxb).
b. Family : Poaceae
c. Bengali name : Agam ghaas, Agiyaa ghaas, Lebu ghas
d. English name : Rosha Grass, Rusa grass, Lemon grass.

Tafseel (Description):

Aam (General) : The medicinal plant lemon grassgrows fairly tall, ranging from 1.3 to 3 m (4 ft 3 in to 9 ft 10 in) in height with a pale green color and a strong thin stem. This crop grows slowly, taking three months to flower; once it has flowered, it can be harvested. It received the name palmarosa from the sweet-smelling floral rose aroma it gives off. Besides medicinal use it is widely used for rose-smelling perfumes and cosmetics around the world.

Figure : Izkhar plant

Klaa Beeni (Macroscopic) :

Root: Short, stout and woody; roots fibrous; many culms arise from root stumps.

Culm: Erect, terete, smooth shiny, upto 6 mm in dia., internodes 5 to 16 cm long, solid.

Leaf: Blades linear-lanceolate or lanceolate tapering to long filiform acuminate point, cordate and amplexicaul at base, upto 50 cm long and 3.5 cm broad; upper leaves are smaller, leaf surface glabrous, margin scabrid; midrib prominent and protruded on the lower surface; leaf sheath shorter than the internodes, glabrous, striate, auriculate, tight and clasping the culm, ligules membranous, 2 to 3 cm long.

Inflorescence: Spathate panicle, compound, upto 30 cm long; primary axis bears 2 or 3 branches at each node, these end in a spatheole which bears a pair of racemes, spatheole 1.8 mm long become reddish at maturity; racemes 1.5-2.0 cm long become subsessile or shortly pedicelled, lower raceme base and lower most pedicel swollen; sessile spikelet about 3.5 mm

long, lower glume 1 mm wide, ovate, with deep median groove, broadly winged, 2 nerved; awn 12 to 18 mm long; pedicellate spikelet about 4 mm long, glabrous; lower glume lanceolate, 8 nerved, flower hermaphrodite or male, stamens-3, anthers 1 or 2 mm long, style 2, stigma pilose.

Khurd Beeni (Microscopic) :

Root : T.S. shows thin walled epiblema with unicellular root hairs; cortex composed of thin walled, parenchymatous cells; large air chambers present in the cortex; endodermis single layered and pericycle two cell layered; central vascular strand has outer 2 or 3 layers of sclerenchymatous cells followed by 3 to 5 cells deep zones of thin walled phloem with a row of circular cavities of 12 to 25 μ diam.; 5 to 10 cell layer thick zone encloses xylem vessels; which are 35 to 50 μ in diam.; pith cells thick walled and devoid of any cell contents.

Stem: T.S. shows thick cuticle; epidermis devoid of any appendages; hypodermis 6 to 10 cells deep and composed of sclerenchymatous cells; vascular bundles scattered throughout the ground tissue with a row of smaller vascular bundles in the hypodermis; cells of ground tissue thin walled, parenchymatous; vascular bundles present in the ground tissue enclosed by 2 or 3 layers of sclerenchymatous cells.

Leaf : T.S. shows isobilateral structure, with a spongy mesophyll between; outline showing a slightly concave upper surface and a convex lower surface; midrib protruded towards lower side; cells of upper epidermis interrupted by the presence of bulliform or motor cells; lower epidermal cells are more uniform in size and smaller; stomata present on both surfaces, characteristically placed in a straight line between veins, mesophyll consists of chlorenchymatous cells placed radially around smaller vascular bundles; bundle sheath

present around smaller vascular bundles, on either side of the midrib vascular bundle; group of sclerenchymatous fibres are found and may extend upto bundle sheath; vascular bundle of midrib usually has two conspicuous metaxylem vessels. Lower epidermis can be distinguished from the upper epidermis by its having more number of stomata, smaller epidermal cells and presence of microhairs and papillae; stomata of the lower epidermis: oval, mostly with low dome shaped long cells present between the veins; long cells of lower epidermis possess 1 or 2 papillae, while papillae are absent on the long cells of upper epidermis; short cells over the veins in rows of more than 5 cells and may be in pairs; silica bodies abundant over the veins mostly dumbbell shaped, occasionally cross-shaped, narrow and crenate; prickle and micro hairs present; micro hairs two celled, observed only on lower epidermis; the basal cell of micro hairs is wide as compared to distal cell; distal cell tapers to an acutely pointed apex.

Powder: Brown, fibrous, free flowing, shows debris from leaves showing characteristic graminaceous stomata, silica bodies, and micro hairs; also contains pitted parenchyma and fiber.

Juz-e-Mustamil (Parts used): Root, stem, leaves, whole plant and oil.

Maskan (Habitat) : The plant Grows in well-drained soil in area with temp above than 10 degree, rain 100 cm and in full sun. Semi-arid to moist tropical and subtropical lowlands.

native to India and Indochina, but widely cultivated in many places for its aromatic oil.

In India, it is distributed in Kashmir, Almora, Garhwal, Punjab, Rajasthan, Mumbai and Southern states.

Jwoher'e Nabatati (Phytoconstituents): Geraniol, geranyl acetate, citronellol, linalool, myrcene, gammamuurolene, alpha and beta-pinene, betaselinene, alpha-terpinene and alpha-phellandrene limonene, iso-piperitenol and trans-p-menthadien-z.

Mizaj (Temperament): Hot 2^0 and Dry 2^0

Musleh (Correction): Sandal Sufaid.

Badal (Proximal substitute): Chirata, Saffron, Garlic.

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

Foreign matter	: Not more than 2 percent, Appendix 2.2.2.
Total ash	: Not more than 14 percent, Appendix 2.2.3.
Acid insoluble ash	: Not more than 7 percent, Appendix 2.2.4.
Alcohol soluble extractive	: Not less than 5 percent, Appendix 2.2.6.
Water-soluble extractive	: Not less than 7 percent, Appendix 2.2.7.
Essential oil	: Not less than 0.2 percent, Appendix 2.2.14.

TLC behavior of chloroform extract:

T.L.C. of essential oil on silica gel 'G' plate using hexane: ethyl acetate (90:10) shows seven

spots at RF 0.25, 0.38, 0.47, 0.57, 0.64, 0.71 and 0.78 on spraying with Vanillin-Sulphuric acid reagent and heating the plate for 15 minutes at 1100C. Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Munzij Akhlat Ghaleeza, Dafe Tashnnuj, Mufatteh Sudad, Mohallil Auram, Kasir Riyah, Mudirr Baul wa Haiz, Muqawwi Meda (Gastic Tonic).

Mahall-e-Istemalat (Therapeutic uses): Falij (paralysis), Laqwa(Facial palsy), Tashannuj, Nisyan, Istisqa, Ehtabas-e-Baul wa Hiaz, Warm-e-Meda wa Jigar

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

Muzir (Side-effects / adverse-effects): Avoid using on children below 12 years. It has fertility reducing and abortifacient activities on oral use. So, it should not be used during pregnancy.

Aaham Nukhsajat (Important formulations): Dawaul Kurkum, Majoon Dabeedul Ward.

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IRSA
(Root)

The drug Irsa consists of dried roots of *Iris ensata* Thunb.

Naam-e-Degar (Other names):

a) Botanical name: *Iris ensata* Thunb.

b) Family: Iridaceae

c) Bengali name: -

d) English name: Iris or Iris root

Tafseel (Description):

Aam (General): The stem of Iris bears flowers of different colours, e.g. white, yellow, blue, or purple, which cover one another. Due to the diversity of colours, it looks like Qaus-i-Qazah (rainbow) and has been therefore named as *Iris ensata. Iris* means 'the goddess of the Rainbow', and *ensata* means 'sword shaped' as its leaves resemble the sword. The smell of the rhizome is like banafsha (*Viola odorata*); hence, it is also called *Bīkhī-Banafsha* (Viola root), though it is not a root of banafshaIt occurs throughout the year. Flowering and fruiting take place during June-September.

Irsa (*Iris ensata* Thunb)
Family: Iridaceae

Klaa Beeni (Macroscopic): The root of *Iris ensata* Thunb. are brown small pieces of different shapes but usually they are elongated having transverse wrinkles. The odour is pungent and taste is slightly bitter and aromatic.

Khurd Beeni (Microscopic): The transverse section of root shows the single layer of epidermis which consists of typical parenchymatous cells with thick outer walls. The conical region usually made up of several layers of rectangular to oval parenchymatous cells. Most of these cells possess oil globules with other yellowish-brown contents. The endodermis is found to attached with 4-5 layers of highly thick walled cells which are polygonal to oval in shape and they are present in somewhat compact masses. There is no conical vascular bundle but vascular bundles are numerous and closely scattered in the pith internal to the endodermis. Vascular bundles are more or less roundish in shape on tapering to one side. Each vascular bundle consists of phloem and scattered xylem elements which are enclosed by lignified fibrous sheath of 1-3 layers of cells. The parenchymatous cells of pith are thin walled compact and polygonal to oval in shape.

Powder: Powder of crude drug is characterised by the presence of fragments of epidermis, cortical parenchyma and highly thick walled cells attached with endodermis, fragments of vessels and fibres. The vessels are long, lignified and generally have spiral and pitted thickenings.

Juz-e-Mustamil (Part used): Root / Rhizome

Maskan (Habitat): It is native to Nepal, Bhutan, Northeast India, Myanmar (Burma), Malaya, Sumatra, and Java. In India it is found in Temperate Northwestern Himalaya at 1500–2700 m. and from Kashmir to Himachal Pradesh. Due to the beautiful flowers, this is often grown in gardens as an ornamental plant

Jwoher'e Nabatati (Phytoconstituents): Glycosides, steroids, resins, proteins. phenolic compounds, tannins, sodium, potassium, iron, calcium.

Mizaj (Temperament): Hot 2° Dry 2°

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 2 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 6 %	Appendix 2.2.6
Water soluble extractive	Not less than 2 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	6	0.12, 0.21, 0.34, 0.59, 0.65, 0.78

Aa'maal-e-Adviya (Pharmacological action): Mohalhil-e-Waram, Mulattif (Demulcent), Mufatteh Sudad, Munaffis-e- Balgham (Expectorant), Dafa-e-Tashannuj

Mahall-e-Istemalat (Therapeutic use): Nazla (Catarrh), Sual (Cough), Ribu**,** Zat-ur-Riyah, Falij (paralysis)

Meqdar-e-Khorak (Dose): 5-7 g

Muzir (Side-effects / adverse-effects): It causes headache if used for a long time and is also harmful for the lungs.

Musleeh (Corrective): Honey is used to prevent its toxicity.

Badal (Proximal substitute): Asaruun and Zanjabil are used as substitutes of Īrsa.

Aaham Nukhsajat (Important formulations):

Majoon-e-Rahul Momineen, Zimad-e-Khanazeer, Arq-e-Chobchini, Aqras kundi, Aqras ward; Dawaul Khatateef, Habb-e-Maghz badam, Kalkalanaj Asghar; Lauq Batam; Qantarghan Akbar; Qantarghan Asghar; Qurs Luk, Mājun Balādur, Mājun Laboob, Marham Irsā, Roghan Balādur, Roghan Bedanjīr Murakkab, Roghan Sosan, Roghan Kalān, Zimād-ī-Muhasā, Roghan Alqam, Roghan Irsā, Roghan, Surkh bādā, Roghan Laqwā.

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KAIPHAL
(Stem Bark)

The palnt Kaiphal is broadly used in Unani system of medicine for its various phytochemical constituents. Though different parts of Kaiphal are used as medicine, the dried stem bark of it is taken into account to prepare medicine for alleviating particular diseases.

Naam-e-Degar (Other names):

a. Botanical name: *Myrica esculenta*Buch.
b. Family : Myricaceae
c. Bengali name : Kaychhal, Katphal, Kayphal
d. English name : Box myrtle

Tafseel (Description):

Aam (General) : The popular medicinal plant Kaiphal is a small moderate sized evergreen woody tree with a height of 3 to 15 meter. Its leaves are lanceolate, obovate, with diameter 9 × 3 cm, and lower surface shows light green; upper surface dark green in appearance.

Figure : Stem bark of Kaiphal

Klaa Beeni (Macroscopic) : Drug occurs in pieces of variable length, 1-2.5 cm thick, slightly quilled, fissured longitudinally and transversely, outer surface rough, grey to brownish-grey, inner surgace dark brown and smooth; fracture, hard; taste, bitter.

Khurd Beeni (Microscopic) : Mature stem bark shows multilayered cork, composed of rectangular, tangentially elongated, thin-walled cells, some filled with red contents;

secondary cortex a wide zone, composed of thinwalled, rectangular to polygonal, parenchymatous cells, a number of cells filled with red colouring matter and simple, round to oval starch grains measuring 6-11 μ diameter a number of stonecells, in singles or in groups, circular polygonal or oval, thick walled, lignified with simple pits and radiating canals, found scattered throughout secondary cortex; secondary phloem consists of sieve elements, phloem fibres, crystal fibres, stone cells and phloem parenchyma traversed by phloem rays. Numerous prismatic crystals of calcium oxalate present in secondary phloem; phloem fibres with blunt or pointed end and highly thick walled, with very narrow lumen present in groups; stone cells similar to those found in secondary cortex, mostly in singles or in groups of 2-3 sometimes associated with fibre groups in phloem parenchyma. In isolated preparation and tangential sections crystal fibres show more than twenty chambers having single prismatic crystals of calcium oxalate in each chamber; a number of phloem parenchyma cells containing red colouring matter; phloem rays 1-4 seriate, containing red colouring matter.

Powder: Rusty red; shows a number of stone cells, phloem fibres, crystal fibres and prismatic crystals of calcium oxalate and simple, round to oval, starch grains measuring 6-11 μ in diameter.

Juz-e-Mustamil (Parts used): Roots, stem bark, leaves and fruits..

Maskan (Habitat) : The plant Kaiphal is native to the subtropical and temperate zones of the earth and is found in China, Taiwan, Japan, Western Highland of Cameroon, North America,

South Africa, Australia, Brazil, Ethiopia, Nepal, Bhutan and different regions of India and Bangladesh.

Jwoher'e Nabatati (Phytoconstituents): The bark consists of tannins and phenolic acids, gallic acid; epigallocatechin 3-O-gallate; epigallocatechin-(4β→8)- epigallocatechin3-O-gallate;3-O-galloyl-epigallocatechin-(4β→8)-epigalloc-atechin3-O-gallate along with the hydrolyzable tannin castalagin. It also containsfFlavonoids, triterpenoids, proanthocyanidins (proanthocyanidin acetate, proanthocyanidin methyl-ether and prodelhinidin), Diarylheptanoids, steroids and volatile compounds.

Mizaj (Temperament): Hot 1^0 and Dry 2^0

Musleh (Correction): Rowghan-e-Badam, Rowghan-e-Zard (Ghee).

Badal (Proximal substitute): Majuphal.

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 13 per cent, Appendix 2.2.6

Water-soluble extractive: Not less than 12 per cent, Appendix 2.2.7

TLC behavior of chloroform extract:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid: Water (4:1:5) shows in visible light five spots at Rf. 0.25, 0.43, 57, 0.75 (all grey) and 0.88 (yellowish green). Under U.V. (366 nm) seven fluorescent zone are visible at Rf. 0.09, 0.18 and 0.30 (all light blue), 0.43 (green), 0.49 (blue), 0.65 blue) and 0.71 (pink). On exposure to Iodine vapour eleven spots appear at Rf. 0.07, 09, 0.12, 0.25, 0.30, 0.35, 0.43, 0.52, 0.57, 0.75 and 0.88 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C six spots appear at Rf. 0.09 (black), 0.30 (black), 0.57 (light brown), 0.71 (light pink), 0.82 light pink) and 0.88 (yellowish green). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mohallil, Qabiz (astringent), Kasir-e-Riyah (carminative), Muqawwi-e-Asab (Nervine tonic), Daf-e- Taaffun, Muattis, Jazib-e-Ratubat.

Mahall-e-Istemalat (Therapeutic uses): Falij (Paralysis), Laqwa (Facial palsy), Rasha (Tremor), Qurooh-e-Khabisa, Dard-e-Dandan,

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

Muzir (Side-effects / adverse-effects): No adverse/side-effect is known/reported after the normal use of this plant.

Aaham Nukhsajat (Important formulations): Safoof Istihaza, Raughan Surkh.

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KARANJ
(Leaf)

Karanja is a medicinal herb which is used in Unani system for the alleviation of some skin and gastro-intestinal disorders due to presence of various phytochemical constituents. All parts of Karanja tree (roots, flowers, leaves, bark) are used for medicinal purposes.

Naam-e-Degar (Other names):

a. Botanical name: *Pongamia pinnata* (Linn.) Pierre, *Cytisus pinnatus* Linn.
b. Family : Papilionaceae
c. Bengali name : Karanj, Papar, Kanji, Honge Beru,
d. English name : Karum Tree, Poonga Oil Tree, Indian Beech.

Tafseel (Description):

Aam (General) : The plant grows wild in the coastal forests throughout India to Fiji and beside the streams and rivers. It is a glabrous medium-sized tree that grows rapidly upto 18 meter or sometimes more in height. It contains a rough and grey-brown bark. The new leaves develop and the flower bloom in the great numbers almost simultaneously in this tree

Figure : Leaves of Karanj

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

Khurd Beeni (Microscopic) :

Leaf :

Petiolule – circular in outline, covered with cuticle, epidermis single layered, consisting of tabular cells; cortex consisting of angular, isodiametric, collenchymatous cells without intercellular spaces, a few cells containing prismatic crystals of calcium oxalate; pericycle present in the form of sclerenchymatous sheath; vascular bundle single, arc-shaped,

consisting of xylem and phloem; xylem vessels arranged radially, traversed by xylem rays; a few schizogenous cavities found scattered in cortex.

Midrib – shows single layered epidermis, consisting of tabular cells, covered with thick cuticle, followed by 3-4 layered collenchymatous hypodermis; cotrtex consists of round to oval, thin-walled parenchymatous cells; pericycle present in the form of sclerenchymatous sheath; vascular bundle, collateral, conjoint and arranged in discontinuous ring; central portion occupied by oval to polygonal thin-walled parenchymatous pith, prismatic crystals of calcium oxalate present in cortex, phloem and pith.

Lamina – shows single layered epidermis covered with thick cuticle, palisade two layered; spongy parenchyma 3-5 layered, a few containing prismatic crystals similar to midrib, occasionally a few spongy parenchyma cells get elongated and look like palisade cells, palisade ratio 3.5.5.0; vein islet number 18-25 per mm square, stomata anisocytic, present in lower surface, stomatal index 12.5-20.

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

Juz-e-Mustamil (Parts used): Roots, barks, leaves, flowers, fruits, seeds, whole parts.

Maskan (Habitat) : The plant Pongam grows from sea level upto an altitude of 1200 meter.Now it is found in many pther countries of the world like India, Fiji, Australia, Florida, Hawaii, Malaysia, Oceania, Phillippines and Seychelles.

Jwoher'e Nabatati (Phytoconstituents): Alkcaloids, Arachidic acid, Aspartic acid, Furanoflavone, Karanjin, Kanjone , 7-Methoxyfurano flavones and 8-Methoxyfurano-flavone.

Mizaj (Temperament): Hot 2^0 and Dry 3^0

Musleh (Correction) : Katira gum, Rain water.

Badal (Proximal substitute): No proximal substitute is identified or another species of the same plant may be applied.

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

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): Daf-e-Bawaseer (Anti-haemorrhoid), Daf-e-Taaffun, Mulayen (Laxitive), Qatil-e Deedan (Vermicidal), Daf-e-Dard (Analgesic), Muhallel-e-Waram, Mumsik, Musaffi (Purifier), Qatil-e- Hashrat.

Mahall-e-Istemalat (Therapeutic uses): Bawaseer (Hemorrhoid), Suzak (Gonorrhoea), Sara (Epilepsy), Zakhm Mutaafiin, Deedan-e-A'ma (Intestinal worms), Qabz (Constipation), Waza-ul-Mafasil (Arthritis), Surat-e-inzal.

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

Muzir (Side-effects / adverse-effects): Long term use of this plant may create gastric irritation, increase acidity and other gastric problems since it is hot in potency.

Aaham Nukhsajat (Important formulations):

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1. The Unani Pharmacopoeia of India, Part-1, Volume-4, Pages 67-68, August-2007, Published by AYUSH, Ministry of Health & Family Welfare, New Delhi, India.
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3. The Ayurvedic pharmacopoeia of India. Part 1. Vol 3, 2001, Published by AYUSH, Ministry of Health & Family Welfare, New Delhi, India.
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9. Aneja, R., Khanna, R.N., Seshadri, T.R., 1963. 6-Methoxyfuroflavone, a new component of the seeds of Pongamia glabra. Journal of Chemical Society 1, 163.

KEORA
(Spadix)

Keora commonly known as Screw pine plant belonging to the family Pandanaceae is found in India, Tropical South America, Pacific islands, throughout the Philippines also found in Chittagong and Sunderban areas of Bangladesh.

The drug Keora consists of ripe, mature and dry spadices of male flowers of *Pandanus odoratissimus* Linn. a densely branched, dioecious shrub with still roots.

Naam-e-Degar (Other names):

a) Botanical name: *Pandanus odoratissimus* Linn.

b) Family: Pandanaceae

c) Bengali name: Keya, Kedki-Keya, Keori

d) English name: Screw pine

Tafseel (Description):

Aam (General): It is a Tortuous small tree or branched shrub, rarely erect; stem up to 6 m high, supported by aerial roots. Leaves glaucous-green, 90-150 cm long, ensiform, caudate-acuminate, coriaceous, marginal spines pointing forward and those of the midrib forward and backward; male flowers: spadix with numerous sub sessile cylindrical spikes 5-10 by 2.5-3.8 cm, enclosed in long white fragrant, caudate-acuminate spathes. Staminal column 6-13 mm long; anthers longer than the slender filaments, cuspidate inserted along the whole length of the upper portion. Female flowers; spadix solitary, 5 cm. diameter. Carpals

confluent in a pyramidal groups of 6-10 or fewer; stigmas short, reniform, yellow. Fruit an oblong or globosesyncarpium 15-25 cm. long and broad, yellow or red; drupes numerous (50-60), each consisting of 5-12 carpals; carpals 5-7.5 cm. long, turbinate, angular, the crown smooth, convex, more or less depressed round the reniform stigmas.

Klaa Beeni (Macroscopic): Spadices with numerous sub-sessile cylindrical spikes of male flowers, length 5 to 10 cm and thickness 2.5 to 3 cm enclosed in a long, ivory coioured, fragrant caudate acuminate spathes, with longitudinal striations, 25 to 30 cm in length, 2 to 5 cm in breadth, stamina! column 6 to 13 mm long, anther long than the slender filament. They are very fragrant when fresh and less fragrant when dry.

Khurd Beeni (Microscopic):

Spathe: Outline of Transverse section of spathe resembles of closely set, beaded chain, with alternating ridges and furrows; epidermis uniseriate, cells rectangular to squarish, outer walls showing a thin cuticle. Following epidermis in the ridges formed by veins, 4 to 5 layers of collenchytnatous cells, polygonal in shape present with xylem at the central region; large tabloid crystals of calcium oxalate sporadically present throughout the region; large tabloid crystals of calcium oxalate sporadically present throughout the collenchymatous tissue; epidermal of cell in surface view rectangular: and linearly arranged; stomata paracytic. Most of the epidermal and cells of spathe contain oil globules.

Pedicel: Transverse section somewhat circular in outline; edidermis cuticularised, cells rectangular to squarish, followed by a multilayered cortex made up of the hexagonal to polygonal and compactly arranged parenchymatous cells.

Anther: Transverse section of bithecous anther shows two sporangia: epidermis single layered, cells of edothecium showing lignitication on the radial and inner tangential wills; cells of ground tissue are parenchymatous thin walled and polygonal and contain small oil globules; pollen grains thin walled, spherical with smooth exine; average about 9µ;

Powder: Brown in colour with characteristic aromatic odour; reveals the presence of fragments of epidermal tissue from spathe, endothecial cells of anther and pollen grains.

Juz-e-Mustamil (Part used): Spadix (flower)

Maskan (Habitat): Found in India, tropical south America, pacific islands, throughout the Philippines and also in Chittagong and Sunderban areas of Bangladesh.

Jwoher'e Nabatati (Phytoconstituents): Methyl ether of β-phenyl ethyl alcohol (54-80%) Dipentine, d-linalool, phenyl ethylacetate, citral, phenyl ethyl alcohol, fatty acids and stearoptene

Mizaj (Temperament): Hot2^0, Dry 2°

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 1 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 12 %	Appendix 2.2.6
Water soluble extractive	Not less than 25 %	Appendix 2.2.7

TLC behaviour of petroleum ether (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 cone. H_2SO_4	6	0.32, 0.50, 0.58, 0.70, 0.76, 0.85

Aa'maal-e-Adviya (Pharmacological action): Muqawwi-e-Aza-e-Raeesa, Muqawwi-e-Meda (Gastic Tonic), Mugawwi-e-Basar, Musakkin-e-Aam, Musaffi-ud-Dam (Blood purifier)

Mahall-e-Istemalat (Therapeutic use): Khafqan (Palpitation), Juzam(Leprosy) , Waj-ul-Badan (Bodyach), Niqras (Gout), Zof-e-Qalb (Cardiac weakness), Zof-e-Dimagh, Zof-e-Kabid, Judri, Hasba, Waj-ul-Qutun, Waj-ul-uzn

Meqdar-e-Khorak (Dose): Arq 30-50 ml, Sharbat 20-30 ml

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

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute have been identified

Aaham Nukhsajat (Important formulations): Sharabat-e-Keora, Arq-e-Keora

Refrences:

1. The Unani Pharmacpoeia of India, P-1, Vol-3, 2007, AYUSH, MHFW, Govt. of India.
2. Awan MH, 1981, Ketabul Mufraydat, Sheikh Gulam Ali & Sons, Lahore, Pakistan.
3. Kusuma et al., Phytochemical and phamacological studies of *Pandanus odoratissimus* Linn., International Journal of Research in Phytochemistry&Pharmacology (2012), 2(4), 171-174.
4. Ghani A. Medicinal Plants of Bangladesh: Chemical Constituents & Uses, 2nd Edition, Asiatic Society of Bangladesh, Dhaka, 2003, p-330-331

KHAKSI
(Seed)

The herbaceous stiffly erect and tap-rooted plant Khaksi produces a large number of seeds that are used for the preparation of various medicine in Unani system to alleviate some particular diseases.

Naam-e-Degar (Other names):

a. Botanical name: *Sisymbrium irio* Linn.

b. Family : Brassicaceae

c. Bengali name : Khaksir

d. English name : Hedge-mustard, London Rocket, Hedge-Mustard, London Rocket

Tafseel (Description):

Aam (General) : The well-known yellow flowered weed Khaksi is naturally found in abandoned fields and other neglected areas, as well as in pastures, livestock watering sites, and open deserts. The plants produce a large number of seeds which can be introduced to countries accidentally as a contaminant in crop seed or deliberately by migrants. Maximum height of the plant can range from 50-80 cm or taller

Figure : Seeds of Khaksi

Klaa Beeni (Macroscopic) : Seeds more or less ellipsoid, minute, size about a mm, orangish-brown, mucilaginous with warty surface; odour, pungent like mustard oil and taste like bitter mustard oil.

Khurd Beeni (Microscopic) : T.S. of seed shows seed coat with six layers, outermost a single layer of epidermis of rectangular, flattened and thin walled cells ranging from 30 to 50 in length containing colourless, concentrically striated mucilage; a two-cell deep layer of parenchymatous cells, a single row of sclerenchymatous cells with their radial and inner tangential walls thickened, a single-cell layer of pigment, a single cell layer of aleurone grains, followed by crushed parenchymatous cells; cotyledons contain aleurone grains and oil globules; embryo folded; starch absent.

Powder: Brown, with pungent mustard oil smell, shows oil globules; aleurone grains containing crystalloids, globoids and sclerenchymatous cells; with ruthenium red mucilage turns pink.

Juz-e-Mustamil (Parts used): Flowers, Leaves, Seeds.

Maskan (Habitat) :*The plant* is native to southern Europe, North Africa and temperate Asia but has been carried by migrants to North America, Australasia and South Africa, where it has naturalised and become a well-known, yellow-flowered weed of waste and neglected areas. Its transport to the far corners of the globe has either been by accidental movement of seeds (sometimes as a contaminant of crop seeds, agricultural produce, etc.) or by deliberate transport of seeds since the plant has been used for herbal medicines and food. Now it is found almost all over the world.

Jwoher'e Nabatati (Phytoconstituents): Fixed oil and Isorhamnetin.

Mizaj (Temperament): Hot 2^0 and Moist 2^0

Musleh (Correction) : Katira gum, Milk, Sugar

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 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 22 per cent, Appendix 2.2.6
Water- soluble extractive	: Not less than 14 per cent, Appendix 2.2.7
Fixed oil	: Not less than 20 percent, Appendix 2.2.8.

TLC behavior of chloroform extract:

T.L.C. of the methanolic extract on silica gel 'G' plate (0.2 mm thick) using butanol : acetic acid: methanol (60:10:20) shows under UV (254 nm) green spots at Rf. 0.07, 0.17, 0.23, 0.29, 0.55 and 0.87. After spraying with anisaldehyde-sulphuric acid reagent and heating the plate at 105 °C for ten minutes spots appear at Rf. 0.05 (green), 0.09 (green), 0.13 (light green), 0.21 (dark green), 0.28 (purple), 0.40 (purple), 0.76 (light purple) and 0.93 (dark purple). After spraying with Dragendorff's reagent, one spot appears at Rf. 0.24 (bright orange). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Muaariq, Daf-e-Humma, Nafae Haiza, Munaffise Akhlate Sadr, Munaffis Balghum (Expectorant)

Mahall-e-Istemalat (Therapeutic uses): Humma, Hasba, Judri. Suale Muzmin

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

Muzir (Side-effects / adverse-effects): It should not be used during pregnancy and lactation, best to avoid higher dose.

Aaham Nukhsajat (Important formulations): Sharbat Khaksi

References:

1. The Unani Pharmacopoeia of India, Part-1, Volume-5, Pages 44-45, January-2008, Published by AYUSH, Ministry of Health & Family Welfare, New Delhi, India.
2. Bangladesh National Formulary of Unani Medicine, 2nd edition, June-2011, Published by Bangladesh Board of Unani and Ayurvedic System of Medicine, Dhaka, Bangladesh.
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KHAS
(Root)

The perennial bunch grass herb Khas is used as medicine in Unani system for its various phytochemical constituents. The dried fragrant fibrous roots of the plant is taken to prepare medicine for the remedy of some diseases.

Naam-e-Degar (Other names):

a. Botanical name: *Vetiveria zizanioides* Linn.
b. Family : Poaceae
c. Bengali name : Venarramula, Khaskhas
d. English name : Cuscus Grass, Khaskhas grass, Vetiver

Tafseel (Description):

Aam (General): The vetiver plant is a densely tufted grass, which grows upto 150 centimetres in height and forms clumps as wide. Under favorable conditions, the erect culms can reach 3m in height. The stems are tall and the leaves are long, thin, and rather rigid. The flowers are brownish-purple. Unlike most grasses, which form horizontally spreading, mat-like root systems, vetiver's roots grow downward, 2 metres to 4 metres in depth. The root system is finely structured and very strong. Vetiver has neither stolons nor rhizomes. Because of all these characteristics, the vetiver plant is highly drought-tolerant and can help to protect soil against sheet erosion. In case of sediment deposition, new roots can grow out of buried nodes.

Figure : Root of Khas

Figure : Dried Root of Khas

Klaa Beeni (Macroscopic) : Clusters of wiry roots upto 2 mm in diameter, minute, longitudinally grooved; colour varies from cream, grey or light yellow to brown; fracture short and splintery; odour strong aromatic; taste slightly bitter.

Khurd Beeni (Microscopic) : Root shows an epidermis consisting of tangentially elongated cells having brownish content, followed by a layer of hypodermis, consisting of thin-walled cells, similar to epidermis; cortex consisting of 2-3 layers of thick-walled, lignified sclerenchymatous cells towards periphery and aerenchymatous cells towards centre; endodermis, single layered of barrel-shaped cells with highly thickened inner walls; pericycle many layered with thick-walled, sclerenchymatous cells enclosing radial vascular bundles arranged in a ring; simple, round to oval starch grains measuring 8--12 μ in diameter present in aerenchyma, pericycle and pith cells.

Powder : Ash-coloured; odour, strongly aromatic and bitter in taste, shows fibres in groups, isolated xylem vessels, simple, round to oval, starch grains measuring 8-12 μ in diameter .

Juz-e-Mustamil (Parts used): Root, vetiver oil.

Maskan (Habitat) : The plant is found throughout the plains and lower hills especially on the banks of rivers and rich marshy soil, ascending to an altitude of 1200 meter. It is widely distributed in India, Burma, Ceylon, Japan, The United States, Europe and also spread from Southwest Asia to tropical Africa.

Jwoher'e Nabatati (Phytoconstituents): The palnt consists of a complex oil which is composed of vetivene, furfurol, vetivenyl vetivenate, khusimene, khusimone, β-humulene,

Calacorene, α-muurolene, δ-selinene, α-longipinene, 5-epiprezizane, valencene, γ-selinene, δ cadineneepizizanalkhusimol, valerenol, benzoic acid, α-vetivone, Iso-khusimol, β-vetivone, vetivazulene etc. compounds.

Mizaj (Temperament): Cold and Dry.

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 2per cent, Appendix 2.2.2
Total ash	: Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 6 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 4 per cent, Appendix 2.2.6
Water-soluble extractive	: Not less than 5 per cent, Appendix 2.2.7
Volatile oil	: Not less than 1 per cent, Appendix 2.2.7

TLC behavior of chloroform extract:

T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under U.V. (366 nm) two fluorescent zones at Rf. 0.49 and 0.72 (both blue). On exposure to Iodine vapour three spots appear at Rf. 0.28, 0.75 and 0.94 (all yellow). On spraying with 5% Methanolic Sulphuric acid reagent and heating the plate at 105°C for ten minutes four spots appear at Rf. 0.19, 0.33, 0.73 and 0.94 (all grey). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mufarreh Qalb, Muqawwi-e-Qalb (Cardiotonic)**,** Muqawwi-e-Dimagh,, Daf-e-Safra (Antacid), Ghasayan, Daf-e-Drad Meda, Daf-e-Drad Azlat wa Mafasil, Muqawwi-e-Meda (Gastic Tonic), Musakkin-e-Atesh.

Mahall-e-Istemalat (Therapeutic uses): Khafaqan (Palpitation), Zof-e-Qalb (Cardiac weakness), Wazaul Mafasil, Zof-e-Dimagh wa Asab, Zof-e-Meda (Weakness of Stomach),

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

Muzir (Side-effects / adverse-effects): The palnt should not be used in pregnancy as it can cause abortion,

Aaham Nukhsajat (Important formulations): Sharbat-e-Khas, Itr-e-Khas.

References:

1. The Unani Pharmacopoeia of India, Part-1, Volume-4, Pages 78-79, August-2007, Published by AYUSH, Ministry of Health & Family Welfare, New Delhi, India.
2. Bangladesh National Formulary of Unani Medicine, 2nd edition, June-2011, Published by Bangladesh Board of Unani and Ayurvedic System of Medicine.
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8. Kabiruddin M , 2007, Ilmul Advia Nafisin, Aijaz Publication, New Delhi, India.
9. Vetiveria zizanioides (Linn.) Nash : A pharmacological overview, August 2013, International Research Journal of Pharmacy 4(7):18-20

KHURFA
(Whole plant)

The annual succulent prostrate herb Khurfa is used as medicine in Unani system for the remedy of various diseases . The whole parts of the plant is used to prepare medicine due to some phytochemical constituents and their pharmacological and therapeutical activities.

Naam-e-Degar (Other names):

a. Botanical name: *Portulaca oleracea* Linn.
b. Family : Portulacaceae
c. Bengali name : Khurfa, Baraloniya, Badanjuni, Baranunia
d. English name : Garden Purslane, Common Indian Purslane

Tafseel (Description):

Aam (General) : The plant Baranunuia has smooth, reddish, mostly prostrate stems and the leaves, which may be alternate or opposite, are clustered at stem joints and ends. The yellow flowers have five regular parts and are up to 6 mm wide. Depending upon rainfall, the flowers appear at any time during the year. The flowers open singly at the center of the leaf cluster for only a few hours on sunny mornings. The tiny seeds are formed in a pod, which opens when the seeds are mature. The plant has a taproot with fibrous secondary roots and is able to tolerate poor compacted soils and drought. The plant is about 50 cm in height.

Figure : Khurfa plant

Klaa Beeni (Macroscopic) :

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

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

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

Flower – A few, bright yellow at terminal heads, sometimes in axillary clusters of 2-6, subtended by an involucre of 3-4 leaves; sepal 0.25-.04 cm long; petals obovate, 0.5 cm long, very delicate and soon falling off; stamens 8-12; style 5-6 fid, 0.35-0.4 cm long.

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

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

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

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

Leaf -

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

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

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

Juz-e-Mustamil (Parts used): Leaves, flowers, whole parts of the plant.

Maskan (Habitat) : The plant Khurfa has an extensive distribution, assumed to be mostly anthropogenic, extending from North Africa and Southern Europe through the Middle East and the Indian subcontinent to Malesia and Australasia. Now it is found throughout the earth ascending upto an altitude of 1500 meter in the Himalayas.

Jwoher'e Nabatati (Phytoconstituents): The plant consists of Protein, carbohydrates lipids, glycosides, alkaloids, sterols, coumarins, triterpenes, flavonoids, phenolic constituents; scopoletin, bergapten, isopimpinellin, lonchocarpic acid, robustin, genisteinascorbic acid, beta carotene, and glutathione, alpha-linolenic acid, 19 Amino acids, phenylalanine, alanine, tyrosine, aspartate,citric, malic, ascorbic, succinic, fumaric, and acetic acids, volatile oil and mucilage. It is rich in vitamin A, B, C, and E and is high in carotenoid content, including beta-carotene. Calcium, magnesium, potassium, folate, lithium, and melatonin are also present in the plant.

Mizaj (Temperament): Cold 2^0 and Moist 2^0.

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 2per cent, Appendix 2.2.2
Total ash	: Not more than 9 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 6 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 4 per cent, Appendix 2.2.6
Water-soluble extractive	: Not less than 5 per cent, Appendix 2.2.7
Volatile oil	: Not less than 1 per cent, Appendix 2.2.7

TLC behavior of chloroform extract: T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) shows six spots at Rf. 0.08, 0.10 (both green) 0.41 0.52 (both faint green), 0.68 (yellow) and 0.76 (green) in visible light. Under UV (366 nm) six fluorescent zones are visible at Rf. 0.08, 0.10, 0.41, 0.52, 0.68, 0.76 (all pinkish red). On exposure to Iodine vapour six spots appear Rf. 0.10, 0.50, 0.61, 0.68, 0.76 and 0.98 (all yellow). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mubarrid, Musakkin-e-Safra wa Dam, Mudirr-e-Baul (Diuretic).

Mahall-e-Istemalat (Therapeutic uses): Shiddat-e-Atash, Ghalayan-e-Dam, Ziyadati-e-Safra, Sozishe Meda, Ama wa Baul.

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

Muzir (Side-effects / adverse-effects): No significant adeferse/side-effects have been reported after normal use.

Aaham Nukhsajat (Important formulations): Mufarreh Barid, Banadiq-ul-Buzoor.

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KONCH
(Seed)

The drug Konch consists of dried seeds of *Mucuna pruriens* Bak. Syn. *Mucuna prurita* Hook. An annual twining herb found in Burma and Bengal, also cultivated in Bengal and Bihar and many places in Bangladesh. The plant occurs in cold season.

Naam-e-Degar (Other names):

a) Botanical name: *Mucuna pruriens* Bak. Syn. *Mucunaprurita* Hook.

b) Family: Papilionaceae

c) Bengali name: Alkushi

d) English name: Lyon bean, Velvet bean, Cowitch, Cowhage.

Tafseel (Description):

Aam (General): The plant has long, slender branches; alternate, lanceolate leaves; and white flowers with a bluishpurple, butterfly-shaped corolla. The pods or legumes are hairy, thick, and leathery; averaging 4 inches long; are shaped like violin sound holes; and contain four to six seeds. They are of a rich dark brown color, and thickly covered with stiff hairs.

Figure : Seeds of Konch

Klaa Beeni (Macroscopic): Seeds large, 1-2 cm in length, 0.8 -1.2 cm breadth, laterally compressed and broad bean shaped. Surface shining and distinctly streaked. Raphe shorter

than antiraphe. Funicle short and flattened. Seeds are totally exalbuminous and also lacking perisperm.

Khurd Beeni (Microscopic): Transverse section reveals that the seed is multi-layered, where the epidermis is represented by a single layered, thick-walled, radially elongated palisade cells with lumen slightly wider at the base. Next to the epidermis is hypodermis, represented by one layered thick-walled, bone-shaped cells- the osteosclereids, between them are wider air spaces. It is followed by 4-8 layers of tangentially elongated cells with slightly thickened walls. Next to this wider zone there are certain layers of crushed cells with small lumen. Elongated schizogenous cavities are present in peripheral region of cotyledon. Rhomboidal crystals are found in large number in these cells.

Powder: The crude drug powder is light yellow in colour and shows the presence of palisade cells of epidermis, parenchymatous cells of cotyledons, osteosclereids of hypodermis and tangentially elongated parenchymatous cells. Starch grains are also observed during powder analysis.

Juz-e-Mustamil (Part used): Seeds

Maskan (Habitat): Found in Burma and Bengal, also cultivated in Bengal and Biharand many places in Bangladesh.

Jwoher'e Nabatati (Phytoconstituents): Carbohydrates, Steroids, Phenols, Glycosides, Tannins, Almunium, Iron, Zinc, Calcium, Magnesium and Potassium

Mizaj (Temperament): Hot 2° Dry I°

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 1 %	Appendix 2.2.6
Water soluble extractive	Not less than 13 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet ether: Diethyl ether (8:2)	2% Ethanolic H_2SO_4	6	0.16, 0.20, 0.31, 0.39, 0.64, 0.68

Aa'maal-e-Adviya (Pharmacological action): Qabiz (astringent), Mughalliz-e-Mani, Muqawwi-e-Rahem, Jiryan(Spermatorrhoea)

Mahall-e-Istemalat (Therapeutic use): Sailan-ur-Rahem (Leuchorrhoea), Istirkha, Deedan-e-Ama (intestinal worm)

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

Muzir (Side-effects / adverse-effects): The most common side effects include nausea and a sensation of abdominal bloating. Less common side effects include vomiting, abnormal

body movements, and insomnia. Rare but possible side effects of other cowhage preparations include headache, pounding heartbeat, confusion, agitation, hallucinations, and delusions.

The hair of the cowhage bean pod is possibly unsafe. It is a strong irritant and can cause severe burning and swelling.

Diseases of the heart and blood vessels (cardiovascular disease): Due to the levodopa (L-dopa) in cowhage, it should be avoided or used cautiously in people with cardiovascular disease. L-dopa can frequently cause low blood pressure on standing (orthostatic hypotension), dizziness, and fainting. Much less frequently, L-dopa can also cause pounding or irregular heartbeat.

Diabetes: There is some evidence that cowhage can lower blood sugar levels and might cause blood sugar to drop too low. Be sure to monitor blood sugar carefully.

Low blood sugar (hypoglycemia): There is some evidence that cowhage can lower blood sugar levels and might make low blood sugar worse.

Liver disease: Cowhage contains levodopa (L-dopa). L-dopa seems to raise the blood levels of chemicals that indicate liver damage. This may mean that the cowhage is making liver disease worse.

Skin cancer called melanoma: The body can use the levodopa (L-dopa) in cowhage to make to the skin pigment called melanin. There is some concern that this extra melanin might make melanoma worse. Don't use cowhage if anyone have a history of melanoma or a suspicious changes in the skin.

Mental illness: Due to the levodopa (L-dopa) content, cowhage might make mental illness disease worse.

Musleeh (Corrective): No Musleeh has been identified.

Badal (Proximal substitute): No proximal substitutes have been identified

Aaham Nukhsajat (Important formulations): Luboob Kabir, Luboob Sagher, Majoon-e-Baladur, Majoon-e-Salab, Majoon-e-Sohag-Sonth, Majoon-e-Bandkushad

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KUNDUSH
(Whole Plant)

The drug Kundush consists of the dried whole plant of *Centipeda minima* Linn. Syn. C. *orbicularis* Lour.The plant is widely used in traditional medicine. It is harvested from the wild for mainly local medicinal use.

Naam-e-Degar (Other names):

a) Botanical name: *Centipeda minima* Linn. Syn. *C. orbicularis* Lour.

b) Family: Asteraceae

c) Bengali name: Hachuti, Mechuti, Nakchikni, Dal Phul

d) English name: Spreading Sneeze Weed, Sneeze Wort

Tafseel (Description):

Aam (General): It isa small, erect to prostrate herb, often much branched from the base, that usually has stems 8 - 20cm long, sometimes to 30cm. Prostrate, annual herbs, glabrous or sparsely puberulous or pubescent at upper part. Leaves obovate-oblanceolate or spathulate, more or less sessile, entire or pinnatifid, usually glabrous, sometimes minutely puberulous on lower surface. Capitulum subglobose, sessile, solitary, heterogamous, usually axillary. Flowers yellow. Corolla of female florets very short, tubular, that of hermaphrodite florets with 4 glabrous lobes. Cypsela linear to oblanceolate with apical corona. Flowering & fruiting takes place in the month of February-June.

Figure : Kundush plant

Klaa Beeni (Macroscopic):

Tap root: Cylindrical, upto 1.5 cm long, 1 mm thick, yellow, numerous lateral rootlets arising from the main root; characteristic odour and taste.

Stem: Stem sub-cylindrical, much branched and tangled, prostrate, slender, glabrous; 10 to 20 cm long, 1 to 3 mm thick; light yellow to yellowish brown; characteristic odour and taste.

Leaf: Leaves numerous, dark green, sub-sessile about 0.2 cm long and about 0.1 cm wide; puberous, oblong, margin dentate, acute apex, asymmetric base; sternutatory odour; taste bitter.

Flower: Flower minute, slight yellowish white colour, solitary, axillary, sessile heads less than 1 mm with ray and tubular florets, involucral bracts, small oblong with membranous margins.

Khurd Beeni (Microscopic):

Root : Transverse section of root shows an epiblema; single outermost layer containing thin walled rectangular cells; numerous small unicellular root hairs present; below epiblema is the cortex which consists of 5 to 7 layers of oval or slightly elongated thin walled parenchyma cells with intercellular spaces; starch grains and calcium oxalate crystals absent; endodermis consists of single layer of barrel shaped cells, slightly thick walled; pericycle consists of a single layer of small and think walled cells. Radial vascular bundles around 2 to 6 in number and with exarch, xylem are present; xylem consists of tracheids, vessels, fibers and parenchyma; phloem consists of sieve tubes, companion cells and phloem parenchyma.

Stem : Transverse section shows a more or less circular of wavy outline; epedermis consisting of a single row of rectangular cells, covered by a thick and smooth cuticle; cortex

consists of 2 or 3 layers of hypodermal region containing collenchymatous cells followed by a central cortex containing 4 to 7 layers of irregular parenchymatous cells; endodermis consisting of parenchymatous cells containing numerous starch grains; vascular bundles, collateral, open; phloem contains sieve tubes, companion cells and phloem .parenchyma, xylem is endarch, containing xylem vessels, fibers and xylem parechyma; pith composed of thin walled parenchyma with conspicuous intercellular spaces.

Leaf : Transverse section of the leaf shows an isobilateral structure; upper epidermis is straight walled, single layered, cuticularized; composed of rectangular cells; ranunculaceous stomata present; mesophyll is differentiated into palisade and spongy parenchyma, palisade parenchyma single layered composed of compact and redially elongated cells, present on both abaxial and adaxial sides; spongy parenchyma many layered, loosely arranged with intercellular spaces, cells contain chloroplast; vascular bundles collateral, surrounded by bundlge sheath, found in the upper layers of spongy parenchyma, more or less centrally to the midrib, lower epidermis is similar to upper epidermis and has covering trichomes. uniseriate. multicellular straight and having blunt tip. The trichomes are short, stout, tip acture.

Powder: Powder is green, with a sternutator odour, hitter and slightly astringent in taste. In microscopic examination, the powder shows scalariform and reticulate vessels, uniseriate multicellular covering trichomes, and 80 to 120 μ long and 15 to 40 μ wide. ranunculaceous stomata.

Juz-e-Mustamil (Part used): Whole plant

Maskan (Habitat): Bandarban, Cox's Bazar and Rangamati.

Jwoher'e Nabatati (Phytoconstituents): Volatile oil, bitter principles, alkaloids, saponins flavonoids and sesquiterpene lactones.

Mizaj (Temperament): Hot 3°- Dry 3°

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 18 %	Appendix 2.2.3
Acid insoluble ash	Not more than 26 %	Appendix 2.2.4
Alcohol soluble extractive	Not less than 10 %	Appendix 2.2.6
Water soluble extractive	Not less than 16 %	Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Chloroform: Diethyl ether (8:2)	On spraying plate with Ethanoloc H_2SO_4 and heated for 10 minutes at 105^0C	8	0.10, 0.20, 0.29, 0.36, 0.47, 0.59, 0.73, 0.79

Aa'maal-e-Adviya (Pharmacological action): Moattish, Munaqqi-e-Dimagh.

Mahall-e-Istemalat (Therapeutic use): Nazla (Catarrh), Zukam (Coryza), Iltehab-e-Gharul Anaf.

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

Muzir (Side-effects / adverse-effects): It is harmful for lung and produces restlessness and syncope.

Musleeh (Corrective): Kateera and milk.

Badal (Proximal substitute): Filfil siyah

Aaham Nukhsajat (Important formulations): Zimad-e-Bahaq, Habb-e-Nakchhikni, Rogan-e-Nakchhikni.

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MAJEETH
(Stem)

The flowering herb Majith has been used as medicine in Unani system for potentially treating particular health disorders. Its stem is taken to prepare medicine for various chemical constituents.

Naam-e-Degar (Other names):

a. Botanical name: *Rubia cordifolia* Linn.

b. Family : Rubiaceae

c. Bengali name : Manjistha, Manjith

d. English name : Indian madder, munjeet.

Tafseel (Description):

Aam (General) : The plant Manjistha can grow to 1.5 meter in height. The evergreenleaves are 5–10 cm long and 2–3 cm broad, produced in whorls of 4-7 starlike around the central stem. It climbs with tiny hooks at the leaves and stems. The flowers are small with five pale yellow petals, in dense racemes, and appear from June to August, followed by small red to black berries. The roots can be over 1 meter long, up to 12 mm thick. It prefers loamy soils with a constant level of moisture.

Figure : Stem of Majeeth

Klaa Beeni (Macroscopic) : Stem slender, more or less cylindrical, slightly flattened, wiry, about 0.5 cm thick, brown to purple coloured; surface scabrous, stiff and grooved with longitudinal cracks; prickles present in the immature stem; nodes distinct having two leaf scars, on either side; fracture short.

Khurd Beeni (Microscopic) : Mature stem shows exfoliating cork, ruptured at places, forming dome-shaped structure, consisintg of 3-12 or more layered radially arranged, squarish and tangentially elongated, thin-walled cells, appearing polygonal in surface view; secondary cortex 3-5 layered consisting of tangentially elongated, thin-walled cells, some of which contain acicular crystals of calcium oxalate as isolated or in bundles; a few cells contain sandy crystals as black granular masses; secondary phloem, a wide zone of reddish colour, composed of sieve elements and phloem parenchyma, fibres absent; phloem

parenchyma smaller towards inner side gradually becoming larger and tangentially elongated towards.

Powder: Pink; shows numerous fragments of cork, lignified xylem vessels, tracheids, and fibres with pitted and reticulate xylem parenchyma having red coloured contents; acicular and sandy crystals as black granular masses.

Juz-e-Mustamil (Parts used): Root, stem, shoot and red bark.

Maskan (Habitat) : The plant Majeeth is found throughout the Indo-Pak subcontinent ascending to 3750 meter.

Jwoher'e Nabatati (Phytoconstituents): The plant consists of glycosides, munjistin, purpurin, xanthopurpurin, and pseudopurpurin.

Mizaj (Temperament): Hot and Dry

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 12 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 17 per cent, Appendix 2.2.7

TLC behavior of chloroform extract: T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol : Acetic acid : Water (4:1:5) shows in visible light two spots at Rf. 0.92 (grey) and 0.98 (green). Under UV (366 nm) six fluorescent zones are visible at Rf. 0.28, 0.37, 0.53, 0.72, 0.92 and 0.98 (all yellow). On spraying with 5% Methanolic- Sulphuric acid reagent and heating the plate for ten minutes at 1100 C six spots appear at Rf. 0.28, 0.37 (both grey), 0.53 (bluish grey), 0.72 (grey), 0.92 (grey) and 0.98 (violet). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mudirr-e-Baul wa Haiz, Munaqqi-e-Jigar wa Tihal, Mufatteh sudad , Musakkhin, Jali (detergent).

Mahall-e-Istemalat (Therapeutic uses): Ehtabas-e-Baul wa Haiz (Anuria and amenorrhea), Amraz-e-Barida Asabia, Daad, Bahaq, Bars (Vitiligo), Aasar-e-Jild

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

Muzir (Side-effects / adverse-effects): No significant Side-effects have been observed after normal use / with in recommended dose, but it shouldn't be taken during pregnancy and lactation.

Aaham Nukhsajat (Important formulations): Majoon Dabeed-ul-ward, Raughan Surkh, Dawa-ul-Kurkum**.**

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MALKANGNI
(Seeds)

The drug Malkangni is used as medicine in Unani system for some phytochemical constituents present in the plant that have the pharmacological and therapeutical activities. The dried mature seeds of the plant are used to prepare medicine for the alleviation of some particular diseases.

Naam-e-Degar (Other names):

a. Botanical name: *Celastrus paniculatus* Willd.
b. Family : Celastraceae
c. Bengali name : Kijri, Malkangani
d. English name : Staff tree, Black Oil Plant

Tafseel (Description):

Aam (General) : Malkangni is a large climbing deciduous shrub with stems up to 10 cm in diameter and 6 meter long with rough, pale brown exfoliating bark covered densely with small, elongated lenticles. The leaves are simple, broad, and oval, obovate or elliptic in shape, with toothed margins

Figure : seeds of Malkangni

Klaa Beeni (Macroscopic) : Dried mature seeds more or less covered by orange-red crustly aril, seeds without aril also present, measuring 5-6 mm in length and 2.5-3.35 mm in

breadth, a few roughly three sided being convex on the sides and a few two sided with one convex and other more or less flat side, one edge of many seeds show a faint ridge or raphe on the whole margin; surface generally smooth and hard; colour, light to dark brown; odour unpleasant ; taste bitter.

Khurd Beeni (Microscopic) : Seed shows single layered epidermis covered exteranally with thick cuticle and filled with tannin, followed by 4-6 layers of thin-walled, collapsed parenchymatous cells and layer of radially elongated stone cells; parenchyma of top one or two layers longer than of the below with trianglualr intercellular spaces; innermost layer of parenchyma containing prismatic crystals of calcium oxalate; beneath stone cells layer quadrangular to octagonal, tangentially elongated cells filled with brownish contents; endosperm composed of polygonal, thin-walled parenchymatous cells having oil globules and aleurone grains; embryo spathulate in fleshy endosperm containing oil globules and aleurone grains.

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

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

Juz-e-Mustamil (Parts used): Leaves, seeds.

Maskan (Habitat) : The plant is found in moist deciduous and semi evergreen forests and distributed up to an altitude of 1250 meter. It is mostly found in the tropical and temperate forests of India, Myanmar, Thailand, Vietnam, Southern China, Malesia Australia and New Caledonia.

Jwoher'e Nabatati (Phytoconstituents): Alkaloids, Oil and Tannins

Mizaj (Temperament): Hot and Dry

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

TLC behavior of chloroform extract: T.L.C of alcoholic extract of drug on Silica gel 'G' plate using Toluene: Ethylacetate (90:10) shows two spots at Rf. 0.82 (pink) & 0.94 (yellow) in visible light. Under U.V. (366nm) four fluorescent zones visible at Rf. 0.54, 0.82, 0.89 (all blue) & 0.94 (yellow). On exposure to Iodine Vapour eight spots appear at Rf. 0.04, 0.15, 0.20, 0.35, 0.54, 0.63, 0.82 & 0.89 (all yellow). On spraying with Vanillin-Sulphuric

acid reagent and heating the plate at 1050 C for ten minutes four spots appear at Rf. 0.35, 0.54 (both blue), 0.78 and 0.89 (both greenish blue). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Muqawwi-e-Bah (Aphrodasiac), Muqawwi-e-Meda (Gastic Tonic), Daf-e-Amraz-e- Balghamia

Mahall-e-Istemalat (Therapeutic uses): Zof-e-Bah (Sexual debility), Zof-e-Meda (Weakness of Stomach), Amraz-e-Balghamia.

Meqdar-e-khorak (Dose): 500 mg-1 gm.

Muzir (Side-effects / adverse-effects): Adverse Effects (Mazarrat): It is harmful in younger age person having a hot temperament in the hot season and hot places. It is contraindicated in pregnancy due to its abortificient property. It also causes headache.

Aaham Nukhsajat (Important formulations): Raughan Malkangni, Tila Khas-ul-Khas.

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MARORPHALI
(Legume)

The drug Marorphali consists of dried fruits of *Helicteres isora* Linn. (Sterculiaceae) ***(IP)***It is commonly known as Marodphali, East India screw tree, Indian screw treeEnthani *etc.* due to screw like appearance of its fruit.

Naam-e-Degar (Other names):

a) Botanical name: *Helicteres isora* Linn.

b) Family: Sterculiaceae

c) Bengali name: Tmora, Antamora

d) English name: East India screw tree, Indian screw tree, Ethami

Tafseel (Description):

Aam (General): It is sub-deciduous small tree or shrub of about 1.5-3.0 m height. Young branches are rough with scattered stellate hairs. The leaves are serrate, obliquely cordate or ovate, shortly acuminate and rough above and pubescent beneath. The flowers are solitary or in sparse clusters with red reflexed petals, become pale-blue when old. The fruits are 5.0 cm long, greenish-brown, beaked and cylindrical with 5 spirally twisted carpels. The seeds are tubercled.

The flowering time of Marorphali is from April to December, and the fruiting time is from October to June.

Figure : Legume of Marophali


Klaa Beeni (Macroscopic): Drug consists of screw like capsules, 3.0 to 5.5 cm long and occasionally over a cm broad; yellowish-brown to blackish-brown slender, stalks nearly as long as fruit; mesocarp mucilaginous, taste slightly sweet and agreeable, no odour.

Khurd Beeni (Microscopic):

Pedicel : Shows a single layered epidermis comprising of rectangular to squarish, thin walled parenchymatous cells with straight walls; cork cambium usually composed of 4 or 5 layers of brick shaped thin walled parenchymatous cells containing tannins; this is followed by several layers of secondary cortex, cells of which are thin walled, oval to round and loosely arranged parenchyma having intercellular spaces, cells in outer layers larger in size, but gradually become smaller in the layers towards the centre.

Groups of stone cells present at the periphery of the stele, forming a discontinuous pericycle. Five separate vascular strands, each surrounded by groups of stone cells, present as medullary bundles. Stele traversed by uni-or biseriate medullary rays. Patches of stone cells

also present in cortex, several cells of which contain calcium oxalate crystals upto about 20 µ in length and upto 15 µ in width.

Fruit: Transverse section shows a thick cuticle, a single layer of epicarp of square shaped parenchymatous cells bearing a number of thick walled stellate trichomes having 3 to 6 unicellular arms; 18.0 to 75 µ long and 9.0 to 36.0 µ broad this is followed by several layers of mesocarpic region which consists of polygonal to oval, slightly thick walled parenchyma smaller in size towards periphery, larger towards interior; some contain a single rosette crystal of calcium oxalate, mesocarp also shows presence of several number of lysogenous mucilage cells. A multilayered band of hexagonal to polygonal, stone cells highly lignified with a narrow lumen present in the lower region of mesocrap; their size 18.0 µ long and 9.0 to 18.0 µ broad, below this are 5 or 6 layers of fiber cells with their long axis, laterally extended.

Seed: Testa shows a cuticle and a single layered epidermis which has rectangular and thin walled parenchymatous cells, followed by 3 or 4 layers of rectangular to oval, compact and slightly thick walled parenchymatous cells; beneath this is a layer of lignified palisade-like cells, radially elongated followed by two layers of rectangular to square, parenchymatous cells of endosperm; cotyledon reveals an upper and lower epidermis consisting of rectangular to barrel shaped thin walled, compact parenchymatous cells, mostly filled with small, oval to round aleurone grains.

Powder: Brown, coarse, free-flowing, revealing the presence of groups of stone cells, cork cambium. parenchyma, mesocarpic parenchyma, fibre cells, trichomes (intact and broken) palisade cells, endospermic cells, epidermis with trichomes, parenchymatous cells containing aleurone grains, fibres, tracheids and vessels. Stone cells are small, numerous,

hexagonal to polygonal, highly lignified with narrow lumen but a frew also found with wider lumen. Fibres are quite long, highly lignified walls with pointed ends. Tracheids are shorter, lignified with rounded ends and having reticulate thickenings. Vessels are shorter, wider, thick walled, reticulate or spiral or scalariform. Rosette crystals of calcium oxalate are occasionally present.

Juz-e-Mustamil (Part used): The Fruits, seeds, bark and roots of the plant are used.

Maskan (Habitat): Found in dry forests throughout central and western hills and plains in India.

Jwoher'e Nabatati (Phytoconstituents): Diosgenin

Mizaj (Temperament): Cold 1^0 - Dry 1^0

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	Not less than 2 %	Appendix 2.2.6
Water soluble extractive	Not less than 10 %	Appendix 2.2.7

TLC behaviour of ethanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Chloroform: Methanol (9:1)	On spraying plate with 5% Ethanolic conc. H_2SO_4	4	0.26, 0.39, 0.48, 0.53

Aa'maal-e-Adviya (Pharmacological action): Muhallil-e-Warm, Mulattif (Demulcent), Daf-e-Zaheer (Antidysentery), Mushil-e-Balgham, Jali (detergent), Musakkin.

Mahall-e-Istemalat (Therapeutic use): Amraz-e-Sadr, Waj-ul-Meda (Gastralgia), Dafa-e-kirm-e-shikam (Anthalmentic), Sual (Cough), Zaheer (Dysentery), Muhallil-e-warm

Meqdar-e-Khorak (Dose): 4-7 gm

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

Musleeh (Corrective): Not require

Badal (Proximal substitute): No proximal substitute has been identified

Aaham Nukhsajat (Important formulations): Majoon JograjGogul

Refrences:

1. The Unani Pharmacpoeia of India, P-1, Vol-3, 2007, AYUSH, MHFW, Govt. of India.
2. Awan MH, 1981, Ketabul Mufraydat, Sheikh Gulam Ali & Sons, Lahore.
3. Kumar N. et. al. Plant profile, phytochemistry and pharmacology of Avartani (*Helicteres isora* Linn.): A review; Asian Pac J Trop Biomed. 2014 May; 4(Suppl 1):

MAUZ
(Fresh Ripe Fruit)

Mauz consists of fresh ripe fruits of *Musa paradisiaca* Linn. Syn. *Musa sapientum* Kuntze. (Musaceae);

Naam-e-Degar (Other names):

a) Botanical name: *Musa paradisiaca* Linn. Syn. *Musa sapientum* Kuntze.

b) Family: Musaceae

c) Bengali name: Kola

d) English name: Banana

Tafseel (Description):

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 colour and somewhat fleshy. Fruits are oblong, fleshy, 5-7cm long in wild form and longer in the cultivated varieties.

Figure : Fruit of Mauz

Klaa Beeni (Macroscopic): Occurs in bunches, each bunch containing 10 to 15 hands and each hand bearing 2 to 3 dozens of fruits; colour ranging from greenish yellow to bright yellow with black spots, depending upon stages of ripening; peel removed easily from mesocarp; pulp yellowish to white; characteristic flavour and odour; taste sweet.

Juz-e-Mustamil (Part used): Fruits (Fresh ripe)

Maskan (Habitat): It is extensively grown and cultivated as a fruit plant all over Bangladesh. The banana grows almost everywhere in the country throughout the year. The

principal banana growing areas however, are Rangamati, Barisal, Rangpur, Dinajpur, Noakhali, Faridpur and Khulna

Jwoher'e Nabatati (Phytoconstituents): Sugar, starch albuminoids, fat. limealkalies, iron, chlorine etc. vitamin B and C.

Mizaj (Temperament): Cold-Moist

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

Foreign matter	Not more than 2 %	Appendix 2.2.2
Total ash on wet wt. basis	Not more than 1 %	Appendix 2.2.3
Acid insoluble ash on wet wt. basis	Not more than 0 %	Appendix 2.2.4
Alcohol soluble extractive value on wet wt. basis	Not less than 16 %	Appendix 2.2.6
Water soluble extractive value on wet wt. basis	Not less than 18 %	Appendix 2.2.7
Moisture content on wet wt. basis	Not less than 54 %	Appendix 2.2.9

TLC behaviour of Ethanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
N-butranol : Acetic acid : Ethyl acetate : Toluene (10:2:2:2)	On spraying plate with Aniline diphenyl amine H_2SO_4 and heating at 1050 C for 15 minutes.	3	0.33 0.61 0.68

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

Mahall-e-Istemalat (Therapeutic use): Zof (Weakness), Laghari-e-Badan (Somatic dibility), Sual-e-Yabis, Khashoonat-e-Halq

Meqdar-e-Khorak (Dose): Q. S.

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

Musleeh (Corrective): Not required.

Refrences:

1. The Unani Pharmacpoeia of India, P-1, Vol-3, 20907, AYUSH, MHFW, Govt. of India.
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MAWEEZ MUNAQQA
(Fruit)

The deciduous climber plant Munaqqa is used as medicine in Unani system for their various phytochemical constituents. The dried mature fruits of *Vitis vinifera* Linn are taken to prepare medicine that have the pharmacological and therapeutical activities.

Naam-e-Degar (Other names):

a. Botanical name: *Vitis vinifera* Linn
b. Family : Vitaceae
c. Bengali name : Maneka
d. English name : Dry Grapes, Raisins

Tafseel (Description):

Aam (General) : The plant is a liana growing to 32 meter in length, with flaky bark. The leaves are alternate, palmately lobed, 5 to 20 cm long and broad. The fruit is a berry, known as a grape; in the wild species it is 6 mm diameter and ripens dark purple to blackish with a pale wax bloom; in cultivated plants it is usually much larger, up to 3 cm long and can be green, red or purple. The species typically occurs in humid forests and streamsides.

Figure : Maweez Munakka Fruits

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

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

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

Juz-e-Mustamil (Parts used): Leaves, fruit and the oil extracted from the seeds.

Maskan (Habitat) : The plant is native to the Mediterranean region, Central Europe, and southwestern Asia, from Morocco and Portugal north to southern Germany and east to northern Iran. The species typically occurs in humid forests and streamsides. In India, it is mostly cultivated in north western India, Punjab, Himachal Pradesh and now a day it is cultivated many other parts of the earth.

Jwoher'e Nabatati (Phytoconstituents): Anthocyaninsproanthocyanidins, stilbenoids, , hydroxycinnamic acids, isoprenoid monoterpenes, acyclic linalool, geraniol, nerol, citronellol, homotrienol, monocyclic α-terpineol, β-ionone, damascenone, β-damascone and β-ionol, melatonin, unsaturated fatty acids, malic acids, tartaric & oxalic acids, carbohydrates and Tannins,

Mizaj (Temperament): Hot 1^0 and Moist 1^0.

Musleh (Correction) : Tokhme Karafs, Badiyan, Azwain, Sekenjabeen.

Badal (Proximal substitute): Raisins, Pomegranates, Dry Dates, Anzeer.

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 0.2 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 25 per cent, Appendix 2.2.6
Water-soluble extractive	: Not less than 70 per cent, Appendix 2.2.7
Loss on drying	: Not less than 15 per cent, Appendix 2.2.9

TLC behavior of chloroform extract:

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

Aa'mal-e-Advia (Pharmacological action): Mughazzi, Munjiz-e-Khilt galiz, Mufatteh Sudad, Mulaiyine- Shikam, Mohallil (Resolvent), Jali (detergent).

Mahall-e-Istemalat (Therapeutic uses): Zof-e-Meda (Weakness of Stomach), Zof-e-Aam, Qabz (Constipation).

Meqdar-e-khorak (Dose): 9-11 nos.

Muzir (Side-effects / adverse-effects): Eating large quantities of Munaqqa might cause diarrhea, allergic reactions, stomach upset, indigestion, nausea, vomiting, cough, dry mouth, sore throat, infections, headache, and muscular problems.

Aaham Nukhsajat (Important formulations): Majoon Zabeeb.

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MUSLI SUFAID
(Root)

The drug MusliSufaid consists of dried roots of *Chlorophytum arundinaceum* Baker (Liliaceae). An annual herb found in Eastern Himalayas, Assam and Bihar upto altitude of 1400 m. The plant occurs almost throughout the year. Flowering takes place from March to July and fruiting during cold season.

Naam-e-Degar (Other names):

a) Botanical name: *Chlorophytum arundinaceum* Baker

b) Family: Liliaceae

c) Bengali name: -

d) English name: White Musale

Tafseel (Description):

Aam (General): It is a perennial herb with a short hard root stocks; roots often thick, fleshy and cylindrical. The leaves are 15-35 cm long and oblanceolate. The plant is considered endangered species. Inflorescence is dense; flowers are arranged in raceme and shortly branched. Flowers white, anthers as long as or longer than the filaments and yellow in colour. Bracts are usually long and over topping the shortly pedicelled buds. Cells of the orbicular capsule are 3-4 seeded and black coloured.

Klaa Beeni (Macroscopic): The drug consists of slender fusiform root pieces which are mostly curved or twisted. The length of pieces varies from 2.5-6 cm. They are ivory white or slightly grey in colour, and some pieces are yellowish. They are wrinkled longitudinally.

Khurd Beeni (Microscopic): Transverse section of the root shows a circular outline without any appendages. A uniseriate epidermis consisting of cells with thickened walls due to siliceous depositions is observed. This is followed by a zone of cortex. The inner most layer of the cortex is a single layered epidermis. The vascular tissue is not very elaborate. The central region is occupied by a large pith region where the cells are closely tagged as in cortical region.

Powder: The powder is slightly brownish grey in colour. It gives a slight spicy odour. It is tasteless and becomes sticky in mouth. The powder forms a gummy mass in water or on clearing with chloral hydrate. Under microscope it mostly shows clumped cells. Very little xylery strands are seen.

Juz-e-Mustamil (Part used): Root /Rhizome

Maskan (Habitat): Plant is distributed sparsely over Eastern India, mainly Bengal, Sikkim, Bihar, Assam and few places in Orissa and Meghalaya.

Jwoher'e Nabatati (Phytoconstituents): Steroids, resin, phenolics. tannins. carbohydrates, calcium, magnesium, potassium.

Mizaj (Temperament): Hot 1°- Dry 1°

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 1 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 1 %	Appendix 2.2.6
Water soluble extractives	Not less than 46 %	Appendix 2.2.7

TLC behaviour of petrpleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Benzene: Chloroform (4:1)	1_2 vapours	3	0.13, 0.46, 0.58

Aa'maal-e-Adviya (Pharmacological action): Muqawwi, Muqawwi-e-Bah (Aphrodasiac), Mudirr-e-Baul (Diuretic), Muharrik

Mahall-e-Istemalat (Therapeutic use): Zof-e-Bah (Sexual debility), Suzak, Sailanur Reham (Leuchorrhoea), Nutoour Reham, Qillat-e-Mani

Meqdar-e-Khorak (Dose): 3 -7 gm

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

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute has been identified.

Aaham Nukhsajat (Important formulations): Habb-e-Kattha, Majoon-e-Bandkushad, Majoon Muqawwi-e-Reham, Majoon-e-Piyaz, Majoon-e-Sohag Sonth.

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1. Anonymous, The Unani Pharmacpoeia of India, P-1, Vol-2, 2007, AYUSH, MHFW, Govt. of India.
2. Awan MH, 1981, Ketabul Mufraydat, Sheikh Gulam Ali & Sons, Lahore.
3. Chlorophytum arundinaceum Baker, Fam. Liliaceae; Agro-Techniques Of Selected Medicinal Plants, Agro-technique study carried out by North East Institute of Science Technology (NEIST) Jorhat – 785006, Assam;

NEEM
(Flower)

The plant Neem consists of various phytochemical constituents that have the pharmacological and therapeutical activities. Different parts of the plant are used as medicine and among them dried flower and flower bud are taken to prepare Unani medicine for the remedy of some diseases.

Naam-e-Degar (Other names):

a. Botanical name: *Azadirachta indica* A. Juss.
b. Family : Meliaceae
c. Bengali name : Nim, Nimgaachh

d. English name : Yepa, Neem, Nimbay, Margosa, Neem tree

Tafseel (Description):

Aam (General) :*The plant Neem* is a medium to large, deep-rooted, evergreen tree, upto 15 meter tall, with a round, large crown to 10 meter in diameterbark moderately thick, with small, scattered tubercles, deeply fissured and flaking in old trees. Leaves alternate, crowded near the end of branches. Flowers bisexual or male on same tree, actinomorphic, small, pentamerous, white or pale yellow, slightly sweet scented. Fruit 1 or 2 seeded drupe, greenish, greenish-yellow to yellow or purple when ripe. Seed ovoid or spherical.

Figure : Flowers of Neem

Klaa Beeni (Macroscopic) : Dried flowers are brown to deep brown; individual flower 5 to 6 mm long and 6 to 11 mm wide, pentamerous, bisexual, regular and hypogynous; calyx 5, short, united at base; corolla 5, free, spathulate, spreading, 4.5 to 5.5 mm long 2 mm wide; stamens 10, monoadelphous, staminal tube inserted at base of corolla; gynoecium tricarpellary, syncarpous, superior, trilocular, two ovules in each locule, style 1, stigma 3-lobed; taste, mildly bitter: odour, indistinct.

Khurd Beeni (Microscopic) :Calyx: Sepal shows thin walled polygonal papillose epidermis; elongated thin walled unicellular conical trichomes of varying lengths; rosette crystals in cells of epidermis.

Petals : Petal shows epidermis of rectangular cells papillose at margins, non-glandular unicellular trichomes, over 150 long, tubular and hyaline; glandular trichomes of about 20 numerous rosette crystals in epidermal cells.

Androecium: Epidermis of staminal tube composed of thick walled rectangular parenchymatous cells and the endothecium of the anther walls.

Gynoecium: Stigma sticky, parenchymatous epidermal cells, elongated into extensive papillae, style thin walled, rectangular, ovary superior, trilocular.

Pollen Grain – Porous, 4-colporate, spherical 105 to161 in diameter, with a smooth exine.

Powder: Yellowish-brown, fragments of parenchymatous papillose epidermal cells, trichomes, numerous vessels, rosette calcium oxalate crystals, and yellowish-brown pollen grains.

Juz-e-Mustamil (Parts used): Root, stem bark, leaves, flowers, fruits.

Maskan (Habitat) : It is considered that the plant Neem is native to dry areas in Afghanistan, Pakistan, India, Sri Lanka, Bangladesh, Myanmar and China (Abdulla, 1972; Tewari, 1992; Vietmeyer, 1992; Gupta, 1993). It is cultivated as well as naturalized in Thailand, Malaysia and Indonesia. The World Agroforestry Centre (2002) reports that it may have originated in Myanmar and from there became naturally distributed across the Indian subcontinent. More recently it has been planted in Peninsular Malaysia and Singapore, the Philippines, Australia, Saudi Arabia, tropical Africa, the Caribbean, and Central and South America and almost all over the world.

Jwoher'e Nabatati (Phytoconstituents): The active constituents of the flower Neem is **azadirachtin,** nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin, salannin, quercetin, neeflone, nonacosane (saturated hydrocarbon).

Mizaj (Temperament): Cold 1^0 and Dry 2^0

Musleh (Correction) : Filfil Siyah, Ishperghula, Aegle marmelos, Honey.

Badal (Proximal substitute): Bakayen, Nishinda.

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

Foreign matter	: Not more than 2 percent, Appendix 2.2.2
Total ash	: Not more than 14 percent, Appendix 2.2.3.
Acid-insoluble ash	: Not more than 5 percent, Appendix 2.2.4.
Alcohol-soluble extractive	: Not less than 5 percent, Appendix 2.2.6.
Water-soluble extractive	: Not less than 12 percent, Appendix 2.2.7.

TLC behavior:

T. L.C. of the alcoholic extract on precoated silica gel 'G' plate (0.2 mm thick) using chloroform: acetone (20:1) shows spots at Rf 0.12 (violet), 0.17 (light pink), 0.33 (violet), 0.51 (purple), 0.64 (dark purple), 0.80 (light purple), 0.85 (light purple), 0.92 (purple) on spraying with 1% Vanillin-Sulphuric acid reagent followed by heating the plate at 105 °C for about ten minutes. Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Musaffie Khoon (Blood purifier), Dafe Humma (Antipyretic), Qatile Kirme Amaa (Anthelmintic).

Mahall-e-Istemalat (Therapeutic uses): Amraze Jild, Fasade Dam

Meqdar-e-khorak (Dose): 6-10 gm.

Muzir (Side-effects / adverse-effects): Too much intake of the flower can create vomiting, diarrhea, drowsiness, blood disorders, seizures, loss of consciousness, coma, brain disorders, and even death. It should be avoided during pregnancy and lactation.

Aaham Nukhsajat (Important formulations): Habbe Musaffie Khoon, Habbe Bawaseer, Majoon.

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PILU
(Leaf)

The plant Pilu is used as medicine in Unani system for its various phytochemical constituents that have the pharmacological and therapeutical activities. The leaves of the plant are taken as herbs to prepare medicine for alleviation of some diseases.

Naam-e-Degar (Other names):

a. Botanical name: *Salvadora persica* Linn.
b. Family : Salvadoraceae
c. Bengali name : Peelugachh, Jhal
d. English name : Salt bush, Toothbrush Tree

Tafseel (Description):

Aam (General) : The plant *Salvadora persica* is a large, well-branched evergreen shrub having soft whitish yellow wood, bark is of old stems rugose, branches are numerous. Leaves are somewhat fleshy, glaucous, elliptic lanceolate or ovate, The flowers are greenish yellow in color. Calyx is 1.25 mm long and glabrous. Corolla is very thin. Stamens are shorter than corolla. Drupe is smooth and becomes red when ripe.

Figure : Leaves of Pilu

Klaa Beeni (Macroscopic) : Leaves are 3 to 10 cm in length and 1 to 4 cm in breadth, green, simple, stipulate, petiolate, oblong, ovate, margin entire, broad at base and acute at apex; veins prominent and raised on lower surface; both surfaces glabrous; taste and odour characteristic.

Khurd Beeni (Microscopic) :Petiole: Petiole somewhat circular in outline with a large crescent-shaped vascular bundle and two small vascular bundles fused together to form a central core of vascular tissue; the presence of interxylary phloem indicates anomalous growth; epidermis single layered, covered externally with thick cuticle; cortex a wide zone consisting of circular to oval parenchyma cells; pericycle represented by small patches of thick walled and lignified fibres; phloem consists of usual elements traversed by uni or biseriate medullary rays; xylem consists of vessels, tracheids, fibres and parenchyma; vessels show scalariform thickening and border pitted walls, tracheids are bordered as well as simple pitted, parenchyma cells and fibres are simple pitted; interxylary phloem present in the central xlyem region; pith composed of thin walled parenchyma cells; rosettes of calcium oxalate crystals and starch grains present in the parenchyma cells of the cortex and pericyclic region.

Midrib: Midrib shows single layered epidermis covered externally with thin cuticle on both the surfaces, except at a few places where a periclinal division is seen; cortex is a wide zone of thinwalled parenchyma cells, the centre of midrib is occupied by a vascular cylinder consisting of a large crescent-shaped vascular bundle, the pericycle is represented by small patches of fibres, the phloem consists of usual elements, the xylem is represented by vessels, tracheids, parenchyma and fibres; interxylary phloem is present in the xylem region; the

xylem is traversed by uniseriate medullary rays which become bi or tri seriate in the phloem region; rosettes of calcium oxalate crystals and a few starch grains are present in the parenchymatous cells of cortex and pericyclic region.

Lamina : Lamina shows isobilateral structure; cuticle present, both epidermises are single layered, except for occasional periclinal division; in surface view both the surfaces shows anisocytic and paracytic stomata; 2 or 3 layers of palisade cells are present below the upper and above the lower epidermis, remaining area being occupied by thin walled cells of pongy parenchyma; a number of small vascular bundle and vascular strand are distributed in the mesophyll of the lamina; idioblasts containing large rosettes of calcium oxalate crystals are present beneath both the epidermises; rosettes of calcium oxalate crystals are also present in spongy parenchyma and palisade cells; stomatal index 9 to 11 (upper surface) and 8 to 10 (lower surface); palisade ratio 5 to 6 (upper surface) and 4 to 5 (lower surface); vein islet number 4 to 6 (upper surface) and 5 to 7 (lower surface).

Powder : Pale green, shows presence of thin walled parenchyma cells several containing rosettes of calcium oxalate crystals and a few simple starch grains; fragments of epidermal cells showing anisocytic and paracytic stomata; fragment of scalariform and bordered pitted vessels, border and simple pitted tracheid, simple pitted parenchyma cells and thick walled fibres.

Juz-e-Mustamil (Parts used): Root barks, stem barks, leaves, fruits and seeds.

Maskan (Habitat): The plant is native to the Middle East and Africaand is found on desert floodplains, riverbanks, and grassy savannahs. The plant is widely distributed in the drier

parts of Punjab, north western parts of India, Baluchistan, Ceylon and in the dry regions of West Asia and Egypt.

Jwoher'e Nabatati (Phytoconstituents): The plant leaf Pilu consists of; Tri-Methyamin, salvadrin, β-sitosterol, glucotropaeolin, terpenes, flavonoids, chloride, fluoride, silica, sulfur, mustard, vitamin C and a small amount of aponine & tanin

.**Mizaj (Temperament):** Hot 2^0 and Dry 2^0

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 percent, Appendix 2.2.2.
Total ash	: Not more than 27 percent, Appendix 2.2.3.
Acid insoluble ash	: Not more than 1 percent, Appendix 2.2.4.
Alcohol soluble extractive	: Not less than 5 percent, Appendix 2.2.6.
Water-soluble extractive	: Not less than 40 percent, Appendix 2.2.7.

TLC behavior :

T.L.C. of alcoholic extract on Silica gel 'G' plate (Merck), using Toluene; Methanol (86:14), shows in visible light nine spots at Rf.0.21, 0.25, 0.28(all green), 0.45 (bright yellow), 0.60 (faint green), 0.72(dark green), 0.79, 0.85 and 0.94 (all green); under UV (254nm) twelve

spots appear at Rf.0.14 (faint orange), 0.21, 0.25, 0.28 (all orange), 0.36, 0.45 (both light orange), 0.53 (faint orange), 0.60, 0.72, 0.79 (all light orange), 0.85 and 0.94 (both orange); on exposure to Iodine vapours ten spots appear at Rf 0.14 (yellow), 0.21, 0.25, 0.28 (all green), 0.53, 0.60, 0.72, 0.79 (all faint yellow), 0.85, 0.94 (both bluish green), on spraying with sulphuric acid and heatin'G' plate at 1100C for 30 minutes, twelve pots appear at Rf. 0.14 (yellow), 0.21, 0.25, 0.28 (all dark green), 0.36 (faint brown), 0.45 (brown), 0.53 (faint brown), 0.60 (violet), 0.72, 0.79 (both faint brown), 0.85 (dark green) and 0.94 (blackish green). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mohallil (Resolvent), Musakkin, Dafe Nazla (Catarrh), Muqawwie Lissa, Dafe Gathia, Wajaul Mafasil (Arthritis), Mudirr-e-Moul.

Mahall-e-Istemalat (Therapeutic uses): Nazla (Catarrh), Wajaul Mafasil (Arthritis), Warme Raham, Bawaseer (Hemorrhoid).

Meqdar-e-khorak (Dose): 150 ml in the form of Joshanda (decoction).

Muzir (Side-effects / adverse-effects): No significant side-effects/adverse-effects have been reported after use.

Aaham Nukhsajat (Important formulations):

References:

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POST-E-KACHNAL
(Stem Bark)

The drug Post-e-Kachnal consists of dried stem bark of *Bauhinia racemosa* Lam. Syn. *Bauhinia parviflora* Vahl. (Caesalpiniaceae). A deciduous, bushy to crooked trees, 6-12 m tall. It occurs throughout the year.

Naam-e-Degar (Other names):

a) Botanical name: *Bauhinia racemosa* Lam. Syn. *Bauhinia parviflora* Vahl.

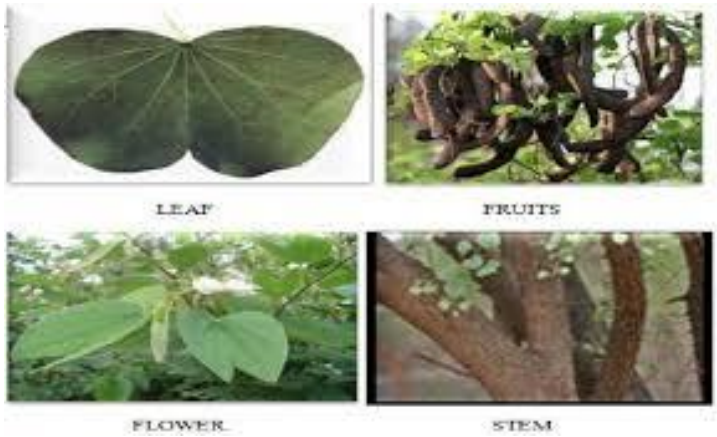
b) Family: Caesalpiniaceae

c) Bengali name: Banarj, Banraji, Jhinjera, Kanchnal, Kosundra

d) English name: Mountain ebony

Tafseel (Description):

Aam (General): A Small deciduous, bushy to crooked trees, 6-12 m tall. Leaves reniform, 1-5 ×2-6 cm, broader than long, deeply cleft up to half way down, base usually truncate to deeply cordate, glabrous above and densely grey, velvety to sub-glabrous beneath, rigidly coriaceous with 7-9 veined, petioles 1-3 cm long, pubescent to sub-glabrous. Flowers white or fading-yellow. Stamens 10, all fertile. Fruit 15-20 × 1.0-2.5 cm, more or less falcate, turgid, glabrous, blunt at the apex, 12-20 seeded. Flowering and fruiting: January-April.


LEAF
FRUITS
FLOWER
STEM

Klaa Beeni (Macroscopic): The external surface of the bark is greyish brown and rough due to transverse cracks and fissure. The fracture is short outside and fibrous within. The inner surface is smooth and light brown in colour. The dried pieces are slightly curved and channeled.

Khurd Beeni (Microscopic): Cross section of the bark reveals that it is made up of externally the periderm and wide zone of phloem, which is further differentiated into conducting phloem and the remaining zone of non-conducting phloem. Cork consists of 10-15 layers of tangentially elongated, lignified cells. Below the cork a layer of phellogen is also observed which is followed by a wide zone of phelloderm. Lignified fibrous and stone cells are found distributed in this region. The phloem is made up of sieve tubes, companion

cells, phloem parenchyma and phloem fibers in the conducting zone fibrous occur in tangentially extended bands and sieve tubes with companion cells surrounded by phloem parenchyma on either side. The medullary rays are also found. The non-conducting zone of phloem is distinguished due to the presence of somewhat wavy and dilated medullary rays. The stone cells are found in both in radial and tangential band in the outer bark in greater number than in inner. The phloem fibrous are long, tapering, thick walled, lignified having narrow lumen and intrusively grown pointed ends. The cells of medullary rays are rectangular in the outer region and radially elongated in the middle and inner region of the bark. Tannin is found throughout the bark. Starch grains, resin is also found in parenchymatous cells of phelloderm and phloem. Druses are also found throughout the bark in parenchyma cells.

Powder: The powder is fine, dark brown and with an acrid taste and a characteristic odour. Microscopic examination of power after clearing with lactic acid reveals that it is made up of abundance of lignified fibres in broken pieces, elongated parenchyma cells having various cells contents and reddish cork cells. Starch grains and calcium crystals are also found in good quantity.

Juz-e-Mustamil (Part used): The leave, Bark, Fruit, kernel, seed, rhizome of Kachnal plant used as drugs purpose.

Maskan (Habitat): A deciduous tree met within sub-Himalayan Track Ravi eastwards, ascending to 1700 m in Bengal, Burma and Central and South India. It occurs throughout the year. It's also found in deciduous forests and dry hill slopes of Chittagong.

Jwoher'e Nabatati (Phytoconstituents): Alkaloid, carbohydrate, steroid, phenol, glucoside, tannin, iron, calcium, potassium, magnesium.

Mizaj (Temperament): Cold 2° Dry 2°

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 20 %	Appendix 2.2.3
Acid insoluble ash	Not more than 3 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 3 %	Appendix 2.2.6
Water soluble extractives	Not less than 9 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Chloroform: Benzene (4:1)	1_2 vapours	2	0.15, 0.40

Aa'maal-e-Adviya (Pharmacological action): Qabiz (astringent), Habis, Musakkin, Musaffi-e-Dam (Blood purifier)

Mahall-e-Istemalat (Therapeutic use): Ishal (Diarrhoea), Bawaseer-e-Damia, Baul-ud-Dam, **Damameel**, Jarb

Meqdar-e-Khorak (Dose): 6 -12 gm

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

Musleeh (Corrective): Not require.

Badal (Proximal substitute): No proximal substitute has been identified.

Aaham Nukhsajat (Important formulations): Majoon-e-Suparipak, Arq-e-Juzam, Arq-e-Musaffi-e-Khoon Qawi, Matbukh-e- Haft'roza

Refrences:

1. The Unani Pharmacpoeia of India, P-1, Vol-2,2007, AYUSH, MHFW, Govt. of India.
2. Awan MH, 1981, Ketabul Mufraydat, Sheikh Gulam Ali & Sons, Lahore, Pakistan
3. http://bnh-flora.gov.bd/species-description/?id=2287

RASAUT
(Root extract)

The drug Rasaut consists of dried root extract of *Berberis aristata* D.C. It is a large shrub found in Himalayas and Nilgiri hills. It occurs throughout the year.

Naam-e-Degar (Other names):

a) Botanical name: *Berberis aristata* D.C.

b) Family: Berberidaceae

c) Bengali name: Darhaldi

d) English name: Indian Barberry, Tree turmeric.

Tafseel (Description):

Aam (General): It is an erect spiny shrub, ranging between 2 and 3 metres in height wood, hard and yellow; bark, yellow to brown from outside and deep yellow from inside, removable in longitudinal strips by hand; spines (which, in fact, are modified leaves), three-branched and 1.5 cm long. Leaves, in tufts of 5 to 8, phyllotaxy verticillate, lanceolate, simple spiny, toothed, leathery, sessile, acuminate, with reticulate pinnate venation, 4.9 cm. long, 1.8 cm. broad, deep green on the dorsal surface and light green on the ventral surface.3 Flowers, stalked, yellow, complete, hermaphrodite, cyclic, actinomorphic, perigynous, the average diameter of a fully opened flower being 12.5 mm; inflorescence, a simple to corymbose raceme, with 11 to 16 flowers per cluster; calyx, yellow, polysepalous, with 6 sepals (3 small, 3 large), yellow, actinomorphic caducous, 4 to 5 mm long; corolla, polypetalous, with 6 petals, yellow, actinomorphic, 4 to 5 mm long; androecium,

polyandrous, with 6 stamens, adnate, 5 to 6 mm long; gynoecium, one, 4 to 5 mm long, with a short style and a broad stigma. Fruits, globose to ovoid, usually covered with bloom as in plums, 7 mm long, 4 mm in diameter, weighing 227 mg, 237 microlitres in volume; fruit colour, aconite violet 937; colour of pulp and juice, plum purple 934/3. Seeds, 2 to 5, varying in colour from yellow to pink, each weighing 25 mg and being 29 microlitres in volume. Flowering in *Berberis aristata* starts from the first fortnight of March and remains in progress up to the end of April. The peak flowering season under Solan conditions was recorded to be from 8-25 April. The fruits start ripening from the second week of May and continue to do so throughout June. They can be retained on the shrub after ripening for quite a long period, but they fall off soon after the onset of rains. The fruiting season, therefore, ends abruptly with the commencement of the rainy season. An average-sized bush of *Berberis aristata* was found to yield 657 g of fruits in about 4 pickings. *(Das et al., Phyto-Pharmacology Of Berberis Aristata Dc: A Review, Journal of Drug Delivery & Therapeutics; 2011, 1(2): 46-50)*

Root Bark Extract

Berries

Klaa Beeni (Macroscopic): The drug Rasaut occurs in the form of small pebbles of different irregular shapes. The pebbles are hard and do not break easily. When broken they are black and opaque, the breaking surfaces are lustrous and uneven. The taste is bitter with aromatic smell.

Khurd Beeni (Microscopic): The drug is unorganized.

Powder: The drug powder is black in colour, little lustrous and is admixed with some foreign organic matters mostly broken leaves. Taste bitter and smell prominent and tobacco like.

Juz-e-Mustamil (Part used): Root extract

Maskan (Habitat): The plant is native of the whole range of Himalaya mountains at an elevation 2000 to 3500 metres. It also occurs in Nilagiri range in Southern India

Jwoher'e Nabatati (Phytoconstituents): Alkaloids-berberine, oxyacanthine, bcrbamins. palmatine, jatorarrhizine, columbamins;.berbrrubine and hydrastine.

Mizaj (Temperament): Cold 2° Dry 2^{o}

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 28 %	Appendix 2.2.3
Acid insoluble ash	Not more than 15 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 4 %	Appendix 2.2.6
Water soluble extractives	Not less than 32 %	Appendix 2.2.7

TLC behaviour of petroleum ether (60-80^{o}) extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Pet. Ether: Benzene: Chloroform (50:50:30)	2% Ethanolic H_2SO_4	4	0.14, 0.26,0.59,0.71

Aa'maal-e-Adviya (Pharmacological action): Mohallil-e-Waram (Anti-inflammatory)

Mahall-e-Istemalat (Therapeutic use): Amraz-e-Chashm (Eye diseases). Yarqan (Jundice), Waram-e-Tehal, Bawaseer (Hemorrhoid)

Meqdar-e-Khorak (Dose): 3 gm

Muzir (Side-effects / adverse-effects): No significant side effects, adverse effects have been reported. / Significant side effects / adverse effects have not been reported.

Musleeh (Corrective): Not require. / No Musleeh have been identified

Badal (Proximal substitute): No proximal substitute have been identified

Aaham Nukhsajat (Important formulations): Habb-e-Bawaweer Amya, Habb-e-Bawaseer Damiya, Habb-e-Rasaut, Habb-e-Siyah Chashm, Kohal-ul-Jawahir, Zimad-e-Mubarrid, Zimad-e-Waram-e-Unsayain Haad, Tila-e-Musakkin.

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RATANJOT
(Root)

The drug Ratanjot consists of dried roots of *Onosma hispidum* wall. ex D. Don. Syn. *O. echioides* C.B. Clarke non Linn. (Boraginaceae); a perennial erect herb found in Himalyas from Kashmir to Kumaon at altitudes of 2,000 to 4,500 m.

Naam-e-Degar (Other names):

a) Botanical name: *Onosma hispidum* wall. ex D. Don. Syn. *O. echioides* C.B. Clarke non Linn.

b) Family: Boraginaceae

c) Bengali name: Ratanjot

d) English name: -

Tafseel (Description):

Aam (General): *Onosma hispidum*, a perennial herb with a sharp and bitter taste**.**

Figure : Root of Ratanjot

Klaa Beeni (Macroscopic): Dried roots tapering, light in weight. reddish brown, fractured, twisted or straight with blunt apices; presence of layers of loose papery pieces in outer region. Individual piece is papery, thin, smooth, delicate and easily detachable from central wood; odour, disagreeable; taste; nil; imparts stain to fingers when handled.

Khurd Beeni (Microscopic):

Root: The transverse section of the root is more or less circular in outline; epidermis and cortical region are completely obliterated as they get exfoliated in the form of papery layers and are cut off from the axis: the remaining outer most layer of cells become further

suberised and form I to 2 rows of cork tissue: such cells are compactly arranged, thick-walled, rectangular, somewhat irregular in shape and consisting of reddish-brown matter; endodermis and pericycle not defined; the central portion of vascular elements are highly diffused, woody, obliterating primary stellar structure and pith; phloem indistinguishable; the vessels of secondary xylem are distributed singly or in groups; variable in lumen size; scattered among xylem parenchyma; ray parenchyma distinct; occasional scattered xylem fibres are ascptate and lignilied as seen in longitudinal section.

Powder: Reddish-brown; fragments of loose papery layer in surface view consisting of tangentially elongated thick-walled cork ce!ls; crystals of calcium oxalate; vessel of variable size, about 37.0 to 104.0 µ in length and 58.0 to 83.0 µin width; lumen large; pits simple and fairly numerous. Xylem fibers are stout. long, varying in size. about 139.0 to 177.0 µ in length and 3.0 to 4.0 µm in width; lumen narrow, aseptate, fairly thick-walled, lignified; ends plain and pointed. Powder imparts reddish-brown colour to cold and hot water as well as oils.

Chemical Test: One gram powder extracted with absolute alcohol (4.20%), petroleum ether (2.70%), chloroform (4.50%) and benzene (4.80%), the extract turns blue when 20% aqueous potassium hydroxide is added to it.

Juz-e-Mustamil (Part used): Root

Maskan (Habitat): Found in Himalyas from Kashmir to Kumaon at altitudes of 2,000 to 4,500 m.

Jwoher'e Nabatati (Phytoconstituents): Alkannin and aliphatic ketones

Mizaj (Temperament): Cold 2°, Dry 2°

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 7 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 15 %	Appendix 2.2.6
Water soluble extractives	Not less than 5 %	Appendix 2.2.7

TLC behaviour of petroleum Ethanolic extract:

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Toluene : Ethyl Acetate : Methanol (95:5:0.5)	On spraying plate with 2% Ethanolic H_2SO_4 and heated for 5 minutes at 115°C	3	0.33 0.50 0.90

Aa'maal-e-Adviya (Pharmacological action): Qabiz (astringent), Mujaffif (Dessicant), Jaali

Mahall-e-Istemalat (Therapeutic use): Qurooh-e-Khabeesa, Harq, Bard, Namla, Zof-e-Basar (Eye weakness)

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

Muzir (Side-effects / adverse-effects): No significant side effects, adverse effects have been reported. / Significant side effects / adverse effects have not been reported.

Musleeh (Corrective): Not required / No Musleeh have been identified

Badal (Proximal substitute): No proximal substitute have been identified

Aaham Nukhsajat (Important formulations): Marham - e - Jadwar, Marham -e-Khanazeer, Raughan - e – Surkh.

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REHAN
(Whole plant)

The much branched annual herb Rehan is a medicinal plant which has been used as medicine in Unani system since long time. The different parts of the plant have the medicinal properties that are used to alleviate various diseases for their pharmacological and therapeutical activities.

Naam-e-Degar (Other names):

a. Botanical nam: *Ocimum sanctum* Linn.
b. Family : Lamiaceae
c. Bengali name : Tulsi
d. English name : Brush-leaf-tea, sacred basil, holy basil.

Tafseel (Description):

Aam (General) : The plant Tulsi is an erect, many-branched subshrub, 30–60 cm tall with hairy stems. Leaves are green or purple; they are simple, petioled, with an ovate, up to 5 cm (2.0 in)-long blade, which usually has a slightly toothed margin; they are strongly scented and have a decussatephyllotaxy. The purplish flowers are placed in close whorls on elongated racemes. The three main morphotypes cultivated in Bangladesh, India and Nepal are *Ram tulsi* (the most common type, with broad bright green leaves that are slightly sweet), the less common purplish green-leaved (Krishna*tulsi*) and the common wild *vana tulsi*.

Figure : Rehan plant

Klaa Beeni (Macroscopic): Root: Thin, wiry, branched, hairy, soft, blakish-brown externally and pale violet internally.

Stem: Erect, herbaceaous, woody, branched, hairy, subquadrangular, externally purplish-brown to black, internally cream coloured; fracture, fibrous in bark and short in xylem; odur, faintly aromatic.

Leaf: 2.5-5 cm long 1.6:3.2 cm wide, elliptic obtuse, entire or serrate, pubescent on both sides; petiole thin, about 1.5-3 cm long hairy; odour aromatic; taste pungent.

Flower: Purplish or crimson coloured, small in close whorls; bracts about 3 mm long and broad, pedicels longer tan calyx, slender, pubescent; calyx ovoid or campanulate, 3-4 mm bilipped, upper lip broadly obovate or suborbicular, shortly apiculate, lower lip longer than upper haing four mucronate teeth, lateral tow short and central two largest; corolla about 4 mm long, puibescent; odour, aromatic; taste, pungent.

Fruit*:* A group of 4 nutlets, each with one seed enclosed in an enlarged, membranous, veined calyx, nutlets sub-globose or broadly elliptic, slightly compressed, nearly smooth; pale brown or reddish with small black

Khurd Beeni (Microscopic):

Root : Shows a single layered epidermis followed by cortex, consisting of seven or more layers of rectangular, round to oval polygonal, thin-walled, parenchymatous cells, filled with brown content, inner layers or cortex devoid of contents; phloem consisting of sieve elements, thin-walled, rectangular parenchyma cells and scattered groups of fibres, found scattered in phloem; xylem consists of vessels, tracheids, fibres and parenchymal vessels

spotted; fibre tracheides, long, pitted with pointed ends; fibres thick walled and with pointed ends.

Stem : shows a single layered epidermis with uniseriate, multicellular covering trichomes having 5-6 cells, occasionally a few cells collaped; cortex consists of 10 or more layers of thin-walled, rectangular, parenchymatous cells; phloem consists of sieve elements, thin-walled, rectangular parenchyma cells and fibres; fibres found scattered mostly throughout phloem in groups and rarely in singles; xylem occupies major portion of stem consisting of vessels, tracheids fibres and parenchyma of; vessels pitted; fibres with pointed ends; centre occupied by narrow pith consisting of round to oval, thin-walled, parenchymatous cells.

Leaf: Petiol: Shows somewhat cordate outline, consisting of single layered epidermis composed of thinwalled, oval cells having a number of covering and glandular trichomes; covering trichomes multicellular 1-8 celled laong, rarely slightly reflexed at tip; glandular trichomes short, sessile with 1-2 celled stalk and 2-8 celled balloon-shaped head, measuring 22-27 in diameter ; epidermis followed by 1-2 layers and 2-3 layers of thin-walled, elongated, parenchymacells towards upper and lower surfaces respectively; three vascular bundles situated centrally, middle one larger than other two ; xylem surrounded by phloem.

Midrib: Epidermis, trichomes and vascular bundles similar to those of pertiole except cortical layers

reduced towards apical region.

Lamina: epidermis and trichomes similar to those of petiole; both anomocytic and diameter cytic type of stomata present on both surfaces, slightly raised above the level of epidermis; palisade single layered followed by 4-6 layers of closely packed spongy parenchyma with

chloroplast and oleo-resin; stomatal index 10-12-15 on upper surface and 14-15-16 on lower surface; palisade ratio 3.8; vein islet number 31- 35.

Powder : Greenish; shows thin-walled, parenchymatous cells, a few containing reddish brown contents, unicellular and lulticellular trichomes either entire or in pieces; thin-walled fibres, xylem vessels with pitted thickenings fragments of epidermal cells in surface view having irregular shape, oil globules, rounded to oval, simple as well as compound starch grains having 2-5 components , measuring 3-17 μ in diameter meter.

Juz-e-Mustamil (Parts used): Root, stem, leaves, flower, seeds and whole plant.

Maskan (Habitat) : The plant holy absil is found in Bangladessh, India, Nepal, Australia, West Africa and some Middle Eastern countries. Now a day it is cultivated in parts of the world.

Jwoher'e Nabatati (Phytoconstituents): The phytochemical constituents of Tulsi are oleanolic acid, ursolic acid, rosmarinic acid, eugenol, carvacrol, linalool, and β-caryophyllene. The essential oil of Tulsi consists mostly of eugenol, β-elemene, β-caryophyllene and germacrene with the balance being made up of various trace compounds, mostly terpenes.

Mizaj (Temperament): Hot 2^0 and Dry 1^0

Musleh (Correction) : Cucumber, Tokhme Khurfa, Sekenjabeen.

Badal (Proximal substitute): Easily available, So no alternatives required.

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 10 per cent, Appendix 2.2.3
Acid-insoluble ash	: Not more than 1.5 per cent, Appendix 2.2.4
Alcohol-soluble extractive	: Not less than 04 per cent, Appendix 2.2.6
Water-soluble extractive	: Not less than 08 per cent, Appendix 2.2.7

TLC behavior :

T.L.C. of Tulasi oil obtained by stem distillation is carried out on silica gel 'g' plate using Toluene: Ethylacetate (93:7) Tulasi oil is diluted in chloroform-toluene (1:10) Eugenol to be applied as standard also diluted of 10 cm the plate is air drying for 15 minutes and thn kept in the over for 2 to 5 minutes. On cooling spray, in thoroughly vanillin – Sulphuric acid reagent and heat the plate at 1100 C for 5-1-minutes. Under observation record Rf. Values of eugenol and caryophyllence. Eugenol (orange brown) approx. Rf. Value 0.7, caryophyllence (reddish violet) runs to solvent front. Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Mufarreh wa Muqawwie Qalb, Muqawwie Meda (Gastic Tonic), Mudirre Baul wa Haiz, Mohallil-e-Waram (Anti-inflammatory),

Mahall-e-Istemalat (Therapeutic uses): Wajaul Gosh, Khafqan (Palpitation), Ehtabase Haiz, Zofe Meda (Weakness of Stomach)

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

Muzir (Side-effects / adverse-effects): Use of too much doses or longer period Tulsi make create nausea or diarrhea.

Aaham Nukhsajat (Important formulations): Khamira Abresham Ood Mastagiwala, Arq Maullaham Ambari.

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REWAND CHINI
(Root)

The drug Rewandchini consists of dried roots of *Rheum emodi* Wall. (Polygonaceae). It is a stout herb found in the Himalayas at altitudes of 1500 to 4000 m and in Kashmir, Nepal, Sikkim and Bhutan. Flowering and fruiting takes place during June-July.

Naam-e-Degar (Other names):

a) Botanical name: *Rheum emodi* Wall.

b) Family: Polygonaceae

c) Bengali name: Revanchini

d) English name: Indian Rhubarb or Himalayan Rhubarb

Tafseel (Description):

Aam (General):

Rheum emodi Wall.exMeissn, is a leafy perennial herb,1.5-3.0 m in height **[3]**. Roots very stout. Radical leaves longpetioled,very large, often 60 cm in diameter, orbicular orbroadly ovate obtuse, base cordate 5-7 nerved, papillosebeneath, subscaberulous above; petiole 30-45 cm, very stout,scaberulous. Panicle is 0.6-0.9 m, papillosely puberulous,fastigiately branched and leafy with erect strict branches;flowers small 3 mm diameter, dark purple or pale red, inaxillary panicles. Fruit ovoid-oblong, 13 mm long, purple,base cordate, apex notched, wings narrower than the disk.

Roots and rhizomes are the main parts used as drug and arecollected in October to November. Root of Indian Rhubarb isdarker, inferior in aroma, coarser and untrimmed, is notdecorticated. Fresh rhizome is 6 to 12 inches long, and thefreshly fractured surface is dull orange to yellowish brown

Klaa Beeni (Macroscopic): The drug consists of dried solid, compact cylindrical pieces of various sizes. Outer surface is irregularly longitudinally wrinkled, furrowed or ridged but few have transverse wrinkles and they are usually covered with brownish or yellowish brown cortex. Inner surface possesses yellow colour. Fracture is hard and shows cambium line.

Khurd Beeni (Microscopic): The transverse section of the root shows brown bark which consists 10-14 layers of cells. Cortical region is usually made up of a few layers of parenchymatous cells which are mostly oval to irregularly rounded and thin walled. Most of the cortical cells possess grains in abundant, spheroidal or round in shape and found single or 2-4 compound. A few cells of the region merged into the secondary phloem tissue which forms a few layers of cells. Cambium is wavy and is much compressed. Medullary rays are prominent and radially elongated and consisted of one to two layers of cells. The ray cells are radiating and often extend through the phloem region. The vascular bundles are arranged in one to two cells of layer of radial chain and central cylinder of wood is formed in this way. The rest of the wood is composed of tracheids and xylem parenchyma. The vessels are mostly found to have scalariform and spiral thickenings.

Powder: Powder analysis of the crude drug reveals the presence of fragments of thin walled parenchyma and ray cells. The scalariform or spiral vessels, tracheids, rosette aggregate crystals of calcium oxalate and abundant starch grains.

Juz-e-Mustamil (Part used): Roots

Maskan (Habitat): *Rheum emodi* is a stout herb, endemic to the Himalayan region distributed in the temperate and subtropical region from Kashmir to Sikkim at an elevation of 2800-3000m in India and also in Nepal and Bhutan. It grows in the alpine zone on rocky soils, moraines and cervices. *(Rehman H. et.al., Rheum emodi (Rhubarb): A Fascinating Herb, Journal of Pharmacognosy and Phytochemistry 2014; 3 (2): 89-94).*

Jwoher'e Nabatati (Phytoconstituents): Glycosides, sterioids, phenolica, flavonoids, sodium, potassium, calcium and iron, rhein, emodin.

Mizaj (Temperament): Hot , Dry

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 11 %	Appendix 2.2.3
Acid insoluble ash	Not more than 2.5 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 22 %	Appendix 2.2.6
Water soluble extractives	Not less than 19 %	Appendix 2.2.7

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

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Pet. Ether: Ethyl acetate (24:1)	5% Ethanolic H_2SO_4	4	0.27, 0.29, 0.37, 0.38

Aa'maal-e-Adviya (Pharmacological action): Jali (detergent), Mohallil-e-Waram (Anti-inflammatory), Musakkin, Munaffis, Muqawwi-e-Meda-wa-Kabid (Gastic and Liver Tonic), Mudirr-e-Baul (Diuretic), Mudirr-e-Tams.

Mahall-e-Istemalat (Therapeutic use): Yarqan (Jaundice), lstisqa. Waram-e-Kabid (Hepatitis), Ehtebas-e- Tams, Ehtebas-e-Baul

Meqdar-e-Khorak (Dose): l-3 g

Muzir (Side-effects / adverse-effects): No significant side effects, adverse effects have been reported. / Significant side effects / adverse effects have not been reported.

Musleeh (Corrective): Not required / No Musleeh have been identified

Badal (Proximal substitute): No proximal substitutes have been identified

Aaham Nukhsajat (Important formulations): Habb-e-Miskeen Nawaz, Habb-e-Mushil lstisqaee, Habb-e-Shabyar, Habb-e-Shifa, Qurs-e-Zarishk, Dawa-ul-Luk, Jawarish-e-Narmushk, Majoon-e-Juntiyana, Majoon-e-Talkh, Sabadaritoos, Raughan-e-Aqrab, Sharbat-e-Deenar, Sufoof-e-Lajward, Sufoof-e-Mudirr-e-Haiz, Qurs-e-Mulaiyin, Zimad-e-Mohallil.

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SAMANDER PHAL
(Fruit)

The plant Samander phal is a medicinal herb which is used in Unani system for the remedy of some diseases. Particularly the fruits of the plant are taken to prepare mrdicine for its various phytochemical constituents.

Naam-e-Degar (Other names):

a. Botanical name : *Barringtonia acutangula* Gaertn.

b. Family : Lecythidaceae

c. Bengali name : Hijjala

d. English name : Indian oak, Freshwater mangrove, Small indian oak, Itchytree and Mango-pine.

Tafseel (Description):

Aam (General) : Hijjala is a moderate sized, evergreen, glabrous tree, that grows to about 8 to 15 meter high. Its leaves are thick, smooth and oval in shape, about 8 to 12 cm long and 4 to 5 cm wide, with reddish petioles about 0.5 to 1.0 cm long. The plant has drooping raceme of up to 50 cm long, with numerous large, white flowers. Its fruit is oval-shaped and about 3 cm long, with 1 seed inside.

Figure Fruits of Samanderphal

Klaa Beeni (Macroscopic) : Fruit - A drupe, yellowish-brown, oblong, 2.5-3.3 by 1.00 - 1.3 cm, bluntly quadrangular, broadest in the middle, slightly narrow and truncate at each

end, fibrous; no characteristic odour and taste. Seed - Single, 2-2.5 by 0.7-1.0 cm, wrinkled longitudinally, dark brown in colour.

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

Juz-e-Mustamil (Parts used): Root, stem bark, leaves, fruit.

Maskan (Habitat): The plant Samanderphal is native to coastal wetlands in southern Asia and northern Australasia, from Afghanistan east to the Philippines and Queensland. It prefers moist situations but is not found in mangrove forests.

Jwoher'e Nabatati (Phytoconstituents): Samanderphal consists of dihydromyticetin, triterpenoids; racemosol, gallic acid, bartogenic acid, stigmasterol, saponins; barringtoside and sapogenins.

Mizaj (Temperament): Hot and Dry.

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

TLC behavior of chloroform extract:

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

0.41, 0.48, 0.56, 0.61 (all violet), 0.87 (blue), 0.92 (violet) and 0.96 (brown). , Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Jali (Detergent), Mahallil (Resolvent), Jazib-e-Rutubat-e-Dimagh, Munaffis-e-Balgham (Expectorant) Kasir-e-Riyah (Carminative)

Mahall-e-Istemalat (Therapeutic uses): Jiryan (Spermatorrhoea), Shaqeeqa (Migrain), Aqrab Gaqeedgi, Sara (Epilepsy), Bayaz-ul-chashm (Opacity),

Meqdar-e-khorak (Dose): Half to One fruit

Muzir (Side-effects / adverse-effects): There are no known side-effects with this herb.

Aaham Nukhsajat (Important formulations): Habb-e-Hindi Chashm

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SANDAL SAFAID
(Heart Wood)

The heartwood of the plant Sandal safaid is used as medicine in Unani system. It is composed of different phytochemical constituents that have the pharmacological and therapeutical activities.

Naam-e-Degar (Other names):

a. Botanical name: *Santalum album* Linn.
b. Family : Santalaceae
c. Bengali name : Shet Chandan

d. English name : Sandal Wood

Tafseel (Description):

Aam (General) : The plant Sandal Safaid is an evergreen, semi parasitic tree which is 8 to 18 meter in height and 2 to 4 meter in girth. The plant parasitises the roots of other tree species, with a haustorium adaptation on its own roots, but without major detriment to its hosts. An individual will form a non-obligate relationship with a number of other plants. The reddish or brown bark can be almost black and is smooth in young trees, becoming cracked with a red reveal. The heartwood is pale green to white. The leaves are thin, opposite and ovate to lanceolate in shape. Glabrous surface is shiny and bright green, with a glaucous pale reverse. Fruit is produced after three years, viable seeds after five. These seeds are distributed by birds.

Figure : Heart wood of Sandal Safaid

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

Khurd Beeni (Microscopic) : Wood consists of tracheids, vessels, fibres, xylem parenchyma and traversed by medullary rays; vessels numerous scattered singly throughout the region, rarely two together, barrelshaped, pitted and with transverse to oblique pen oration with tail-like projections, at one or both ends; a few tracheids elongated with

tapering ends and possess bordered pits on their walls; fibres many, lignified with pointed tips; xylem parenchyma mostly rectangular, a few of them contain prismatic crystals of calcium oxalate; xylem rays numerous, run straight, uni to triseriate, mostly biseriate, thickwalled, radially elongated having golden yellow to brownish contents and contain a few prismatic crystals of calcium oxalate.

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

Juz-e-Mustamil (Parts used): Heart wood, oil.

Maskan (Habitat) : The plant Sandal Safaid is indigenous to the tropical belt of the peninsular India, eastern Indonesia and northern Australia. The main distribution is in the drier tropical regions of Southeast Asia and the Indonesian islands of Timor and Sumba.

Jwoher'e Nabatati (Phytoconstituents): Volatile oil (á- and â- Santalol) and some macronutrients like phosphorus, nitrogen and potassium

Mizaj (Temperament): Cold 2^0 and Dry 2^0

Musleh (Correction) : Honey, Sugar, Katira.

Badal (Proximal substitute): Sandal Surkh, Bahman Sufaid, Mako.

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

Foreign matter : Not more than 2 Percent, Appendix 2.2.2

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

TLC behavior :

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

Aa'mal-e-Advia (Pharmacological action): Mufarreh (Exhilarant), Musakkin, Daf-e-Taffun (Antiseptic), Munaffis-e-Balgham (Expectorant)

Mahall-e-Istemalat (Therapeutic uses): Khafqan (Palpitation), Hirqat-ul-Baul (Burning Micturation), Suzak (Gonorrhoea), Sual (Cough),

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

Muzir (Side-effects / adverse-effects): Use of Samanderphal for longer than 6 weeksmay create itching, nausea and stomach upset.

Aaham Nukhsajat (Important formulations): Dawa-ul-Misk Motadil, Khamira Abresham Hakim Arshad Wala, Khamira Marwarid, Mufarreh Barid

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TUKHM-E-KARAFS (Seed)

The drug Tukhm-e-Karafs consists of dried seeds of *Apium graveolens* Linn. (Apiaceae). treatment of various diseases. It is an erect, annual or biennial, aromatic glabrous herb, with succulent, well developed tap root. *(Naushad M. et. Al., A comprehensive review on Tukhm-e-Karafs (Apium graveolens L.) with special reference to Unani System of Medicine, CellMed 2020 / Volume 10 / Issue 3 / e20)*

Naam-e-Degar (Other names):

a) Botanical name: *Apium graveolens* Linn.

b) Family: Apiaceae

c) Bengali name: Chani, Randhuni

d) English name: Celery, Cultivated Celery, Marsh Parsley, Marsh Parsley, Smallage, Wild celery, Apium

Tafseel (Description):

Aam (General): *Tukhm-e-Karaf*is the seeds (fruit) of the *Apium graveolens*L. and frequently used in Unani system of Medicine for the treatment of various diseases. It is an erect, annual or biennial, aromatic glabrous herb, with succulent, well developed tap root, branching angular or fistular stem, pinnate or trifoliate leaves and white flower. The plant occurs from November to March. Flowering and fruiting take place during the month of February to March. It is wild as well as cultivated in many countries for its seeds and whole herb as a salad crop. It is an aromatic herb and also used as a medicine in many folklore. It is a believed to be native of Europe and Western Asia but cultivated in many countries now a day (Anonymous, 2007). *(Naushad M. et. Al., A comprehensive review on Tukhm-e-Karafs*

(Apium graveolens L.) with special reference to Unani System of Medicine, CellMed 2020 / Volume 10 / Issue 3 / e20)

Figure : Dried seeds of Karafs

Klaa Beeni (Macroscopic):The fruit of Tukhm-e-Karafs are mostly separated, mericarps. The cremocarp is brown, roundish ovoid, laterally compressed and about 1.0-1.5 mm long, 1.5 mm wide and 1.5 mm thick. Each mericarp has five straight, scarcely prominent primary ridges. The seeds are orthospermous. The odour and taste of drug is aromatic.

Khurd Beeni (Microscopic): The sectional view of the fruit shows a wavy outline. Each mericarp has mostly five ridges and six to nine vittae. The epicarp consists of single layer of rectangular, thin walled parenchymatous cells coated with irregular cuticle on the outer side. The mesocarp region mostly composed of several layers of moderately thick walled parenchymatous cells which are polygonal to oval in shape. The sclereids of mesocarp are ovoid to elongated rectangular with a slightly sinuous outline. The walls are slightly

thickened at corners. Innermost layer of mesocarp is made up of large brown parenchymatous cells which are elongated rectangular in shape and is attached to the endocarp. The endocarp consists of a single layer of rectangular to squarish thin walled parenchymatous cells brown parenchymatous cells which are elongated rectangular in shape and is attached to the endocarp. The endocarp consists of a single layer of rectangular to squarish, thin walled parenchymatous cells. The testa, which is usually associated with the endocarp, is generally single layered consisted of thin walled elongated rectangular and mostly collapsed cells. Beneath which the endospermic region is composed of several layers of rectangular to polygonal, thick walled parenchymatous cells containing aleurone grains, which are oval to round and are joined in groups. Most of the endospermic cells contain microspheroidal crystal of calcium oxalate. A small amount of vascular tissue and reticulated parenchyma is present. The elements are small and are usually in groups the vessels show spiral or reticulate thickenings.

Powder: Powder analysis of the crude drug reveals the presence of fragments of epicarp having stomata, mesocarp, vittae, endosperm, vessels, sclereids and aleurone grains and microspheroidal crystals of calcium oxalate.

Juz-e-Mustamil (Part used): Seed

Maskan (Habitat): Found in the base of the North West Himalayas and outlying hills in Punjab and Western India. The plant occurs from November-March. Flowering and fruiting take place during February-March. *(IP-2)*

Jwoher'e Nabatati (Phytoconstituents): Glycosides, steroids, phenolics, flavonoid, sodium. potassium, calcium and iron. essential oil, glucoside, apin.

Mizaj (Temperament): Hot 2° Dry 2°

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 extractives	Not less than 9 %	Appendix 2.2.6
Water soluble extractives	Not less than 9 %	Appendix 2.2.7

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

Solvent system	***Spray/reagent treatment***	***No. of spots***	***Rf value***
Pure Chloroform	2% Methanol	1	0.19

Aa'maal-e-Adviya (Pharmacological action): Mufatteh Sudad, Muarriq, Mushtahi (Appetizer) , Kasir-e-Riyah (carminative), Mufattit-e-Hisat, Mudirr-e-Tams**,** Mudirr-i-Bawl, Mushtahī (Appetizer), Muqawwi-i-Bāh, Muhallil, Musakkin-i-Dimāgh, Mulayyin-i-Am'ā', Qātil-i-Dīdān, Mukhrij-i-Janīn, Muqawwī, Dafi'-i-Tashannuj, Mugharrī, Dafi'-i-Maghs, Musakkin-i-Suda.

Mahall-e-Istemalat (Therapeutic use): Zat-ul-Janb(Pleurisy), Irq-un-Nisa, Niqras (Gout), Waja-ul-Zohar, Nafkh-e-Shikam (Flatulance), Istisqa, Ehtebas-e-BauI, Hasat-e-KuIiya-wa-Masana *(IP)*

Dīq al-Nafas (Br. Asthma), Irq al-Nasā (Scietica), Istisqā, Hudūr, Waja'al-Kulya (renal colic), Waja'al-Mathāna, Qay (Vomiting), Maghs, Suda.

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

Muzir (Side-effects / adverse-effects): No significant side effects, adverse effects have been reported. / Significant side effects / adverse effects have not been reported.

Musleeh (Corrective): Not required / No Musleeh have been identified.

Badal (Proximal substitute): No proximal substitute have been identified.

Aaham Nukhsajat (Important formulations): Banadiq-ul-Buzoor, Habb-e-Khabs-ul-Hadeed, Jawarish-Falafili, Jawarish-Safarjali Qabiz (astringent), Jawarish-e-Shahreyaran, Jawarish-e-Zarooni Sada, Majoon-e-Hajr-ul-Yahood, Majoon-e-Jalali, Majoon-e-Jograj Gugal, Majoon-e-Kalkalanaj,Majoon-e-Nankhwah, Majoon-e-Fotnaji, Zimad-e-Sumbul-ut-Teeb, Sikanjabeen Buzoori Motadil, Sufoof-e-Namak Sheikh-ur-Raees, Sufoof-e-Moya, Sufoof-e-Mohazzil, Sufoof-e-Habb-ur-Rumman, Jawarish-e-Narmushk, Majoon Dabeedul Ward. Shiyaf-i-Kundur, Majoon Dabeed-ul-Ward,Sikanjabeen Buzoori Motadil.

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TUKHM-E-KASOOS
(Seed)

The drug Tukhm-e-Kasoos consists of dried seeds of *Cuscuta reflexa* Linn. Syn. *Cuscuta grandiflora* Wall., C. verucosa Sweet. (Cuscutaceae).

It is a leafless parasitic climber with thin, slender and delicate stem bears flower, fruit and seeds. *Cuscuta reflexa*, is commonly called Aftimoon or Kasoos in the Unani System of medicine the seeds are known as Tukhm-e Kasoos. The plant occurs for most pail of the year. Flowering takes place during January- February while fruiting occurs from March-April.

Naam-e-Degar (Other names):

a) Botanical : *Cuscuta reflexa* Linn. Syn. *Cuscuta grandiflora* Wall., C. verucosa Sweet.

b) Family: Cuscutaceae

c) Bengali name: Akash bail, Swarno lota, Aloklota, Jorbuti, Alkilota, Algushi

d) English name: Dodder

Tafseel (Description):

Aam (General): Aftimoon (*Cuscuta reflexa*) is a perennial rootless, leafless, which shows an extensive climbing habit. It is a widespread creeper yearly parasitic plant. It grows as holoparasite and it has very low level of chlorophyll and photosynthetic activity, completely depends over the host plant for its survival. The plant is acrid and tastes bitter and sharp. The stems are long, narrowly twined,branched, glabrous, pale greenish-yellow, often dotted with red. Flowers are single or in umbellate clusters of 2 - 4 in shortracemes, pedicels is glabrous, short and generally curved; bracts is ovate to oblong, obtuse and fleshy and 1,5 mm long. Calyx is dividedalmost to the base, long, slightly irregular, 3 mm lobes, obtuse, glabrous and fleshy. Corolla is white; tube 6 - 8 mm by 4 mm; lobes 2.5 - 3 mm, almost cylindrical, acutely reflexed, almost at the base of corolla tube. Stamens lies in the throat of the corolla tube; filaments are scattered scarcely; anthers lies beyond the top of the corolla tube. Ovary is simple and ovoid with very short and thick style; two stigmas, which are distinct, thick, fleshy and large, 1.5 mm long. Capsules 68 mm wide, glabrous, circumscissile near thebase, and depressed globose. Seeds are black and glabrous 2 - 4 innumber.

Figure : Dried aerial parts of the plant Kasus.

Klaa Beeni (Macroscopic): The fruit consists of four seeds which are smooth and 04-0.6 mm in diameter, brownish or black in colour, convex on one side to concave on other.

Khurd Beeni (Microscopic): The seed in cross section shows three zones; the seed coat , endosperm and embryo. Seed coat is characterized by a persistent testa and tegmen. The testa is further differentiated into three layers the epidermis consisting of large cuboid cells with starch, hypodermis composed of short cells with lignified walls while the third layer is of palisade like prismatic cells with thick lignified and brownish wall. Endosperm and embryo are parenchymatous.

The pale brownish fine powder having an acrid-bitter taste is without any characteristic odour. The powder is characterised by the presence of some cuboid cells containing starch grains, abundance of short and palisade like lignified cells and a few parenchymatous cells.

Juz-e-Mustamil (Part used): The Whole plant, stem and seeds are used as drugs purpose.

Maskan (Habitat): The parasitic intensive creeper can be seen everywhere in Bangladesh. It is known by many local names, like Aloklota, Jorbuti, Alkilota, Algushi etc.

Jwoher'e Nabatati (Phytoconstituents): Proteins, phenols, tannins, resin. glycosides, carbohydrates, steroids. aluminium, iron, calcium, sodium, potassium.

Mizaj (Temperament): Moderately Hot-Dry 1^0

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 15 %	Appendix 2.2.3
Acid insoluble ash	Not more than 11 %	Appendix 2.2.4
Alcohol soluble extractives	Not less than 11 %	Appendix 2.2.6
Water soluble extractives	Not less than 5 %	Appendix 2.2.7

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

Solvent system	*Spray/reagent treatment*	*No. of spots*	*Rf value*
Diethly : Pet. Ether (1:4)	2% Ethanolic H_2SO_4	2	0.14, 0.31

Aa'maal-e-Adviya (Pharmacological action): Mudirr-e-Baul, Mohallil-e-Waram-e-Kabid (Hepatitis), Dal-c-Humma, Mulaiyin (Laxitive), Dāfi'-e- Sawdā'

Meqdar-e-Khorak (Dose): 6-10 g

Muzir (Side-effects / adverse-effects): Harmful for people with condition of Mirra-i-Ṣafrā' (serous bile). Also harmful for people of hot temperament as it may cause irritability, nausea and vomiting. It is also Muzir(harmful) for lungs. Aftimoon due to its basic temperament causes dryness of mouth, irritability and thirst. Therefore, correctives are adviced to be used long with the intake of drug.

Musleeh (Corrective): *Kateera, Zafran, Roghan badam,* Kasni.

Badal (Proximal substitute): Ustukhuddus, Basfaij, Hasha, Turbud, Afsanteen

Aaham Nukhsajat (Important formulations): Majoon-e-Dabeed-ul-Ward, Sharabat-e-Deenar

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USHBA
(Root)

The plant Ushba is used as medicine in Unani system for its phytochemical constituents. The dried roots of the palnt are taken to prepare medicine for their pharmacological and therapeutical activities.

Naam-e-Degar (Other names):

a. Botanical name: *Smilax aristolociaefolia* Mill.
b. Family : Liliaceae
c. Bengali name : Kumarica, Oshba, Ushba
d. English name : Mexican Sarsaparilla, Sarsa radix

Tafseel (Description):

Aam (General) : Kumarica is a perennial woody climber with tendrils, thin branches and extended ovate leaves that grows about 4 to 5 meters vertically. Its paper-like leaves are pinnate veined, leathery and alternatively arranged. It is known for its small red berries with 2 or 3 seeds and small green flowers. The flowers are radially symmetrical, dioecious and have umbel inflorescence of 12 flowers. The berries are produced in the fall or in the late summer.

Figure : Dried root of Ushba

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

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

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

very few spiral vessels upto 20µ, cortical parenchyma cells and thick walled pith parenchyma cells.

Juz-e-Mustamil (Parts used):

Maskan (Habitat) : The plant Ushba is common in wooded areas because it uses its tendrils to climb up the trees. It is widely found in temperate, swampy and warm areas. Sarsaparilla is also found in high elevations; in Nuevo León, Mexico, it is found at elevation of 1760 meters, in Oaxaca at 100 meters, in Hacienda San José, Santa Ana at 850 to 1100 meters. It is native to America, Mexico and the West Indies.

Jwoher'e Nabatati (Phytoconstituents): The plant Ushbaroot consists of; saponins, flavonoids, sitosterol, stigmasterol, acetyl-parigenin, astilbin, beta-sitosterol, caffeoyl-shikimic acids, dihydroquercetin, diosgenin, engeletin, essential oils, epsilon-sitosterol, eucryphin, eurryphin, ferulic acid, glucopyranosides, isoastilbin, isoengetitin, kaempferol, parigenin, parillin, pollinastanol, resveratrol, rhamnose, saponin, sarasaponin, sarsaparilloside, sarsaponin, sarsasapogenin, shikimic acid, sitosterol-d-glucoside, smilagenin, smilasaponin, smilax saponins A-C, smiglaside A-E, smitilbin, stigmasterol, taxifolin, and titogenin.

Mizaj (Temperament): Hot 3^0 and Dry 3^0.

Musleh (Correction) : Bihidana, Babulgum, Milk.

Badal (Proximal substitute): Anantamul, Shamalata, Chobchini.

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

Foreign matter	: Not more than 2 percent , Appendix 2.2.2
Total ash	: Not more than 6 percent , Appendix 2.2.3
Acid insoluble ash	: Not more than 1 percent , Appendix 2.2.4
Alcohol soluble extractives	: Not less than 7 percent , Appendix 2.2.6
Water soluble extractives	: Not less than 31 percent , Appendix 2.2.7
Loss in weight on drying at 105°C	: Not more than 10 percent , Appendix 2.2.9

TLC behavior :

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

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

shows major spots at Rf 0.89 (Yellow), 0.60 (Greenish yellow), 0.28 (Violet) and 0.12 (Yellow). Appendix 2.2.10

Aa'mal-e-Advia (Pharmacological action): Daf-e-Atishak (Anti-syphlis), Muqawwi-e-Bah (Aphrodesiac), Musakkenat, Daf-e-Dard Mafasil (Antiarthrilgia).

Mahall-e-Istemalat (Therapeutic uses): Suzak (Gonorrhoea), Atishak (Syphlis), Zof-e-Bah (Sexual debility), Waza-ul-Mafasil (Joint pain), Amraz-e-Zild(Dermatological diseases).

Meqdar-e-khorak (Dose): 35 grains.

Muzir (Side-effects/adverse-effects): Long time use of the plant Ushba may create GI irritation and dieresis.

Aaham Nukhsajat (Important formulations): Majoon-e-Ushba.

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APPENDICES

CONTENTS OF APPENDICES

2.3.4 – Limit Test for Iron

2.3.5 – Limit Test for Lead

2.3.6 – Limit Test for Sulphates

APPENDIX – 3

3.1 PHYSICAL TESTS AND DETERMINATIONS

3.1.1 – Determination of Boiling or Distilling Range

3.1.2 – Determination of congealing range of temperature

3.1.3 – Determination of pH Values

3.1.4 – Determination of melting range of temperature

3.1.5 – Optical rotation and specific optical rotation

3.1.6 – Powder Fineness

3.1.7 – Refractive Index

3.1.8 – Weight per Milliliter and Specific Gravity

APPENDIX – 4

4.1 REAGENTS AND SOLUTIONS

APPENDIX – 5

5.1 GENERAL INFORMATION

5.1.1 – Defination and Method of Preparing of Joshanda or Decoction

5.1.2 – Tasfia (Decontamination)

5.1.3 – Tadbir-e-Adviyah (Detoxification of Drugs)

5.1.5 – Neem-Kob (Bruising)

5.1.6 – Tahmiz-o-Biryan-e-Adviyah (Roasting or Parching)

5.1.6 – Tarviq-e-Adviyah

WEIGHT AND MEASURE

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	$\pm$ 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.

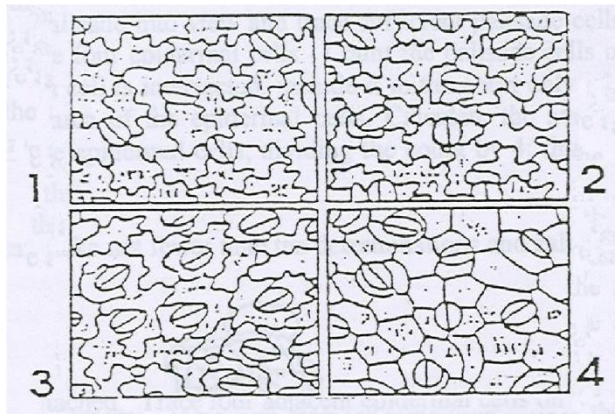

Fig. 1. Various types of stomata

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.

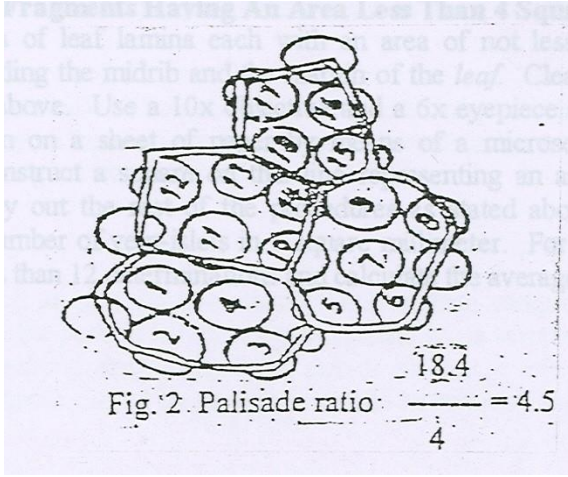

Figure 2

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.

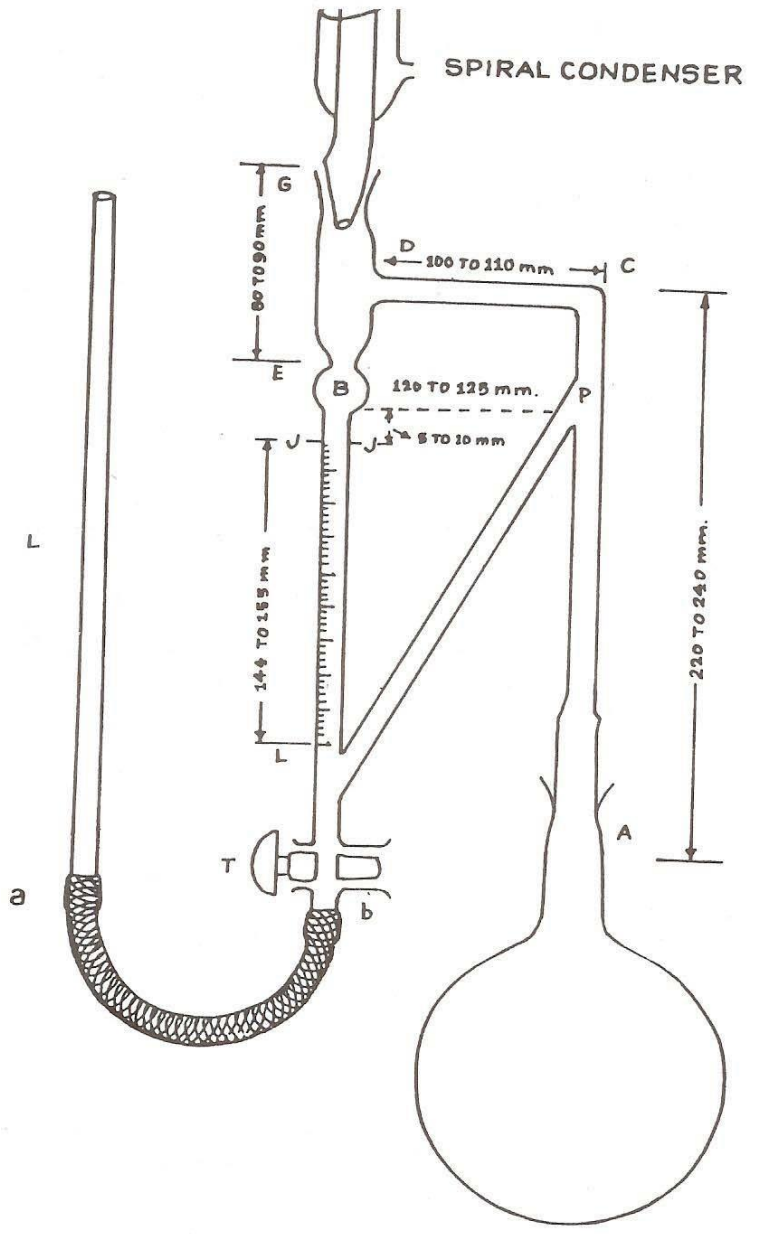

Fig. Apparatus for volatile oil determination

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.