UNIT – V

6. **Systematic pharmacognostic study of following**
   - (a) Carbohydrates & derived products : Agar, Guar gum, acacia, Honey, Isabgol, pectin, starch, sterculia & tragacanth.
   - (b) Lipids – Beeswax, castor oil, Cocabutter, Kokum butter, hydnoarpus oil, Codliver oil, shark liver oil, Linseed oil, wool fat, Rice-bran oil, Lard & Suet.

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Tragacanth

Synonym Gum Tragacanth

Biological Source The dried gummy exudation from *Astragalus gummifer* Labill. (white gavan)or other Asiatic species of *Astragalus* belonging to the family of *Leguminoseae*.

Geographical Source It is naturally found in various countries, *viz.*, Iran, Iraq, Armenia, Syria,Greece and Turkey. A few species of *Astragalous* are located in India, *viz.*, Kumaon, Garhwal and Punjab.*Persian tragacanth* are exported from Iran and North Syria, whereas the *Smyrna tragacanth*from the Smyrna port in Asiatic Turkey.

Collection The thorny shrubs of **tragacanth** normally grow at an altitude of 1000-3000 meters.

As an usual practice transverse incisions are inflicted just at the base of the stem, whereby the gum is given out both in the pith and medullary rays. Thus, the absorption of water helps the gum to swell-up and subsequently exude through the incisions. The gummy exudates are duly collected and dried rapidly to yield the best quality white product. It usually takes about a week to collect the gum exudates right from the day the incisions are made; and this process continues thereafter periodically.

Description

Colour: White or pale

Odour: Odourless

Taste: Tasteless

Shape: Curved or twisted ribbon –like flakes marked with concentric ridges that is indicative of successive exudation and solidification. Fracture is normally short and horny.

Size: Flakes are usually 25 × 12 × 12 mm.

Appearance: Translucent

Chemical Constituents Interestingly, tragacanth comprises of two vital fractions: *first*, being water soluble and is termed as **'tragacanthin'** and the *second*, being water-insoluble and is known as**'bassorin'.** Both are not soluble in alcohol. The said two components may be separated by carrying out the simple filtration of a very dilute mucilage of tragacanth and are found to be present in concentrations ranging from 60-70% for bassorin and 30-40% for tragacanthin. Bassorin actually gets swelled up in water to form a gel, whereas tragacanthin forms an instant colloidal solution. It has been established that no methoxyl groups are present in the tragacanthin fraction, whereas the bassorin fraction comprised of approximately 5.38% methoxyl moieties. **Chemical Test**

1. An aqueous solution of tragacanth on boiling with conc. HCl does not develop a red colour.

2. Ruthenim Red* solution (0.1% in H_2O) on being added to powdered gum tragacanth whereby the particles will not either acquire a pink colour or are merely stained lightly.

3. When a solution of tragacanth is boiled with few drops of $FeCl_3$ [aqueous 10% (w/v)] it produces a deep-yellow precipitate.

4. It gives a heavy precipitate with lead acetate.

5. When tragacanth and precipitated copper oxide are made to dissolve in conc. NH4OH it yields a meagre precipitate.

Substituents/Adulterants **Karaya gum** which is sometimes known as **sterculia gum** or **Indian tragacanth** and is invariably used as a substitute for gum tragacanth.

Uses

1. It is used as a demulcent in throat preparations.

2. It is employed as an emolient in cosmetics (*e.g.*, hand lotions).

3. It is used as a pharmaceutical aid as a suspending agent for insoluble and heavy powders in mixtures.

4. It is effectively employed as a binding agent for the preparation of tablets and pills.

5. It is also used as an emulsifying agent for oils and waxes.

6. A substantial amount find its application in calico printing and in confectionary.

7. It is used in making medicinal jellies *e.g.*, spermicidal jelly.

8. A 0.2-0.3% concentration is frequently used as a stabilizer for making ice-creams and various types of sauces *e.g.*, tomato sauce, mustard sauce.

9. It is used to impart consistence to troches.

10. The mucilages and pastes find their usage as adhesives

Acacia

Synonyms Indian Gum; Gum Acacia; Gum Arabic.

Biological Source According to the USP, acacia is the dried gummy exudation from the stems and branches of *Acacia senegal* (L.) Willd; family; Leguminoseae, or other African species of Acacia.

It is also found in the stems and branches of ***Acacia arabica*****,** Willd. Geographial Source The plant is extensively found in India, Arabia, Sudan and Kordofan (North- East Africa), Sri Lanka, Morocco, and Senegal (West Africa). Sudan is the major producer of this gum and caters for about 85% of the world supply.

Cultivation and Collection Acacia is recovered from wild as well as duly cultivated plants in the following manner, such as:

(a) From Wild Plants: The Gum after collection is freed from small bits of bark and other foreign organic matter, dried in the sun directly that helps in the bleaching of the natural gum to a certain extent, and

(b) From Cultivated Plants: Usually, transverse incisions are inflicted on the bark which is subsequently peeled both above and below the incision to a distance 2-3 feet in length and 2-3 inches in breadth. Upon oxidation, the gum gets solidified in the form small translucent beads, sometimes referred to as 'tears'. Tears of gum normally become apparent in 2-3 weeks, which is subsequently hand picked , bleached in the sun, garbled, graded and packed.

Description

Colour: Tears are usually white, pale-yellow and sometimes creamish-brown to red in colour. The power has an off-white, pale-yellow or light-brown in appearance.

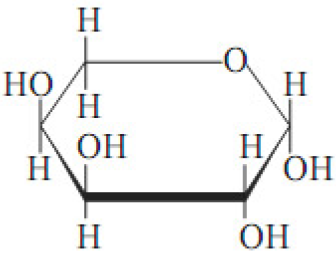
Odour: Odourless (There is a close relationship between colour and flavour due to the presence of tannins).

Taste: Bland and mucillagenous.

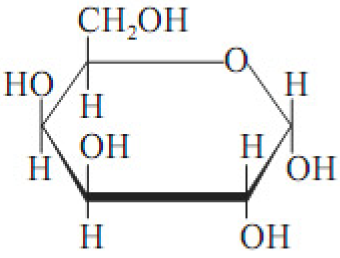
Shape & Size: Tears are mostly spheroidal or ovoid in shape and having a diameter of about 2.5-3.0 cm.

Appearance: Tears are invariably opaque either due to the presence of cracks or fissures produced on the outer surface during the process or ripening. The fracture is usually very brittle in nature and the exposed surface appears to be glossy.

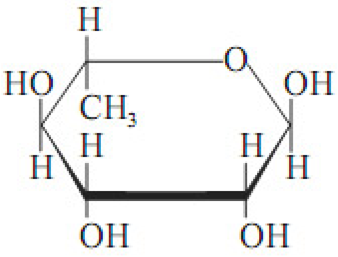
Chemical Constituents Acacia was originally thought to be composed only of four chemical constituents, namely : (–) arabinose; (+) – galactose; (–)–rhamnose and (+) glucuronic acid.



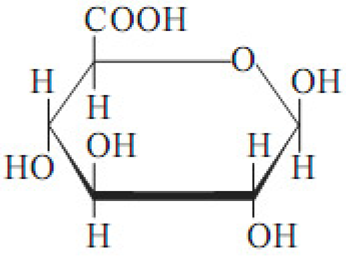
(–)–Arabinose



(+)–Galactose



(–)–Rhamnose



(+)–Glucuronic Acid

On subjecting the gum acacia to hydrolysis with 0.01 N H_2SO_4 helps in removing the combined product of (–) – arabinose and (+) – galactose, whereas the residue consists of the product (+) – galactose and (+) – glucuronic acid. These two products are formed in the ratio of 3:1.

It also contains a peroxidase enzyme.

Chemical Tests

1. **Lead Acetate Test:** An aqueous solution of acacia when treated with lead-acetate solution it yields a heavy white precipitate.

2. **Borax Test:** An aqueous solution of acacia affords a stiff translucent mass on treatment with borax.

3. **Blue Colouration due to Enzyme:** When the aqueous solution of acacia is treated with benzidine in alcohol together with a few drops of hydrogen peroxide (H_2O_2), it gives rise to a distinct–blue colour indicating the presence of enzyme.

4. **Reducing Sugars Test:** Hydrolysis of an aqueous solution of acacia with dilute HCl yields reducing sugars whose presence are ascertained by boiling with Fehling's solution to give a brick-red precipitate of cuprous oxide.

5. **Specific Test:** A 10% aqueous solution of acacia fails to produce any precipitate with dilute solution of lead acetate (a clear distinction from Agar and Tragacanth); it does not give any colour change with Iodine solution (a marked distinction from starch and dextrin); and it never produces a bluish-black colour with $FeCl_3$ solution (an apparent distinction from tannins).

Uses

1. The mucilage of acacia is employed as a demulscent.

2. It is used extensively as a vital pharmaceutical aid for emulsification and to serve as a thickening agent.

3. It finds its enormous application as a binding agent for tablets e.g., cough lozenges.

4. It is used in the process of 'granulation' for the manufacture of tablets. It is considered to be the gum of choice by virtue of the fact that it is quite compatible with other plant hydrocolloids as well as starches, carbohydrates and proteins.

5. It is used in conjuction with gelatin to form conservates for microencapsulation of drugs.

6. It is employed as colloidal stabilizer.

7. It is used extensively in making of candy and other food products.

8. It is skillfully used in the manufacture of spray – dried ‘fixed’ flavours – stable, powdered flavours employed in packaged dry-mix products (puddings, desserts, cake mixes) where flavour stability and long shelf-life are important.

Agar

Synonyms Agar-agar; Gelose; Japan-agar; Chinese-isinglass; Bengal isinglass; Ceylon isinglass; Layor carang; Vegetable gelatin.

Biological Source, It is also obtained as the dried gelatinous substance from *Gelidium amansii* belonging to the family *Gelidaceae* and several other species of red algae, such as *Gracilaria* (family: *Gracilariaceae)* and *Pterocladia (Gelidaceae)*. The predominant agar-producing genera are, namely; *Gelidium; Gracilaria; Acanthopeltis; Ceramium and Pterocladia.*

Geographical Source, Agar is largely produced in Japan, Australia, India, New Zealand, and USA. It is also found in Korea, Spain, South Africa and in the Coastal regions of Bay of Bengal (India) together with Atlantic and Specific Coast of USA.

Preparation It is an usual practice in Japan where the **red-algae** is cultivated by placing poles or bamboos spread in the ocean which will serve as a support and shall augment the growth of algae on them. During the months of May and October the poles are removed and the algae are carefully stripped off from them. The fresh seaweed thus collected is washed thoroughly in water and subsequently extracted in digestors containing hot solution of dilute acid (1 portion of algae to 60 portions of diluted acid). The mucilagenous extract is filtered through linen while hot and collected in large wooden troughs to cool down to ambient temperature so as to form solid gel. The gel is mechanically cut into bars and passed through a wire netting to form strips. The moisture from the strips is removed by successive **freezing and thawing*** and finally sun dried and stored as thin agar strips.

Alternatively, the mass of gel if frozen and subsequently thawed and the dried agar is obtained by vaccum filtration. The crude agar is usually formed as flakes which can be powdered and stored accordingly.

* To bring down to room temperature from –20 to –30^{o}C.

Description

Colour : Yellowish white or Yellowish grey

Odour : Odourless

Taste : Bland and mucilaginous

Shape : It is available in different shapes, such as: bands, strips, flakes, sheets and coarse powder

Size : Bands: width = 4cm; Length = 40 to 50 cms

Sheets: Width = 10-15cm; Length = 45 to 60 cms

Strips: Width = 4mm; Length = 12 to 15 cms

India produces about 250 MT of good quality agar using *Galidiella accrosa* as the raw material. It is insoluble in cold water in organic solvents. It readily dissolves in hot solutions and it forms a translucent solid mass which characteristic is very useful in microbiology for carrying out the*Standard Plate Count.*

Chemical Constituents Agar can be separated into two major fractions, namely: (*a*) *Agarose*-a neutral gelling fraction; and (*b*) *Agaropectin*—a sulphated non-gelling fraction. The former is solely responsible for the *gel-strength of agar* and consists of (+) –galactose and 3,6-anhydro-(–)-galactose moieties; whereas the latter is responsible for the *viscosity of agar solutions* and comprises of sulphonated polysaccharide wherein both uronic acid and galactose moieties are partially esterified with sulphuric acid. In short, it is believed to be a complex range of polysaccharide chains having alternating α–(1→3) and β–(1-4) linkages and varying *total charge content.*

Chemical Tests

1. It gives a pink colouration with Ruthenium Red solution.

2. A 1.5-2.0% (w/v) solution of agar when boiled and cooled produces a *stiff-jelly.*

3. Prepare a 0.5%(w/v) solution of agar and add to 5 ml of it 0.5 ml of HCl, boil gently for 30 minutes and divide into two equal portions:

(*a*) To one portion add $BaCl_2$ solution and observe a slight whitish precipitate due to the formation of $BaS0_4$ (distinction from Tragacanth), and

(*b*) To the other portion add dilute KOH solution for neutralization, add 2 ml of Fehling’s

solution and heat on a water bath. The appearance of a brick red precipitate confirms the presence of galactose.

Substituents/Adulterants **Gelatin** and **isinglass** are usually used as substituents for **agar.**

Uses

1. It is used in making photographic emulsions.
2. It is also employed as a bulk laxative.
3. It is extensively used in preparing gels in cosmetics.
4. It is widely used as thickening agent in confectionaries and dairy products.
5. It is used in the production of ointments and medicinal encapsulations.
6. In microbiology, it is employed in the preparation of bacteriological culture media.
7. It is used for sizing silks and paper.
8. It finds its enormous usage in the dyeing and printing of fabrics and textiles.
9. It is also used as dental impression mould base.
10. It is employed as corrosion inhibitor.

Guar Gum

Synonyms Guar flour; Decorpa; Jaguar; Gum cyamopsis; Cyamopsis gum; Burtonite V-7-E.

Biological Source, is the ground endosperms of *Cyamopsis tetragonolobus* (L.) Taub; belonging to family *Leguminoseae.*

Geographical Source It grows abundantly in tropical countries like: Indonesia, India, Pakistan and Africa. In USA, southern western regions it was introduced in the year 1900 and its large-scale production commenced in early 1950’s.

Preparation First of all the fully developed white seeds of Guar gum are collected and freed from any foreign substances. The sorted seeds are fed to a mechanical **'splitter'** to obtain the *bifurcated guar seeds* which are then separated into husk and the respective cotyledons having the *'embryo'*.The gum is found into the endosperm. Generally, the guar seeds comprise of the following:

Endosperm : 35 to 40%

Germ (or Embryo) : 45 to 50%, and

Husk : 14 to 17%

The **cotyledons,** having a distinct bitter taste are separated from the endosperm by the process called **'winnowing'.** The crude guar gum *i.e.*, the endosperms is subsequently pulverised by means of a '*micro-pulveriser*' followed by grinding. The relatively softer cotyledons sticking to the endosperms are separated by mechanical '*sifting*' process. Thus, the crude guar-gum is converted to a purified form (*i.e.*, devoid of cotyledons), which is then repeatedly pulverized and shifted for several hours till a final white powder or gramular product is obtained.

Description

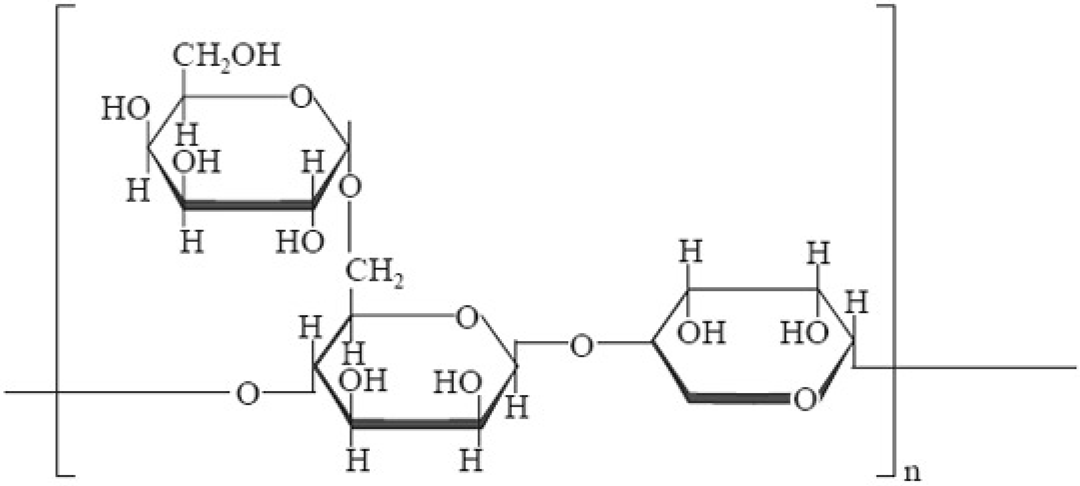
Colour : Colourless; Pale-yellowish white powder

Odour : Characteristic smell

Taste : Mucilagenous

Solubility : Insoluble in alcohol with water it gives a thick transparent suspension

Chemical Constituents It has been found that the water soluble fraction constitutes 85% of Guar gum and is commonly known as **Guaran.** It essentially consists of linear chains of (1 → 4) –β-D mannopyranosyl units with α–D-galactopyranosyl units attached by (1 → 6) linkages. However, the ratio of D-galactose to D-mannose is 1:2.



Guaran

Chemical Tests

1. On being treated with iodine solution (0.1 N) it fails to give olive-green colouration.

2. It does not produce pink colour when treated with Ruthenium Red solution (distinction from sterculia gum and agar)

3. A 2% solution of lead acetate gives an instant white precipitate with guar gum (distinction from sterculia gum and acacia)

4. A solution of guar gum (0.25 g in 10 ml of water) when mixed with 0.5 ml of benzidine (1% in ethanol) and 0.5 ml of hydrogen peroxide produces no blue colouration (distinction from gum acacia).

Uses

1. It is used therapeutically as a bulk laxative.

2. It is employed as a protective colloid.

3. It is also used as a thickner and its thickening property is 5 to 8 times more than starch.

4. It finds its use in peptice ulcer therapy.

5. It is used as an anorectic substance *i.e.*, it acts as an appetite depressant.

6. It is employed both as a binding and a disintegrating agent in tablet formulations.

7. It is used in paper sizing.

8. It is abundantly employed as film forming agent for cheese, salad dressing, ice-cream and soups.

9. It is used in pharmaceutical jelly formulations.

10. It is widely used in suspensions, emulsions, lotions, creams and toothpastes.

11. It is largely used in mining industry as a flocculant and also as a filtering agent.

12. It is also employed in water treatment plants as a coagulant aid.

Isabgol

Synonyms:

Psyllium seed; Flea seed: Plantain seed; Isabgol; Ishabgul Spogel seed.

Biological Source: Ispaghula consists of cleaned, dried, ripe seed of Plantago psyrium Linn, or of Plantago indica Linn. (P. arenaric Wald.). known as Spanish or French Psyllium seed, or of Plantago ovate Fork, known as Blonde Psyllium or Indian Plantago.

Habitat:

P Psyllium Linn, is indigenous to the Mediterranean region and west. Asia, presently cultivated in France. Spain and Cuba. P. ovata is found in Punjab hills and other parts of north-west India, Sind and Baluchistan and is cultivated in Bengal, Karnataka, Gujarat and Maharashtra.

Cultivation and Collection:

The plant is a stemless or sub-coalescent, soft, hairy annual herb. It is cultivated by spreading seeds in November in well drained loamy soil. To the fields ammonium sulphate fertilizer is added and they are irrigated at an interval of 8-10 days for about 8 times.The crop is harvested in four months in March/April. The plants are cut just above the ground, dried and seeds are separated by thrashing.

Characters :

The seeds of P. ovata are 2.0-3.3 mm in length, 1-16 mm in breadth; dull, pinkish grey-brown; long to elliptical in outline, boat shaped; the dorsal surface is convex with a small elliptical or elongated shining reddish brown spot while the ventral surface is concave with a deep furrow, not perfectly reaching to either end of the seeds. At the furrow a hilum is present which is covered by a thin membrane and appears as a red spot in the centre. The outer surface is smooth, hard and translucent. The seeds are odorless and taste is bland but mucilaginous.

Chemical Constituents:

The seeds contain hydrocolloidal polysaccharide (mucilage) in the outer seed coat (20-30%), fixed oils, tannin, aucubin glycoside (iridoid), sugars, sterols and protein. The mucilage of Ispaghula is colloidal in nature and its composition varies with the conditions of preparation, it is mainly composed of xylose, arabinose and galacturonic acid;rhamnose and galactose have also been reported. Two poly saccharine fractions have been separated from the muscilage.

One fraction is soluble in cold water and on hydrolysis yields xylose (46%). an aldobiouronic acid (40%), arabinose (7%) and insoluble residue. The other fraction in soluble in hot water forming a highly viscous solution which sets as a gel on cooling and yields on hydrolysis xylose (80%). arabinose (14%), aldobiouronic acid (0.3%) and trace of galactose. The fatty oil is composed of linolenic, linoleic, oleic, palmitic, stearic and lignoceric acids. P. ovata is a good source of linoleic acid. The amino acids reported in the seed-are valine. alanine, glycine, glutamic acid, cystine. lysine, leucine and tyrosine.

Uses:

1. Seeds are demulcent, cooling, diuretic and used in inflammatory conditions of mucus membrane of gastrointestinal and gestourinary tracts.
2. They are used to cure chronic dysentery, diarrhea, duodenal ulcer, gonorrhea, constipation and piles.
3. Isabgol preparations are given after colostomy to assist the production of smooth solid faecal mass. The mucilage is not digested by enzymes and intestinal bacteria in the gut and comes out unchanged. Jelly-like mucilage absorbs irritating products and toxins of the gut and they are expelled from the body.
4. The seeds are used in febrile conditions and the affections of kidneys, bladder and urethra.

5. A decoction of seeds is prescribed in cough and cold, and the crushed seeds made into poultice are applied to rheumatic and glandular swellings. Recently anticancer, antitoxic, antiatherosclerosis, hypocholesteremic, hypo-glycemic, hypotensive, cardiac depressant, cholinergic and cervical activities have been reported.

Karaya Gum

Synonyms Gum Karaya; Kadaya; Katilo; Kullo; Kuteera; Sterculia; Indian Tragacanth; Mucara.

Biological Sourc, It is the dried exudate of the tree *Sterculia urens* Roxb; *Sterculia villosa* Roxb; *Sterculia tragacantha* Lindley and other species of *Sterculia, belonging to the family: Sterculeaceae*..

Geographical Source The *S. urens* is found in India especially in the *Gujarat* region and in the central provinces.

Preparation The gum is obtained from the *Sterculia* species by making incisions and, thereafter, collecting the plant excudates usually after a gap of 24 hours. The large irregular mass of gums (tears) which weigh between 250 g to 1 kg approximately are hand picked and despatched to the various collecting centres. The gum is usually tapped during the dry season spreading over from March to June. Each healthy fully grown tree yields from 1 to 5 kg of gum per year; and such operations may be performed about five times during its lifetime. In short, the large bulky lumps (tears) are broken to small pieces to cause effective drying. The foreign particles *e.g.*, pieces of bark, sand particles, leaves are removed. Thus, purified gum is available in *two* varieties, namely:

(*a*) **Granular or Crystal Gum:** Having a particle size ranging between 6 to 30 mesh, and

(*b*) **Powdered Gum:** Having particle size of 150 mesh

Description

Colour : White, pink or brown in colour

Odour : Slight odour resembling acetic acid

Taste : Bland and mucilageous taste

Shape : Irregular tears or vermiform pieces.

It is water insoluble but yields a translucent colloidal solution.

Chemical Constituents Karaya gum is partially acetylated polysaccharide containing about 8% acetyl groups and about 37% uronic acid residues. It undergoes hydrolysis in an acidic medium to produce (+)–galactose, (–)–rhamnose, (+)–galacturonic acid and a trisaccharide acidic substance. It contains a branched heteropolysaccharide moiety having a major chain of 1, 4-linked α–(+)–galacturonic acid along with 1, 2-linked (–)–rhamnopyranose units with a short (+)–glucopyranosyluronic acid containing the side chains attached 1→3 to the main chain *i.e.*, (+)–galactouronic acid moieties.

Chemical Test It readily produces a pink colour with a solution of Ruthenium Red.

Substituent/Adulterant It is used as a substitute for **gum tragacanth.**

Uses

1. It is employed as a denture adhesive.
2. It is used as a 'binder' in the paper industry.
3. It is also employed as a thickening agent for dyes in the textile industry.
4. It is widely used as a stabilizer, thickner, texturizer and emulsifier in food
5. It is used as a bulk laxalive.
6. It finds its usage in lozenges.
7. It is employed extensively in wave set solution and in skin lotions.
8. It is used in preparations concerned with composite building materials.

Pectin

Pectin, in general, is a group of polysaccharides found in nature in the primary cell walls of all seed bearing plants and are invariably located in the middle lamella. It has been observed that these specific polysaccharides actually function in combination with both cellulose and hamicellulose as an intercellular cementing substance. One of the richest sources of pectin is lemon or orange rind which contains about 30% of this polysaccharide.

Pectin is naturally found in a number of plants namely: lemon peel, orange peel, apple pomace, carrots, sunflower-heads, guava, mangoes and papaya. The European countries, Switzerland and USA largely produce pectin either from apple pomace or peels of citrus fruits. Evaluation and standardization of pectin is based on its '*Gelly-Grade*' that is, its setting capacity by the addition of sugar. Usually, pectin having 'gelly grade' of 100, 150 and 200 are recommended for medicinal and food usuages.

Biological Sources , It is the purified admixture of polysaccharides, obtained by carrying out the hydrolysis in an acidic medium of the inner part of the rind of citrus peels, for instance: *Citrus limon*(or Lemon) and *Citrus aurantium* belonging to the family *Rutaceae*, or from apple pomace *Malus sylvestris* Mill (*Syn: Pyrus malus* Linn, family: *Rosaceae*).

Geographical Source Lemon and oranges are mostly grown in India, Africa and other tropical countries. Apple is grown in the Himalayas, California, many European countries and the countries located in the Mediterranean climatic zone.

Preparation The specific method of preparation of **pectin** is solely guided by the source of raw material *i.e.*, lemon/orange rind or apple pomace; besides the attempt to prepare either low methoxy group or high methoxy group *pectins.*

In general, the preserved or freshly obtained lemon peels are gently boiled with approximately 20 times its weight of fresh water maintained duly at 90ºC for a duration of 30 minutes. The effective pH (3.5 to 4.0) must be maintained with food grade lactic acid/citric acid/tartaric acid to achieve maximum extraction. Once the boiling is completed the peels are mildly squeezed to obtain the liquid portion which is then subjected to centrifugation to result into a clear solution. From this resulting solution both proteins and starch contents are suitably removed by enzymatic hydrolysis. The remaining solution is warmed to deactivate the added enzymes. The slightly coloured solution is effectively decolourized with activated carbon or bone charcoal. Finally, the pectin in its purest form is obtained by precipitation with water-miscible organic solvents (*e.g.*, methanol, ethanol, acetone), washed with small quantities of solvent and dried in a vaccum oven and stored in air-tight containers or polybags.

Note: As Pectin is fairly incompatible with Ca^{2+}, hence due precautions must be taken to avoid the contact of any metallic salts in the course of its preparation.

Description

Appearance : Coarse or fine- powder

Colour : Yellowish white

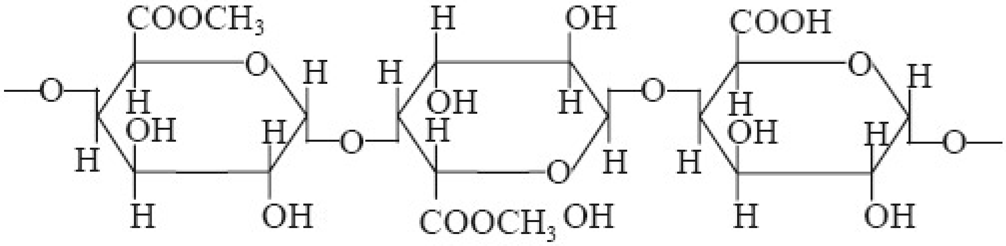
Odour : Practically odourless

Taste : Mucilaginous taste

Solubility : 1. Completely soluble in 20 parts of water forming a solution containing negatively charged and very much hydrated particles. 2. Dissolves more swiftly in water, if previously moistened with sugar syrup, alcohol, glycerol or if first mixed with 3 or more parts of sucrose.

Chemical Constituents Pectin occurs naturally as the partial methyl ester of a (1→4) linked (+) – polygalacturonate sequences interrupted with (1–2) – (–) – rhamnose residues. The neutral sugars

that essentially form the side chains on the pectin molecules are namely: (+) – galactose, (–) –arabinose, (+) – xylose, and (–) – fructose. Schneider and Bock (1938) put forward the following probable structure for **pectin galacturonan:**



Pectin Galacturonan

Chemical Tests

1. A 10% (w/v) solution gives rise to a solid gel on cooling.

2. A *transparent gel* or *semigel* results by the interaction of 5 ml of 1% solution of pectin with 1 ml of 2% solution of KOH and subsequently setting aside the mixture at an ambient temperature for 15 minutes. The resulting gel on acidification with dilute HCl and brisk shaking yields a voluminous and gelatinous colourless precipitate which on warming turns into white and flocculent.

Uses

1. It is employed mostly as an intestinal demulscent. It is believed that the unchanged molecules of polygalacturonic acids may exert an adsorbent action in the internal layers of the intestine, thereby producing a protective action along with *Kaolin* to prevent and control diarrhoea.

2. As a pharmaceutical aid pectin is used frequently as an emulsifying agent and also as a gelling agent preferably in an acidic medium.

3. It is employed extensively in the preparation of jellies and similar food products *e.g.*, jams, sauces, ketchups.

4. Poectin in the form of pastes exerts a bacteriostatic activity and hence, is used frequently in the treatment of indolent ulcers and deep wounds.

5. A combination of *pectin* and *gelatin* find its application as an encapsulating agent in various pharmaceutical formulations to afford sustained-release characteristics.

Honey

Synonyms Madhu, Madh, Mel, Honey (English);

Biological Source Honey is a viscid and sweet secretion stored in the honey comb by various species of bees, such as: *Apis dorsata, Apis florea, Apis indica, Apis mellifica,* belonging the natural order *Hymenotera* (Family: *Apideae*).

Geographical Source Honey is available in abudance in Africa, India, Jamaica, Australia, California, Chili, Great Britain and New Zealand.

Preparation Generally, honey bees are matched with social insects that reside in colonies and produce honey and beeswax. Every colony esentially has one *'queen'* or *'mother bee'*, under whose command a huge number of *'employees'* exist which could be mostly sterile females and in certain seasons male bees. The *'employees'* are entrusted to collect nector from sweet smelling flowers from far and near that mostly contains aqueous solution of sucrose (ie; approximately 25% sucrose and 75% water) and pollens. Invertase, an enzyme present in the saliva of bees converts the nector into the invert sugar, which is partly consumed by the bee for its survival and the balance is carefully stored into the honey comb. With the passage of time the water gets evaporated thereby producing honey(ie; approximately 80% invert sugar and 20% water). As soon as the cell is filled up completely, the bees seal it with wax to preserve it for off-season utility.

The honey is collected by removing the wax-seal by the help of a sterilized sharp knife. The pure honey is obtained by centrifugation and filtering through a moistened cheese-cloth. Invariably, the professional honey collectors smoke away the bees at night, drain-out honey, and warm the separated combs to recover the beeswax.

Description

Appearances : Pale yellow to reddish brown viscid fluid,

Odour : Pleasant and characteristic,

Taste: : Sweet, Slightly acrid,

Specific gravity : 1.35-1.36

Specific rotation : $+3^{o}$ to -15^{o}

Total Ash : 0.1-0.8%

However, the taste and odour of honey solely depends upon the availability of surrounding flowers from which nector is collected. On prolonged storage it usually turns opaque and granular due to the crystallisation of dextrose and is termed as **'granular honey'.**

Chemical Constituents The average composition of honey rangles as follows: Moisture 14-24%, Dextrose 23-36%, Levulose (Fructose) 30-47%, Sucrose 0.4-6%, Dextrin and Gums 0-7% and Ash 0.1-0.8%. Besides, it is found to contain small amounts of essential oil, beeswax, pollen grains, formic acid, acetic acid, succinic acid, maltose, dextrin, colouring pigments, vitamins and an admixture of enzymes eg; diastase, invertase and inulase. Interestingly, the sugar contents in honey varies widely from one country to another as it is exclusively governed by the source of the nector (availability of fragment flowers in the region) and also the enzymatic activity solely controlling the conversion

of nector into honey.

Substituents/Adulterants Due to the relatively high price of pure honey, it is invariably adulterated either with artificial invert sugar or simply with cane-sugar syrup. These adulterants or cheaper substituents not only alter the optical property of honey but also its natural aroma and fragrance.

Uses

1. It is used as a sweetening agent in confectionaries.

2. Being a demulsent, it helps to relieve dryness and is, therefore, recommended for coughs, colds, sore-throats and constipation.

3. Because of its natural content of easily assimilable simple sugars, it is globaly employed as a good source of nutrient for infants, elderly persons and convalescing patients.

STARCH

Synonym Amylum, (Corn starch, Potato Starch, Rice Starch, Wheat Starch)

Biological Source Starch comprises of mostly polysaccharide granules usually separated from the fully grown grains of Corn [*Zea mays* Linn.]; Rice [*Oryza sativa* Linn.] ; and Wheat [*Triticum aestivum* Linn.] belonging to the family *Gramineae* and also from the tubers of Potato [*Solanum tuberosum* Linn.] family *Solanaceae*.

Geographical Source USA, Canada, Australia, China, India, CIS – countries (Russia), Thailand, Indonesia, Vietnam, Pakistan and many other tropical and sub-tropical countries are the major producers of starch in the world.

Preparation In general, cereal grains *e.g.,* corn, rice and wheat mostly comprise of starch bundles, oil, soluble protein and the insoluble protein termed as *'gluten'*; whereas the potato contains starch, mineral salts (inorganic), soluble proteins and vegetable tissues. Obviously, various specific methods are normally employed to separate starch either from cereal grains or from potato. These methods are briefly enumerated below, namely:

(*a*) Methods for Maize (Corn) Starch

Maize grains are first washed with running water to get rid of dust particles and adhered organic matters. They are now softened by soaking in warm water (40-60^{o}C) for 48 to 72 hrs charged with a 0.2-0.3% solution of SO_2 to check the fermentation. The swollen grains are passed through **'Attrition Mill'** to split and partly crush them to separate the embryo and the epicarp. It is extremely important to isolate the germ (embryo) which may be accomplished by addition of water, whereby the germs float and are segregated by skimming off promptly.

The corn oil, a rich source of Vitamin E, is recovered from the germ by the process of expression. After removal of the germ the resultant liquid mass is subsequently freed from the accompanying **cell debris** and **gluten** (insoluble protein) by passing through a number of fine sieves. The milky slurry thus obtained is a mixture of starch andgluten particles which is then subjected to centrifugation by custom-designed **starch purification centrifuges.** Thus, the starch which being relatively heavier settles at the bottom and the gluten being lighter floats on the surface and removed quickly by a jet of water. Consequently, the starch is washed thoroughly with successive treatment of fresh water, centrifuged or filter pressed and ultimately dried either on a *moving belt dryer* or *flash dryer.*

(*b*) Method for Rice Starch

The rice* is adequately soaked in a solution of NaOH (0.5% w/v) till such time when the gluten is softened and dissolved partially. The resulting grains are wet-milled and taken up with water. The suspension is purified by repeatedly passing through sieves and the starch is recovered by centrifugation. Finally, the starch is duly washed, dried, powdered and stored in HDPE** bags.

(*c*) Method for Wheat Starch

Wheat being an extensively used common staple food, therefore, its utility for making starch is restricted by many government authorities. First of all the wheat flour is made into a stiff ball of dough which are kept for a short duration. The gluten present in the dough swells up and are shifted to grooved-rollers that move forward and backward slowly. Constant sprinkling of water is done which carries off the starch along with it whereas gluten remains as a soft elastic mass. The shurry of starch is purified by centrifugation, washed, dried, powdered and packed in HDPE bags.

(*d*) Method for Potato Starch

The tubers of potato are thoroughly washed to get rid of the sticking soil. These are subsequently chopped into small pieces and made into a fine pulp by crushing in a **Rasping Machine.** The resulting

slurry is passed through metallic sieves to remove the cellular matter as completely as possible. The starch suspension (slurry) is purified by centrifugation, washed, dried and the stocked in HDPE bags.

Description

Starch occurs in nature as irregular, angular, white masses that may be easily reduced to power.

Appearance : White – rice and maize starch,

Creamy white – Wheat starch,

Pale yellow – potato starch,

Odour : Odourless

Taste : Bland and mucilaginous.

Nevertheless, all the four types of starch mentioned above do possess a definite shape and characteristic features as illustrated in Fig. 3.1

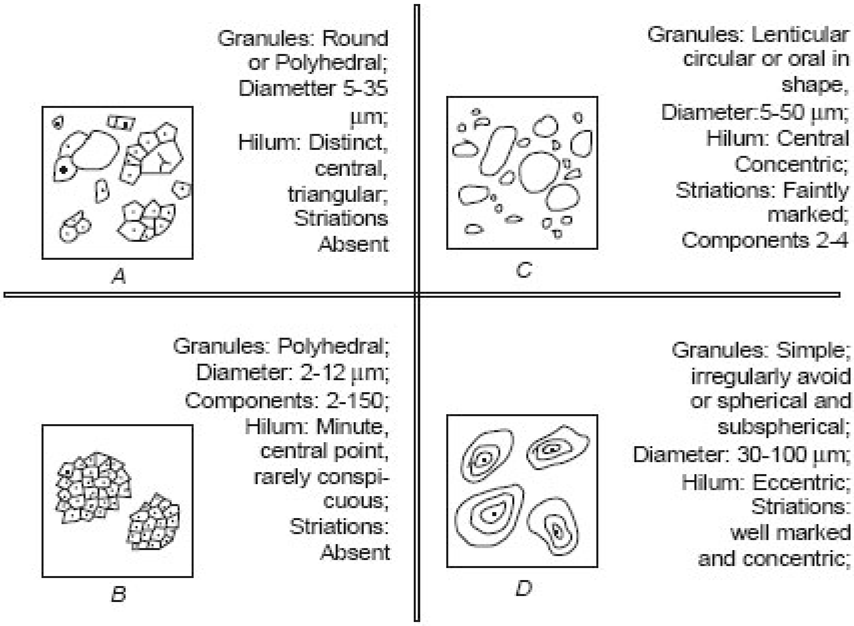


Fig. 3.1 Characteristic Features of (*A*) Maize Starch, (*B*) Rice Starch, (*C*) Wheat Starch, (*D*) Potato Starch.

Chemical Constituents

In general, under ideal experimental parameters hydrolysis of starch in acidic medium yields glucose in theoretical proportion that essentially represent the main building block of the starch molecule. It has been established that starch molecule is essentially made up of *two* **complex polysaccharides,** namely:

(*a*) Amylopectin: (α-Amylose)

Amylopectin is insoluble in water and swells in it thereby giving rise to a thick paste upon boiling with water. It produce a distinct violet or bluish red colouration with iodine* solution (0.1 N). It has a highly branched structure that is composed of several hundred short chains of about 20-25 **D-Glucose units** each. Interestingly, one terminal of each of these chains is joined through C-1 to a C-6 with the next chain and so on and so forth as shown below:

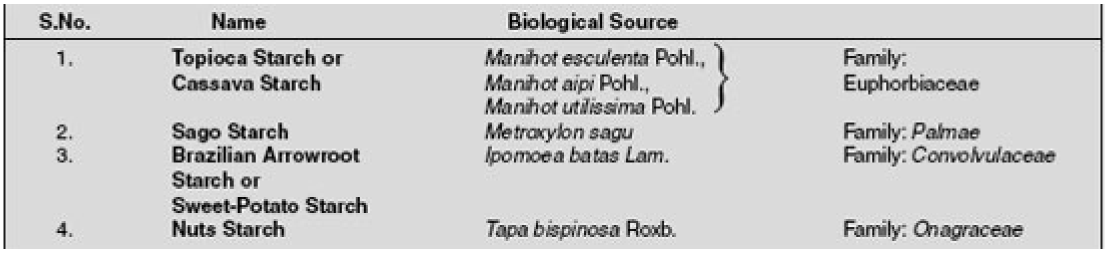
(*b*) Amylose: (β-Amylose)

Amylose is water soluble and gives an instant bright blue colour with iodine solution (0.1 N). Based on the fact that amylose upon hydrolysis yields the only **disaccharide (+) – Maltose** and the only **monosaccharide D-(+) – Glucose,** it has been suggested that amylose is comprised of chains of a number of D-(+) – glucose units, whereby each unit is strategically linked by an **alpha–glycoside bondage** to C-4 of the next unit as depicted below:

Amylose invariably constitutes upto 25% of the total starch content; however, the proportion varies with the particular species under consideration. Amylose is found to be either absent or present to a very small extent (≤ 6%) in some glutinous or waxy starches available in the plant kingdom.

Substituents and Adulterants

A number of biological species containing starch is generally employed to substitute (adulterate) the conventional commercially available starch used as **food** and as **pharmaceutical adjuvants,** namely:



S.No.	Name	Biological Source	
1.	**Topioca Starch or Cassava Starch**	*Manihot esculenta* Pohl., *Manihot aipi* Pohl., *Manihot utilissima* Pohl.	Family: Euphorbiaceae
2.	**Sago Starch**	*Metroxylon sagu*	Family: *Palmae*
3.	**Brazilian Arrowroot Starch or Sweet-Potato Starch**	*Ipomoea batas Lam.*	Family: *Convolvulaceae*
4.	**Nuts Starch**	*Tapa bispinosa* Roxb.	Family: *Onagraceae*

Uses

1. It possesses both absorbent and demulcent properties.

2. It is employed in dusting powder because of its unique protective and absorbent property.

3. It is used in the formulation of tablets and pills as a vital disintegrating agent and a binder.

4. It is utilized as a diagnostic aid for the proper identification of crude drugs.

5. It is employed as a diluent (or filler) and lubricant in the preparation of capsules and tablets.

6. It is used as an indicator in iodimetric analyses.

7. It is an antidote of choice for iodine poisoning.

8. Dietetic grades of corn starch are marked as **'Maizena'** and **'Mondamin'.**

9. **'Glycerine of starch'** is used not only as an emolient but also as a base for the suppositories.

10. It is the starting material for the large scale production of liquid glucose, glucose syrup, dextrose and dextrin.

11. It finds its extensive industrial application for the sizing of paper and textile.

12. It possesses nutrient properties as a food and in cereal based weaning foods for babies *e.g.*, **Farex(R)** (Glaxo) and **Cerelac(R)** (Nestle).

13. It is used topically and externally to allay itching.

14. It is used profusely in laundry starching.

Bees Wax

Synonyms: Beeswax, Cera flava, Cara alba

Biological Source: Beeswax is obtained by purifying the honeycomb of Apis mellifica or A. mellifera and other species of Apis.**Family** : Apidae

Geographical Distribution: France, Italy, West Africa, Jamaica and India etc.

Preparation:

Yellow Beeswax: Wax is secreted in cells on the ventral surface of the last four segments of the abdomen of worker bees. The wax come out through pores in the chitinous plates and is used to form the comb for storing the honey. After separation the honey, the honey comb is melted in water and cooled. The water soluble impurities are removed, stained and allowed to solidify in suitable moulds to get yellow bees wax.

White Beeswax:

White Beeswax is prepared from the yellow beeswax by bleaching with charcoal, potassium permagnate, chromic acid, chlorine, etc. or slow bleaching with the sunlight, air and water. For slow bleaching the melted wax is fell on a revolving moist cylinder. Ribbon-like strips of wax are formed which are exposed to sunlight and air. The strips are frequently moistened and turned until the outer surface is bleached.

Points to remember:

* Bees wax is purified by heating in the boiling water or dilute sulphuric acid and settling. The process is repeated several times and finally wax is skimmed off.

* white beeswax is obtained by bleaching of yellow beeswax. Bleaching of beeswax can be done by –

(a) By sing chemicals like charcoal, potassium permagnate, chromic acid, ozone, and hydrogen peroxide.

(b) Exposing to light and air.

Characters :

Color : Yellowish brown to yellowish-white solid.

Odour : Agreeable and honey like.

Taste : Waxy or slight balsamic.

Fracture : Granular

Extra features :

Yellow bees wax is non crystalline solid. It is soft to touch and crumbles under the pressure of finger to plastic mass. Under molten condition, it can be given any desired shape. It breaks with a granular fracture.

Solubility: It is soluble in chloroform, ether, and warm fixed oils and volatile oils. But it is insoluble in water.

Chemical constituents:

It consists of the esters of straight chain monohydric alcohols with straight chain acids. The chief constituents of the bees wax is myricin(about 80%) which is myricyl palmitate. Free cerotic acid (about 15%), small quantities of melissic acid and aromatic substance cerolein are the other constituents. The colour the wax is due to the presence of pollen pigments and propolis (bee glue). Indian bees wax is characterized by its low acid value, while European bees wax has the acid value of 17 to 22.

Standards: (yellow bees wax)

Melting point- 62^0 C to 65^0 C.

Specific gravity- 0.958 to 0.967

Acid Value- 05 to 10

Sap. Value- 90 to 103

Ester Value- 80 to 95.

Uses:

- It is used in the preparation of ointments (for hardening purposes), plasters and polishes.
- It is also used in cosmetics for the preparation of lipsticks and face creams.
- Pharmaceutically, it is an ingredient of paraffin ointment I.P.
- A beeswax and vegetable oil mixture is used as a vehicle for the administration of respiratory forms of certain medicaments such as penicillin and curare.
- It is also used in the formulation of medicinal preparations for the treating skin cracks.
- A combination of tallow, olive oil, camphor, bees wax and common salt is used for ulcer and external tumor treatment.

Adulterants:

The common adulterants of the beeswax are hard paraffin, colophony, stearic acid, *Japan wax* (Fat of the fruits of Rhus species; family- Anacardiaceae), ceresin, Carnauba wax, spermaceti and several other substances.

Adulteration can be detected on the basis of solubility and melting point. The genuine wax should not give turbidity when 0.5 g of wax is boiled with 20 ml of aqueous caustic soda (Sodium hydroxide) for 10 minutes and cooled.

Note:

Japan wax is not a true wax but only a fat. So it is saponified with aqueous sodium hydroxide. But beeswax is a true wax. So, it is saponified only with alcoholic potash and not with aqueous sodium hydroxide.

Saponification cloud test:

This test can detect adulterants like Japan wax and stearic acid in bees wax. 0.5 g of bees wax is boiled with 8-20 ml of 10% sodium hydroxide solution. It is cooled and filtered. The filtrate is acidified with hydrochloric acid. If a precipitate is formed, it indicates the presence of adulterants (e.g. fats like Japan wax, fatty acids resins).

Castor oil

Synonyms

Olium Ricini, Ricinus oil, Neoloid, Castor bean oil, Oil of Palma Christi, Trangantangan oil, Cold drawn castor oil

Biological source

Castor oil is a fixed oil obtained by the cold expression from the seeds of Ricinus communis Linn.**Family** Euphorbiaceae

Geographical distribution:

Castor seeds are produced in almost all tropical and sub-tropical countries such as India, South America, African Countries, Brazil, China, East and West Indies and Thailand. In India, castor is one of the major oil seed crops and India is the second largest producer of castor seeds in the world. In India, largely grown in Andhra Pradesh, Gujarat and Karnataka. Andhra Pradesh is producing about 60% of the total crop in India.

Character of Seeds

The castor seed are oval, anatropous, compressed, 0.8-1.8 cm long, 0.4-1.2 cm broad with variable size and colour. Seeds weigh from 0.1 to 1 gm. The testa is smooth thin, and brittle. The color is grey, brown or black with brown or black mottled. At one end there is a small yellowish caruncle from which the raphe extends on the flat or ventral side, to the chalazal at the opposite end. The testa is easily removable exposing the large white and oily endosperm bearing thin, flat and foliaceous cotyledons, one of the either side of central, lenticular cavity, and connected with the short caulicle, and radicle.Castor seeds consists of 75% kernel and 25% of hull. The oil content of the kernel varies from 36 to 60%. Amongst different varieties, Hyderabad muggelai variety is supposed be the richest (about 48%) in oil content. Castor seeds containing several enzymes such as lipase, maltase and invertase. The proteinous toxic principle *ricin*, constituting approx. 3% of the whole seeds, is poisonous.

Castor oil preparation

The seed coat is removed by passing through a decorticator. The rollers with sharp cutting edges break testa but do not injure the kernel. The testa are removed by sieves and compressed air. The kernels (or decorticated seeds) are cold expressed under hydraulic press with a pressure of 2 tonnes per square inch, to get about 30% oil at room temperature. The oil is known as *cold drown oil.* Rest of the oil from the seeds is removed by the further increasing the pressure, and some times by hot pressing or even by solvent extraction process. The oil, thus processed, is not suitable for medicinal purposes.

The cold drown oil is then steamed at 80^0 C, to destroy the enzyme lipase and toxic protein albumins (*ricin)*. It is then bleached and de-acidified with sodium carbonate to remove free fatty acid. If necessary, oil is washed with hot water before steaming to remove the mucilaginous matter present in the oil. Finally, it is treated with activated earth or animal charcoal to remove the impurities by adsorption and filled into the container.

Organoleptic Characters:

Colour - colourless to pale yellow liquid.

Odour- characteristic (nauseating).

Taste- First it is bland but afterwards slightly acrid, and usually nauseating.

It is a viscous and transparent liquid.

Solubilty- It is soluble in alcohol (an exception to the category of fixed oil), miscible in chloroform, solvent ether, glacial acetic acid. It dissolves in its own volume of petroleum ether and in 95% alcohol due to the presence of hydroxyl group in ricinoleic acid. It is insoluble in mineral oil. When heated to 300^0 C for several hours it polymerizes and becomes miscible with mineral oil.

Standards:

Weight per ml- 0.945 to 0.965 g

Acid value- not more than 2

Acetyl value-144-150

Iodine value-82-90

Saponification number- 176-187

Optical rotation-dextrorotatory, between $+3.5^0$ and $+6.0^0$, $[\alpha]_D=0.96$

Solidifying Point- -10 to -18^0C

Hydroxyl Value- not less than 150

Viscosity- 6-8 poises

Refractive index- between 1.4758 and 1.4798.

Chemical constituents Castor seeds contain fixed oil (45-55%), proteins (20%) consisting of globulin, albumin, nucleoalbumin, glycoprotein and ricin (a *toxalbumin*), ricinine alkaloid and some enzymes.

The castor oil is a fixed oil containing triglyceride of *ricinoleic acid* (87%), iso ricinoleic, stearic(1%), dihydroxystearic (traces), linoleic (3%), oleic (7%) and palmitic(2%) acids. The viscosity and purgative nature of the oil is due to the free ricinoleic acid and its sterioisomers which are produced by hydrolysis of triricinolein by lipases in the duodenum.

Ricinoleic acid: $CH_3\ (CH_2)_6CHOHCH_2CH{=}CH\ (CH_2)_7COOH$

Castor oil also contains heptaldehyde (heptanal), undecenoic acid and sebacic acid.

Identification Test

1- It mixes with half its volume of light petroleum ether (40-60^0).

2- With equal volume of alcohol (ethanol), clear liquid is obtained, on cooling to 0^0C and on storage for three hours; the liquid remains clear. (distinction from the other fixed oil).

USES:

Castor oil is, irritant, purgative and emollient. It is as ointment base, preparation of flexible collodion, to prepare undecylenic acid which is fungistatic preparation, to manufacture lipstics, perfumed hair oil and hair fixers.

The cathartic property of castor oil is due irritant action of ricinoleic acid. Castor oil is often given orally or as aromatic castor oil or in the form capsules. It is used as abortificient paste and ricinolic acid is used in the contraceptive creams and jellies. Atropine and cocaine for the ophthalmic purposes are suspended in castor oil. As an industrial raw material it is used for the preparation of chemical derivatives used in coating, urethane derivatives, surfactants and dispersants, cosmetic, lubricants, paints, varnishes, grease, polishes, etc. It is chief raw material for the production of sebacic acid.

Cocoa butter

Synonyms Theobroma o il, Cacao butter

Biolgical Source: It is obtained from the seeds of Theobroma cacao L.

FamilySterculiaceae

Geographical Distribution,Cocoa is cultivated in most of the tropical and subtropical countries, especially Sri Lanka, Philippines, Brazil, Curacao, Mexico, West Africa, Ecuador and parts of India.

Cultivation of Cocoa:

Cocoa is cultivated upto an elevation of 1000 meters above sea level. It needs well drained good quality soil, with a capacity to hold moisture. About 15 to 30 cm of top soil should have sufficient organic matter. Cocoa plant can tolerate a rain fall of 150 cm to 500 cm per annum; provided it is properly distributed. Cocoa plant survives for 60 to 70 years and start bearing fruits after three years of planting. Hindustan Cocoa Products Limited, in India has under taken extensive cultivation of Cocoa in Kerala.

Preparation of Cocoa butter:

Cocoa seeds contain about 50% of cocoa butter. The seeds are separated from pods and are allowed to ferment wherein the seeds change the colour from white to the dark reddish-brown due to enzymatic reaction. The fermentation process take place at 30-40^0 C. The process of fermentation is carried out in tubes, boxes or in the cavities made in the earth for 3 to 6 days. After fermentation, the seeds are roasted at 100-140^0 C, which loses water and acetic acid from the seeds and facilitates removal of seed coat. The seeds are then cooled immediately and are fed to nibbling machine to remove the shells followed by winnowing. The kernel is then fed to hot rollers which yield a pasty mass containing cocoa butter. This is further purified to give cocoa butter. The cocoa shells are processed further to yield an alkaloid.

Description:

Cocoa butter is yellowish-white solid and brittle below 25^0 C. It has pleasant chocolate odour and taste.

It is insoluble in water, but soluble in ether, chloroform, benzene and petroleum ether.

Standards :

Specific gravity- 0.858-0.864	Sap. Value- 188-195
Melting point- 30-35^0 C	Iodine Value- 35-40
Refractive Index- 1.4637-1.4578	

Chemical Constituents:

It consists of glycerides of stearic (34%), palmitic (25%), oleic (37%) acids and small amount of arachidic and linoleic acid. The non-greasiness of product is due to its glyceride structure.]

Uses :

It is used as a base for suppositories and ointments, manufacture of creams and toilet soaps.

Substitue :

Mango kernel oil, which is sold fat at room temperature and has a melting point of 35^0 C, it, is used as a substitute for cocoa butter.

Kokum butter

Synonyms : Goa butter, Kokum oil, Mangosteen oil.

Biological Source : It is the fat expressed from the seeds of Garcinia indica Chois.

Family: Guttiferae

Note- Commercial kokum butter from the market is melted; its free acidity is neutralized with treatment of sodium carbonate solution and washed in hot water. It is decolorized, if necessary, by using suitable adsorbent.

Geographical Source :

The tree is indigenous to Thialand, Cambodia, and China. It is also found in India. It is wildly grown in Konkan, Western ghats, Coorg dist and Niligiri Hills. It is cultivated in Maharashtra and Mauritius.

Methods of Preparation :

The kernels from the seeds are churned and boiled in water. The melted fat is separated by skimming, washed and hot water twice and decolorized with animal charcoal or fuller' earth.

Description:

Colour- Light grey or yellowishwith a greasy feel.

Odour- Slight and characteristic.

Taste- Characteristic (Bland oily).

Shape-it is marked in the egg-shaped lumps.

Standards:

Weight per ml- 0.895-0.899 g

Melting Point- $39\text{-}42^0$ C

Acid Value - not more than 3

Sap. Value - 185-190

Iodine Value - 35-37

Refractive index- 1.4565- 1.4575

Unsaponifiable matter- 2-3%

Chemical constituents:

Kokum butter contains glycerides of stearic(55%), oleic(40%), hydroxy capric acid (10%), palmitic (2.5%), and linoleic acids(1.5%). The fat is slightly bitter.

Uses

It is used as a nutritive, demulcent, astringent and emollient. Locally, it is used in fissures of lips and hands. Cake, left after the extraction of the oil, is manure. It is employed in sizing of cotton yarn. It is used in the preparation of ointments and suppositories. The dried rind of the fruit is called as *Amsul* and used as a substitute for tamarind. It is also used in dysentery, mucous diarrhea, and phthisis pneumonia.

Hydnocarpus oil

Synonyms Chaulmoogra oil, Gynocardia oil

Biological Source: Hydnocarpus oil is the fixed oil obtained by cold expression method from the ripe seeds of Taraktogenos kurzii King, [Syn. Hydnocarpus kurzii {King}Warb], Hydnocarpus wightiana Blume, H. hetrophylla, H. anthelmintica Pierre and other species of Hydnocarpus.

Family: Flacourtiaceae

Geographical Distribution:

This plant is native of Myanmar, Thailand, and east India. It is also found in Sri Lanka and Bangladesh. In India, It is grown in Assam and Tripura.

Methods of preparation:

Seeds are sub-ovoid, obtusely angular and approx. 2 cm in length. The seeds contain 40-45% of fixed oil. Seeds are decorticated by machine after grading the kernels are expressed with hydraulic press and the oil is obtained is filtered.

Description:

Colour- Yellow to brownish -yellow coloured liquid

Odour- Characteristic

Taste- Some what acrid

Solubilty- Slightly soluble in alcohol, soluble in chloroform, ether, benzene and carbon disulphide.

It is a soft white solid below 25^0 C.

Standards

Weight per ml-0.935 to 0.960 g

Acid value- not more than 10

Sap. Value- 195-213

Iodine value- 93-104

Specific rotation- not less than $+48^0$and not more than $+60^0$

Refractive index- 1.472 to 1.476

Chemical Constituents

The oil of H. wightiana contains glycerides of cyclopentenyl fatty acids like chaulmoogric acid (27%), Hydnocarpic acid (about 48%), gorlic acid and small amounts of other acids like palmitic , oleic acid etc. The cyclic acids are formed during the last 3-4 months of maturation of the fruit and are strongly bactericidal towards Miicrocccus of leprosy. The esterified oil of H.wightiana is preferable to that of other species.

Uses

The cyclopentenyl fatty acids(unsaturated) of chaulmoogra oil posses strong bactericidal effect, against Mycobacterium leprae, and M. tuberculosis. It is found to be useful in the treatment of T.B., Leprosy, psoriasis and rheumatism.It is intended only for external use.

The oil has now been replaced by the ethyl esters and salts of hydnocarpic and chaulmoogric acid.

Cod liver oil

Synonyms Oleum morrhi

Biological source Cod liver oil is a fixed oil prepared from the fresh liver of the cod, Gadus callarius and other species of Gadus.

Family Gadidae

Geographical Distribution:

Large quantities of oil consignments are prepared in coastal region of Norway, Scotland, Iceland, Germany, Denmark and Britain.

Methods of Preparation:

The fishes are caught by nets, opened, and livers are separated. The healthy livers free from gallbladders are washed , minced, steamed in steam jacketed vessels or 'kars' at a temperaturenot exceeding 85^0C for half an hour,cooled and buried in snow for several days. Special barrels are used forthis cooling process, which results in separation of stearin. The steaming of the oils destroys enzymes lipase. The medicinal oil after filtration is kept in well closed air-tight containers in a cool place protected from light.

Description

Pale yellow thin liquid with slightly fishy taste and odour, becoming disagreeable on exposure to air and light.

Solubility:

It is freely soluble in chloroform, ether, carbon disulphide, petroleum ether, and slightly soluble in alcohol.

Five major steps involved in refining of medicinal cod-liver oil are (i) removal of impurities (ii) drying (iii) winterization, (iv) deodorization, (v) standardization for vitamin content. The vitamin A content of the oil is determined spectrophotometrically.

Standards Specific gravity- 0.918 to 0.927

Acid value- less than 2	Iodine value- 145-180
Sap. Value- 180-190	Refractive index- 1.4705 to 1.4745

Chemical Constituents

The medicinal value of the oil is due to the vitamin A and Vitamins of D group. About 1 gm of oil contains not less than 255 mcg of vitamin A and 2.125 mcg. of vitamin D. The oil contains glyceryl esters of oleic, linoleic, gadoleic, myristic, palmitic and other acids. Cod liver oil also contains &% eicosapentaenoic acid and &% decosahexanoic acid (Both of them are omega-3 fatty acids).

Use The oil is used as source of vitamins, as a nutritive and in treatment of rickets and T.B.

Non-destearinated cod liver oil is the entire oil that has not been chilled so as to separate

stearin. The oil contains not more than 0.5 per cent by volume of water and liver tissues and it deposits stearin upon chilling.

Storage:

In order to avoid loss of vitamins during storage, the oil should be kept in well filled air-tight containers, protected from light and in cool place. The addition of small quantities of certain antioxidants (e.g. dodecyl gallate) is permitted. It may be bottled in containers from which air has been expelled by production of vacuum or by inert gas nitrogen.

Shark liver oil

Synonym Oleum Selachoids

Biological source Shark liver oil is a fixed oil prepared from the fresh and carefully preserved livers of the various species of the Shark, mainly *Hypoprion brevirostris* and *Galeorhinus zyopterus*.

In India, Scoliodon, Carcharias, and Spyrna are abundant among the species, and are generally utilized for the extraction purpose. According to I.P., one gram of oil should contain not less than 6000 international units of vitamin A activity.

Methods of Preparation:

Government factories in Tamil Nadu, Maharashtra, and are processing livers for extracting oil. The livers are cleaned and minced. The minced mass is taken to a boiling pot, where the temperature of 80^0C is maintained. The oil extracted is treated with dehydrating agent to remove traces of water.

The oil is taken to the vacuum still for dehydration and chilled to separate stearin. Centrifuges are used to separate suspended material in oil. The clear oil is manipulated to adjust the desired strength of vitamin A. The oil being sensitive to light and air, all the while, care is taken to minimize its exposure to sunlight and air. Many a times, the livers are stored at very low temperature, until they are taken for processing.

Description:

Colour- Pale yellow to brownish -yellow

Odour- Characteristic fishy, but not rancid.

Taste- Bland or fishy.

Solubility

Shark liver oil is soluble in solvent ether, chloroform, and light petroleum. However, it is insoluble in water and slightly soluble in ethyl alcohol.

Standards

Specific gravity- 0.912 to 0.916

Iodine value- not less than 90

Acid value- not more than 2

Refractive index- 1.459 to 1.477 at 40^0

Chemical Constituents:

The shark liver oil contains vitamin A. The concentration of vitamin A in the oil varies from 15000 to 30000 International Units per g. Other constituents of the oil are the glycerides of the saturated and unsaturated fatty acids.

Identification Test:

1. Dissolve 1g shark liver oil in 1 ml chloroform and treat with 0.5 ml sulphuric acid. It acquires light violet colour changing to purple and finally to brown (due to vitamin A).
2. Dissolve 1.0 ml shark liver oil in 10 ml chloroform and treat with saturated solution of antimony trichloride in chloroform. Shake it well; a blue colour is developed (due to vitamin A).

Uses: It is used in the deficiency of vitamin A. It is also known as antixeropthalmic factor. (However it should be noted that shark liver oil is free from of vitamin D and is required to be fortified when necessary. Due to the absence of vitamin D, shark liver oil is not a genuine substitute for cod liver oil. It is also nutritive. Pharmaceutically, it is used in the preparation of dilute shark liver oil, shark liver oil emulsion (Indian N.F.) and shark liver oil with vitamin D. It is used in burn and sunburn ointments.

Storage: Shark liver oil is preserved in well-filled and well closed containers protected from light.

Linseed oil

Synonyms: Flax seed oil, linum oil

Biological source:Linseed oil is a fixed oil obtained from the dried fully ripe seeds of Linum usitatissimum Linn.**Family:**Linaceae

Geographical Distribution:

Turkey, Afghanistan, Egypt, Algeria, Spain, India, Italy and Greece etc.

Methods of Preparation:

The variety yielding high percentage of oil is selected for extraction of oil. Seeds are sieved to make free of earthy matter and other materials.

Commercially, linseed oil is produced by use of expellers. Before the seeds are subjected to the expellers, they are rolled into meal, then moistened and heated by means of steam jacketed troughs filled over the expellers. An average yield of oil is 30-35%. The expressed oil is tanked for a long period, to settle the colouring matter and mucilage. The oil is then treated with alkali immediately after filtration. Alkali treatments help to remove free fatty acids. Bleaching of oil is done by using either charcoal or fueller’s earth at elevated temperature. The refined oil produced as above, is chilled to separate wax.

Description:

Colour- Pale yellow coloured clear liquid.

Odour- Characteristic

Taste- Pleasant

Linseed oil gradually thickens on exposure to air forming a thin transparent film.

Solubilty- Slightly soluble in alcohol, insoluble in water and miscible with petroleum ether and chloroform.

Standards

Specific gravity- 0.927 to 0.931

Acid value- not more than 4

Iodine value- 160-200

Refractive index- 1.4786 to 1.4815

Sap. Value- 188-195

Unsaponifiable matter- not more than 1.5

Chemical Constituents:

It contains the glyceride of palmitic, stearic, oleic, linoleic and linolenic acids. The unsaponifiable matter of the oil contains considerable quantities of sterols, tocopherol and squalene. Linseed also contains a cyanogenetic glycoside linamarin and mucilage (5%), in addition to fixed oil (20-40%).

Uses

It is the most important drying oil and hence , considerably large quantities are used for paints and varnishes. Medicinally, it is used for external applications like lotions and liniments. It is used in the treatment of scabies and other skin diseases along with sulphur. Since, it has very iodine value, it is used in the preparation of non-staining iodine ointment and other products like cresol with soap. It is nutritive and emollient also.

Industrally, it is an important oil used for the various purposes such as in the manufacture of soap, linoleum, greases, polishes, plasticizers, polymers, etc.

Adulterants

Linseed oil is adulterated with boiled linseed oil, cotton seed oil, sun flower oil, rosin, mineral oils, fish oils and mustard oil. Fish oil is detected by odour and rosin and mineral oils are detected by studying the composition of unsaponifiable matter.

Wool Fat:

Synonyms: Lanolin, Adeps Lanae, oesipos, Alapurin, Lanalin,Agnin

Biological source Lanolin (Wool fat) is 'fat like' purified secretion of the sebaceous glands of sheep, *Ovis aries* Linn. It contains 25-30% of water.**Family**:Bovidae

Geographical Distribution: Commercially, lanolin is manufactured in Australia, U.S.A., and to a very less extent in India.

Methods of Preparation and Chemical constituents:

Raw wool contains about 31% wool fibers, suint or wool sweat (chemically potassium salts of fatty acids), about 32% earthy matter and about 25% wool grease or crude lanolin. Crude lanolin is separated by washing with sulphuric acid or suitable organic solvent or soap solution. It is further purified and bleached. Then product is known as anhydrous lanolin or wool fat. The hydrous wool fat is produced by intimately mixing wool fat with 30% of water.

It is complex mixture of esters and polyesters of 33 high molecular weight alcohols and 36 fatty acids. The chief constituents of the lanolin are cholesterol, isocholesterol, unsaturated monohydric alcohols of the formula $C_{27}H_{45}OH$, both free and combined with lanoceric($C_{30}H_{60}O_4$), lanopalmitic ($C_{16}H_{22}O_3$), carnaubic acid and other fatty acids.

Description

Colour- whitish- yellow coloured mass

Odour-Faint and Characteristic

Taste- Bland

Extra Features

It is found in the form of ointment like mass and on heating in water bath, it separates into two layers.

Solubility

It is practically insoluble in water and soluble in chloroform and solvent ether with separation of water.

Standards: *Anhydrous wool fat (lanolin)*

Specific gravity- 0.927 to 0.931

Acid value- not more than 1

Iodine value- 18-36

Sap. Value- 90-105

Melting point- 34 to 44^{0}C

Peroxide Value- not more than 20

Identification Test

Dissolve 0.5 gm of hydrous wool fat in chloroform and to it add 1 ml of acetic anhydride and two drops of sulphuric acid. A deep green is produced, indicating the presence of cholesterol.

Uses

Lanolin is used as an emollient, as water absorbable ointment base in many skin creams and for hoof dressing. It is common ingredient and base for several water soluble creams and cosmetic preparation. It can be allergic also.

Rice bran oil

Synonym : Rice oil

Biological source

Rice bran is the culture existing between the rice and the husk of the paddy and consists of embryo (germ) and endosperm of the seeds of *Oryza sativa*. It is obtained as the by product in rice mill during polishing of rice obtained after dehusking of paddy. **Family** Gramineae

Methods of Preparation:

The quality of the rice bran oil depends upon the time which elapses between milling of the rice and removal of oil from the bran. Rice bran contains an active enzyme lipase, which raises the free fatty acid content on storage. The oil obtained from fresh bran is of good quality and has good flavour and low free fatty acid content. Therefore solvent extraction plant for rice bran oil should be set as nearer as possible to the rice milling so as to process out the rice bran oil quickly.

Rice bran is found in extremely small pieces. It is impermeable to solvents. Before solvent extraction, it is subjected to drying, cooking and flaking operations. The normal percolation method of solvent extraction does not serve the purpose with this type of material, but it is pressed and then extracted with solvent special continuous immersion extractors.

Description

Rice bran oil is golden yellow oil difficult to bleach, and not affected by temporary heating to 160^0C.

Solubilty

It is insoluble in water but soluble in common fat solvents.

Standards:

Specific gravity- 0.916 to 0.921

Acid value- 04-05

Iodine value- 99-108

Sap. value- 181-189

Refractive index- 1.470-1.473

Thiocynogen value- 69-76

Hydroxyl value- 05-14

Chemical constituents

Rice bran oil contains about 20-25% of saturated and 80-85 % unsaturated fatty acids as glycerides. Main fatty acids are oleic (40-50%), linoleic (30-40%) and palmitic acids (12-18%). The oil contains asqualene and antioxidants like tocopherols.

Uses:

Since it contains antioxidants, its keeping quality is very good. It is used in the manufacture of cosmetics and as an emollient. It is an edible oil and used in preparation of vegetable ghee.

Lard:

Synonym: Adeps

- **Biological source**:Lard is the purified internal fat obtained from the abdomen of the hog, Sus scrofa var. domesticus. (**Family :** Suidae)
- The abdominal fat, known as *flare, is obtained by treatment with hot waterat a temperature not exceeding 57*^{0}C.

Description: Lard is a soft, white homogenous *fatty* mass unctuous to touch.It has non-rancid odour and bland taste.

Lard oil is colourless, pale yellow liquid, density 0.90-0.91, viscosity 1.47. It solidifiesin between -2 to + 4^0 C.

Solubilty

It is insoluble in alcohol and soluble in benzene, carbon disulfide, ether and chloroform.

Standards:

Specific gravity- 0.934 to 0.938

Acid value- 01-02

Refractive index- 1.4520-1.4550

Iodine value- 52-56

Melting point-34 -41^0C

Sap. value- 192-198

Unsaponifiable matter-Not more than 0.5%

Chemical constituents

Chemically it contains about 60% olein and 40% of stearin and palmitin.

Uses

Lard is an emollient and used as a base for ointments base and in formulation where more effective absorption is desired. It has tendency to become rancid; this can be retarded by combining lard with 1% Siam benzoin or Sumatra benzoin to prepare Benzoinated Lard (Benzoin resin is used as preservative in Benzoinated Lard).

Lard oil is used as an antifoaming agent in the fermentations and as a tablet lubricant, illuminant, oiling wool and to manufacture soap.

Suet

Synonym: Sevum; Mutton suet

Biological source Medicinal suet is the purified internal fat obtained from the abdomen of the sheep *Ovis aries* Linn.**Family:**Bovidae

Methods of Preparation:

The fat contained in the vesicles of the omentum and near the kidneys is used for suet. The omentum is crushed to break membranous vesicles. It is then melted and strained appropriately. Cooling is done with thorough stirring and allowed to solidify.

Description

It is a white solid fat, which is smooth, uniform and unctuous to touch. It has solid odour and bland taste if fresh, but becomes rancid after long exposure to air.

Solubility:

It is soluble in chloroform, ether and light petroleum and insoluble in alcohol and water.

Standards:

Melting point-45 -50^0C

Specific gravity- 0.948 to 0.953

Iodine value- 33-45

Sap. value- 192-195

Refractive index- 1.449-1.451

Chemical constituents

Chemically it contains palmitin and stearin (approx. 75-80%), along with olein (20-30%).

Uses:

It is used as ointment base.