School of Medical and Allied Sciences

Course Code : BPHT 4005

Course Name: Pharmacognosy an Phytochemistry-I

LIPIDS

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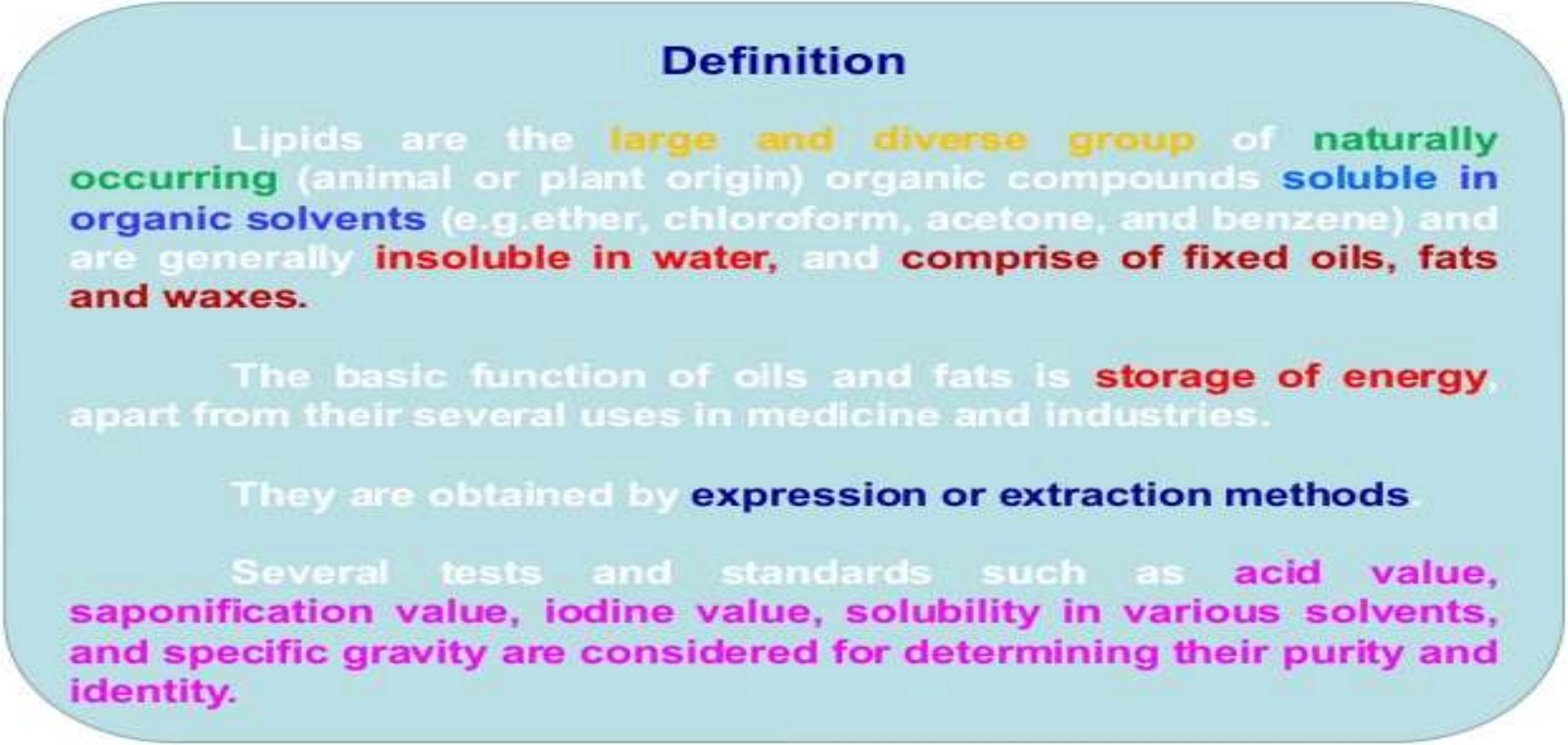
Disclaimer



Definition

Lipids are the large and diverse group of **naturally occurring** (animal or plant origin) organic compounds **soluble in organic solvents** (e.g.ether, chloroform, acetone, and benzene) and are generally **insoluble in water,** and **comprise of fixed oils, fats and waxes.**

The basic function of oils and fats is **storage of energy**, apart from their several uses in medicine and industries.

They are obtained by **expression or extraction methods**.

Several tests and standards such as **acid value, saponification value, iodine value, solubility in various solvents, and specific gravity are considered for determining their purity and identity.**

Lipids

BEESWAX

Synonym

Yellow Bees wax; Cera-flava

Biological Source

Yellow bees wax is **purified wax** and obtained from the **honey comb** of the **bees** ***Apis mellifeca*** and other ***species of Apis***, belonging to family **Apidae.**

Geographical Source

It is processed and commercially prepared in **France, Italy, West Africa, Jamaica** and **India.**

Processing and Preparation

The capping combs of honeycomb are broken

↓ Boil in soft water

Enclosed in a porous bag weighted to keep under water.

↓ Boil

The boiling causes oozing of the wax,

↓ Cooling.

Wax collected outside the bag forms a cake

↓

The debris on outer surface of wax is removed by scraping

Wax purification -Heating in boiling water or dilute sulphuric acid and settling.
Process is repeated several times and finally wax is skimmed off.

Wax bleaching -Treatment with hydrogen peroxide, chromic acid, ozone, charcoal, chlorine or potassium permanganate etc.
Natural bleaching :Exposing the wax to the sun-light in thin layers.

Description

Colour - Yellow to yellowish-brown
Odour - Agreeable and honey-like

Extra Features

Yellow bees wax is non-crystalline solid. It is soft to touch and crumbles under the pressure of fingers to plastic mass.

Under molten condition, it can be given any desired shape.

It breaks with a granular fracture.

Solubility

It is insoluble in water, **soluble in hot alcohol, ether, chloroform, carbon tetrachloride, fixed and volatile oils.**

Standards

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

Chemical Constituents

It consists of esters of straight-chain monohydric alcohols with straight chain acids. The chief constituent of the bees wax is **myricin** i.e. myricyl palmitate **(about 80%)**. **Free cerotic acid** (about 15%), small quantities of melissic acid and aromatic substance cerolein are the other constituents.

Indian bees wax is characterised by its low acid value, while

European bees wax has the acid value of **17 to 22**.

Uses

Bees wax is used in preparation of ointments, plasters and polishes. It is used in ointment for hardening purposes & manufacture of candles, moulds and in dental and electronic industries. It is also used in cosmetics for preparation of lip-sticks and face creams. Pharmaceutically, it is an ingredient of paraffin ointment I.P.

Adulterants

Very frequently bees wax is adulterated with colophony, hard paraffin, stearic acid, Japan wax, spermaceti, carnauba wax 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 for 10 minutes and cooled.

White bees wax : Obtained by bleaching yellow bees wax, should not be used for ophthalmic purposes.

Castor oil

Synonym

Ricinus oil

Biological Source

Castor oil is the fixed oil obtained **by the cold expression** of the seeds of *Ricinus communis*, family **Euphorbiaceae.**

Geographical Source

Castor seeds are produced in almost all tropical and sub-tropical countries. In India, castor is one of the major oil seed crops, and **India** is the second largest producer of castor seeds in the world, producing about 2,80,000 tonnes per annum. Brazil, U.S.S.R., Thailand, U.S.A.& Romania are other countries producing this drug on large scale. In India, it is largely grown in **Andhra Pradesh**, Gujarat, and Karnataka. Andhra Pradesh produces about 60% of the total crop in India.

India is exporter of medicinal castor oil. The other two forms of castor oil i.e. **hydrogenated** and **dehydrated** are also getting exported regularly.

Composition of Seeds

Since castor oil is a fixed oil of therapeutic importance and purgative in action, it cannot be consumed freely.

Apart from the oil, **seeds** also contain some of the **toxic substances**. Castor seeds consist of 75% kernel and 25% of hull. Seeds weigh from 0.1 to 1g. Castor seeds are rich in phosphorus content and most of it is in the form of phytin.

Hull is rich in mineral and also contains an alkaloid ricinine, resin, pigment, etc. The **oil content** of the kernel varies from 36% to 60%.

Amongst different varieties, the **Hyderabad muggelai variety** is supposed to be the **richest (about 48%)** in the oil content.

Castor seeds contain several **enzymes** including lipase, maltase and invertase. The proteinous toxic principle **ricin,** constituting about 3% of the whole seeds, is poisonous.

Preparation of Medicinal Castor Oil

Castor oil can be prepared by **two different methods**, the first being the crushing of whole or decorticated seeds in power driven hydraulic presses and the second one known as Ghani, which consists of manually operated screw press driven by bullocks. For commercial extraction, the first method is adopted. The oil thus produced, is a non-medicinal castor oil.

The seeds are graded and freed of impurities like metallic pieces of iron and sand. The seeds are decorticated and hulls are removed. If the seeds are not decorticated, the manurial value of the cake increases.

For medicinal purposes, it is desired that the seeds should be **decorticated**, as it improves the colour of the oil and also helps in controlling its acid value.

Decorticated seeds are pressed under **hydraulic press** with a pressure of **2 tonnes per square inch**, which helps in extracting out 30% of the oil present in the seeds at room temperature. The oil is known as **cold drown oil**. Rest of the oil from the seeds is removed by further increasing the pressure, and sometimes 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 **steame**d at 80 °C, to destroy the enzyme lipase and ricin (toxic protein). 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 containers.

Description

Colour - Pale yellow or almost colourless liquid.
Odour - Slight and characteristic.
Taste - First it is bland but afterwards slightly acrid, and usually nauseating.

It is a viscous and transparent liquid.

It is soluble in alcohol (an exception to the category of fixed oils); miscible in chloroform, solvent ether, glacial acetic acid and petroleum ether. It is insoluble in mineral oil.

Standards

1. Weight per ml - 0.945 to 0.965 g
2. Acid value - not more than 2
3. Acetyl value - not less than 143
4. Iodine value - between 82 to 90
5. Sap. value - between 176 and 187
6. Optical rotation - between + 3.5° and + 6.0°
7. Solidifying point- - 10 to -18°C
8. Hydroxyl value - not less than 150
9. Viscosity - 6 - 8 poises
10. Refractive index - between 1.4758 and 1.4798

Chemical Constituents

Castor oil chiefly contains **triglyceride of ricinoleic acid** (about 80%). Other glycerides are also present in the drug, where the fatty acids are represented by isoricinoleic, linoleic, stearic and isostearic acids. The **viscosity of the castor oil is due to ricinoleic acid.**

Ricinoleic acid : $\mathrm{CH3\ (CH2)6\ CHOH\ CH2\ CH = CH\ (CH2)7\ COOH}$

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

Identification

1. It **mixes with** half its volume of **light petroleum ether** (40 – 60 ° C).

2.

Oil + Ethanol (equal volume)

↓

Clear liquid

↓ Cool at 0 ° C & store for three hours;

Liquid remains clear (distinction from other fixed oils).

Uses

Castor oil is cathartic. It is also used for lubrication commercially. Several other forms of the castor oil, such as dehydrated castor oil (DCO) or hydrogenated castor oil (HCO) are used industrially for several other purposes. The fatty acid like ricinoleic; heptaldehyde and undecenoic acid are the other substances commercially prepared out of the castor oil. Turkey red oil and soap are the other commercial products, extensively used in textile industry. It is used in preparation of paints, enamel, varnishes, grease, polishes, printing ink, hydraulic and brake spirit with little modifications.

The cathartic property of the castor oil is due to irritant action of ricinoleic acid. Castor oil is often given orally or as aromatic castor oil or in the form of capsules. It is used in **abortifificient** paste and ricinoleic acid is used in **contraceptive creams and jellies**. Atropine and cocaine for opthalmic purposes are suspended in castor oil. It is also employed as an emollient in preparation of lip-sticks and as sulphore cinolate in tooth formulation being strong bactericide. Other cosmetic purposes for which the oil is used include perfumed hair oil and hair fixers, for the commercial manufacture of sebacic acid, which is a raw material for synthesis of resins.

Hydnocarpus oil

Synonym

Gynocardia oil,Chaulmoogra oil

Biological Source

Hydnocarpus oil is the fixed oil obtained by **cold expression** method from **fresh ripe seeds** of the plant ***Hydnocarpus wightiana, Hydnocarpus anthelmintic*** Pierre, ***Hydnocarpus heterophylla*** Kurz other species of the Hydnocarpus, family **Flacourtriaceae**, *Taraktogenous kurzi* (Bixaceae).

Geographical Source

Chaulmoogra plant is **native of Myanmar, Thailand, and Easte India**. It is also found in Sri Lanka and Bangladesh. In India, it is grown in Assam and Tripura.

Method of Preparation

(Chaulmoogra seeds contain 40 - 45% fixed oil)

Seeds
↓ **Cleaned ,Washed and Dried**
Cracked & decorticated by machine (To remove testa)
↓
Grading the kernels
↓
The kernels are reduced to paste
↓
oil is expressed ,
↓
Filtered
↓
Stored in air tight containers.

Description

Colour	-	Yellow to brownish-yellow coloured liquid
Odour	-	**Characteristic**
Taste	-	Some what acrid
Solubility	-	Slightly soluble in alcohol, soluble in chloroform, ether, benzene and carbon disulphide.

It is soft white solid below 25 °C

Standards

Weight per ml	-	0.935 to 0.960 g
Acid value	-	not more than 10
Sap. value	-	195 to 213
Iodine value	-	93 to 104
Specific rotation	-	not less than + 48¡ and not more than +60¡
Refractive index	-	1.472 to 1.476

Lipids

Chemical Constituents

It contains chemically esters of unsaturated fatty acids of **chaulmoogric acid** (27%) and **hydnocarpic acid** (48%) and glycerides of palmitic acid.

Uses

The unsaturated fatty acids of chaulmoogra oil possess **strong bactericidal** effect, against Mycobacterium leprae, & M. tuberculosis. It is useful in the treatment of T.B.,leprosy, psoriasis & rheumatism. It is **intended only for external use.**

Storage

It is stored in closed containers away from light and in cool place.

Substtution

The plant is substituted in India by Hydnocarpus wightiana found abundantly in West Bengal, Kerala and Western ghats and also by Hydnocarpus alpine occurring in Karnataka, Kerala and Tamil Nadu.

Dose

0.3 to 1 ml by intramuscular or subcutaneous injection.

Wool fat

Synonyms

Lanolin, Adeps Lanae.

Biological Source

Hydrous wool fat is the purified fat-like substance obtained from the wool of the sheep ***Ovis aries*** Linn. family Bovidae. It is the secretion of sebaceous glands of sheep deposited onto the wool fibres.

Geographical Source

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

Method of Preparation

Raw wool contains about 31% wool fibres, 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. The product is known as anhydrous lanolin or wool fat. The hydrous wool fat is produced by intimately mixing wool fat with 30.0% of water.

Description

Colour - Whitish-yellow

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 lanolin (wool fat) has following standards.

Melting point - 34 to 44 ° C

Acid value - Not more than 1

Iodine value - 18 - 36

Saponification value - 90 -105

Peroxide value - Not more than 20

Constituents

It is a complex mixture of esters and polyesters of **33 high molecular weight alcohols** and **36 fatty acids**.

Hydrous wool fat contains mainly esters of cholesterol and isocholesterol with caranubic, oleic, myristic, palmitic, lanoceric, and lanopalmitic acids. It also contains 50% of water.

Identification Test

Dissolve 0.5 g of hydrous wool fat in chloroform + 1 ml of acetic anhydride + 2 drops of sulphuric acid.

↓

A deep green colour (Presence of cholesterol.)

Uses

The lanolin is mainly used as water absorbable ointment base. It is a common ingredient and base for several water soluble creams and cosmetic preparations. It can be allergic also

References:

1. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Lehninger principles of biochemistry. New York: Worth Publishers, p. no. 453-478.
2. Hardy K, Brand-Miller J, Brown KD, Thomas MG, Copeland L. The importance of dietary carbohydrate in human evolution. The Quarterly review of biology. 2015 Sep;90(3):251-68.
3. Yudkin J. Evolutionary and historical changes in dietary carbohydrates. The American journal of clinical nutrition. 1967 Feb 1;20(2):108-15
4. Rodwell, V. W., Botham, K. M., Kennelly, P. J., Weil, P. A., & Bender, D. A. (2015). Harper’s illustrated biochemistry (30th ed.). New York, N.Y.: McGraw-Hill Education LLC, p. no. 231- 256.
5. T.E.Walis, Textbook of pharmacognosy, 5th edition, published by CBS Publisher & Distributor,p.no.561
6. U Satyanarayana. Text Book of Biochemistry. Elsevier Health Sciences, 2014, p.no. 332-345