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Topic: LIPIDS

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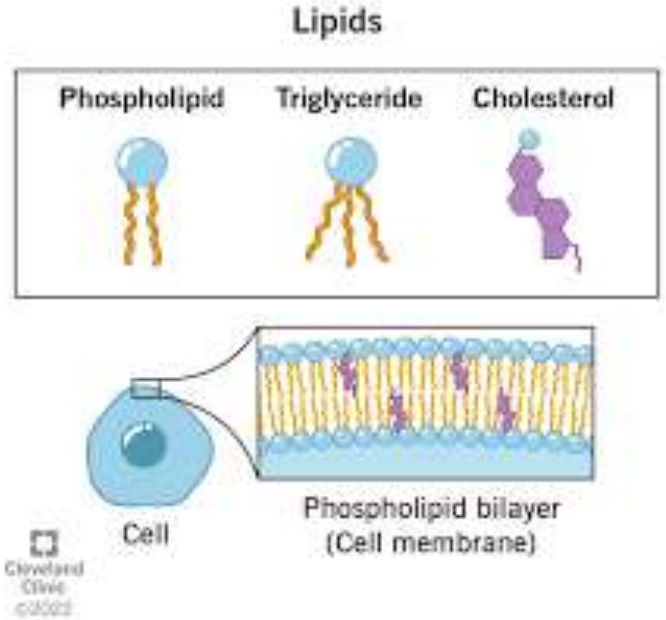
DEFINATION

The lipids are a large and diverse group of naturally occur-ring organic compounds that are related by their solubility in nonpolar organic solvents (e.g. ether, chloroform, acetone, and benzene) and are generally insoluble in water.

The lipids of physiological importance for humans have the following major functions:

1. They serve as structural components of biological membranes.
2. They provide energy reserves, predominantly in the form of triacylglycerols.
3. Both lipids and lipid derivatives serve as vitamins and hormones.
4. Lipophilic bile acids aid in lipid solubilization.



FIXED OILS AND FATS

- Fixed oils and fats are obtained from plants or animal.
- They are rich in calories and in plant source, they are present mostly in the seeds, as reserve substances and in animals they are present in subcutaneous and retroperitoneal tissues.
- They differ only according to their melting point and chemically they belong to the same group.
- If a substance is liquid at 15.5–16.5°C it is called fixed oil and solid or semisolid at the above temperature, it is called fat.
- They are made from two kinds of molecules: glycerol (a type of alcohol with a hydroxyl group on each of its three carbons) and three fatty acids joined by dehydration synthesis.
- Since there are three fatty acids attached, these are known as triglycerides.

- Fixed oils and fats are insoluble in water and alcohol and are soluble in lipid solvents like light petroleum, ether, chloroform, and benzene.
- Only exception in this solubility is castor oil that is soluble in alcohol because of its hydroxy group of ricinoleic acid.
- They float in water since their specific gravity is less than one.
- They produce a permanent translucent stain on the paper and are called fixed oils.
- Fixed oils and fats cannot be distilled without their decomposition.

Analytical Parameters for Fats and Oils

Following are the parameters used to analyse the fats and oils.

1) Iodine value:

The iodine value is the mass of iodine in grams that is consumed by 100 g of fats or oil. A iodine solution is violet in colour and any chemical group in the substance that reacts with iodine will make the colour disappear at a precise concentration. The amount of iodine solution thus required to keep the solution violet is a measure of the amount of iodine sensitive reactive groups. It is a measure of the extent of unsaturation and higher the iodine value, the more chance for rancidity.

3) Hydroxyl value: The hydroxyl value is the number of mg of potassium hydroxide (KOH) required to neutralize acetic acid combined to hydroxyl groups, when 1 g of a sample is acetylated.

2) Saponification value: The saponification value is the number of milligrams of potassium hydroxide required to saponify 1 g of fat under the conditions specified. It is a measure of the average molecular weight of all the fatty acids present.

4) Ester value: The ester value is the number of mg of potassium hydroxide (KOH) required to saponify the ester contained in 1 g of a sample.

5) Unsaponifiable matter: The principle is the saponification of the fat or oil by boiling under reflux with an ethanolic potassium hydroxide solution. Unsaponifiable matter is then extracted from the soap solution by diethyl ether. The solvent is evaporated and then the residue is dried and weighed.

6) Acid value: It is the amount of free acid present in fat as measured by the milligrams of potassium hydroxide needed to neutralize it. As the glycerides in fat slowly-decompose the acid value increases.

7) Peroxide value: One of the most widely used tests for oxidative rancidity; peroxide value is a measure of the concentration of peroxides and hydroperoxides formed in the initial stages of lipid oxidation. Milliequivalents of peroxide per kg of fat are measured by titration with iodide ion.

WAXES

- Waxes are esters of long-chain fatty acids and alcohols.
- The fatty acids are same in wax and fats, but the difference being saponification.
- Waxes are saponified only by alcoholic alkali but the fats may be saponified either by alcoholic alkali or by aqueous alkali.
- Along with fatty acids it also contains monohydroxy alcohols of high molecular weight especially cetyl alcohol, melissyl alcohol, and myricyl alcohol.
- Some-times cholesterol or phytosterols are also present. As such they are not suitable as food because hydrolysing enzymes of wax are not present in system.
- Waxes are widely distributed in nature.
- The leaves and fruits of many plants have waxy coatings, which may protect them from dehydration and small predators.

CASTOR OIL

Synonyms Castor bean oil, castor oil seed, oleum ricini, ricinus oil, oil of palma christi, cold-drawn castor oil.

Biological Source Castor oil is the fixed oil obtained by cold expression of the seeds of Ricinus communis Linn., belonging to family Euphorbiaceae.

Geographical Source

- It is mainly found in India, Brazil, America, China, Thai-land; in India it is cultivated in Gujarat, Andhra Pradesh, and Karnataka.

Preparation

- Castor oil is obtained from castor seeds.
- The oil is obtained by two ways; either after the removal of the seed coat or with the seed coat.
- Seed coats are removed by crushing the seeds under the grooved rollers and then they are subjected to a current of air to blow the testas.
- The kernels are fed in oil expellers and at room temperature they are expressed with 1 to 2 tons pressure per square inch till about 30% oil is obtained.

Characteristics Medicinal or the first grade or Pale pressed castor oil is colourless or slightly yellow coloured. It is a viscid liquid which has slight odour with slightly acrid taste. Castor oil is soluble in absolute alcohol in all proportions; Specific gravity is 0.958 to 0.969, refractive index at 40°C is 1.4695 to 1.4730, acid value not more than 2, saponification value 177 to 187, and acetyl value is about 150.

Chemical Constituents Castor oil consists of glyceride of ricinoleic acid, isoricinoleic, stearic, and dihydroxy stearic acids. Ricinoleic acid is responsible for laxative property. Castor oil also contains vitamin F. 90% of the fatty acid content is ricinoleic acid.

Uses

- Castor oil is mild purgative, fungistatic, used as an ointment base, as plasticizer, wetting agents, as a lubricating agent.
- Ricinoleic acid is used in contraceptive creams and jellies; it is also used as an emollient in the preparation of lipsticks, in tooth formulation, as an ingredient in hair oil.
- The dehydrated oil is used in the manufacture of linoleum and alkyl resin.
- The main use of castor oil is the industrial production of coatings, also employed to make pharmaceuticals and cosmetics in the textile and leather industries and for manufacturing plastics and fibres.
- Marketed Products It is one of the ingredients of the preparations known as Lip balm and Muscle and joint rub (Himalaya Drug Company).

WOOL FAT

Synonyms LANOLIN , Oesipos; Agnin; Alapurin; Anhydrous lanolin; Adeps lanae; Laniol.

Biological Source Lanolin is the fat-like purified secretion of the sebaceous glands which is deposited into the wool fibres of sheep, Ovis aries Linn., belonging to family Bovidae.

Preparation Wool is cut and washed with a soap or alkali. An emulsion of wool fat, called as wool grease, takes place in water. Raw lanolin is separated by cracking the emulsion with sulphuric acid. Wool grease floats on the upper layer and fatty acids are dissolved in the lower layer. Lanolin is purified by treating with sodium peroxide and bleaching with reagents.

Characteristics Lanolin is a yellowish white, tenacious, unctuous mass; odour is slight and characteristic. Practically, it is insoluble in water, but soluble in chloroform or ether with the separation of the water. It melts in between 34 and 40°C. On heating it forms two layers in the beginning, continuous heating removes water. Lanolin is not saponified by an aqueous alkali.

Chemical Constituents

- Lanolin is a complex mixture of esters and polyesters of 33 high molecular weight alcohols, and 36 fatty acids.
- The alcohols are of three types; aliphatic alcohols, steroid alcohols, and triterpenoid alcohols.
- The acids are also of three types: saturated nonhydroxylated acids, unsaturated nonhydroxylated acids, and hydroxylated acids.
- Liquid lanolin is rich in low molecular weight, branched aliphatic acids, and alcohols, whereas waxy lanolin is rich in high molecular weight, straight-chain acids, and alcohols.

Uses

- Wool fat is used as an emollient, as water absorbable ointment base in many skin creams and cosmetic and for hoof dressing.
- Wool fat is readily absorbed through skin and helps in increasing the absorption of active ingredients incorporated in the ointment.
- However, it may act as an allergenic contactant in hypersensitive persons.

BEESWAX

Synonyms White beeswax, yellow beeswax, cera alba, and cera flava.

Biological Source Beeswax is the purified wax obtained from honeycomb of hive bee, Apis mellifera Linn and other species of Apis, belonging to family Apidae.

Geographical Source It is mainly found in Jamaica, Egypt, Africa, India, France, Italy, California etc.

Preparation The worker bee secretes the wax due to the ability of maintaining a high temperature and the wax is secreted in the last four segments of abdomen on the ventral surface. Just below the sterna it has a smooth layer of cells form the chitinous area that secretes the wax. The chitinous area has small pores through, which the wax exudes out. The wax is passed to the front leg and later to the mouth; in the mouth it gets mixed with the saliva, which is then built on the comb.

Characteristics

- Yellow wax or Cera flava is yellowish to greyish brown coloured solid, with agreeable, honey-like odour and a faint, characteristic taste.
- When cold, it is somewhat brittle and when broken, shows presence of a dull, granular, noncrystalline fracture.
- Yellow wax is insoluble in water and sparingly soluble in cold alcohol.

Chemical Constituents

- Beeswax contains myricin, which is melissyl palmitate; melting point 64°C, free cerotic acid ($C_{26}H_{52}O_2$), myricyl alcohol ($C_{30}H_{61}OH$) is liberated when myricyl palmitate is saponified. Melissic acid, some unsaturated acids of the oleic series, ceryl alcohol, and 12 to 13% higher hydrocarbons are present.

Uses

- Beeswax is used in the preparation of ointments, plaster, and polishes.