

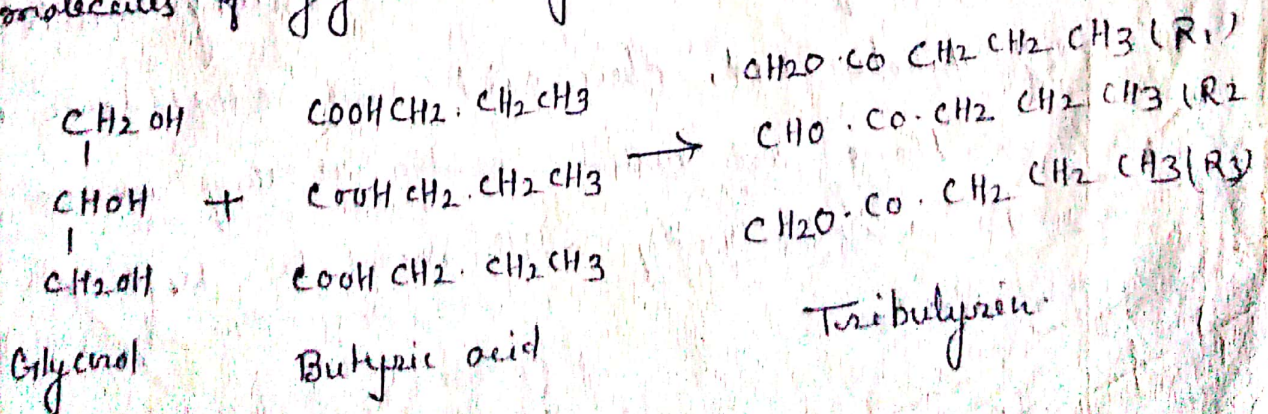
Lipid.

A large group of heterogeneous compound, generally characterised by insolubility in water and solubility in organic solvents constitute lipids.

The chemical composition of all the lipids consists of combination of carbon, hydrogen and oxygen atoms. Blouet (1913) defined lipids as naturally occurring compounds which are insoluble in water and soluble in one or more organic solvents such as benzene, chloroform, ether and acetone the so called fat solvents and on hydrolysis yields fatty acid which are utilized by living organisms.

Lipids are generally classified into simple lipids, compound lipids and derived lipids.

- 1) Simple lipids — Simple lipids are alcoholic esters of fatty acids. Simple lipids may have two categories —
- a) Neutral fats (Glycerides) → Chemically fats are triglyceride because three molecules of fatty acid condense with one molecule of glycerol to yield fat.



Simple glycerides contain same fatty acid group (S.A.)
When two or more of these groups are different it is mixed
Natural fats are largely composed of mixed glycerides.
Since these glycerides have no free acid or base groups, they
are often called neutral fats. Fats are ^{or} ~~solid~~ ^{liquids} at room temperature according to their melting points which
depends upon chain length and degree of saturation of
fatty acids. Saturated fatty acids containing more than 8
carbon atoms are solid. Fatty acids with shorter chain
and more unsaturation are liquids. The melting points
of fats are always higher than their solidification points.

The properties of fats differ according to
the nature of fatty acid present in them. Saturated fatty acids
contain hydrogen and ^{single bond and} their general formula is $R-COOH$ where
 R is $CH_3(CH_2)_n$. The most abundant saturated fatty
acids are palmitic (C_{16}) and stearic acid (C_{18}).

On the other hand unsaturated fatty
acids have one or double bonds. The general formula is
 $R-CH=CH(CH_2)_nCOOH$. Presence of this double bond
in the fatty acids lowers their melting points considerably.
e.g. linoleic acid, oleic acid and arachidonic acid.
These three are called essential as they cannot be synthesized
in the animal body and must be supplemented with
the diet.

Chemical properties of fats! -

- ① Upon hydrolysis with enzyme lipase and alkali fats breaks down into fatty acid and glycerol. When the fats are hydrolysed with alkali, the free fatty acids react with alkali to form salt. These salts are soap and this process is called saponification.
- ② Oxidation! - Oxidation of fats in the air is accompanied with hydrolysis. Oxidation of fats give short chain acids, aldehyde etc. Tocopherol is a natural antioxidant occurring in vegetable oil.
- ③ Hydrogenation! - Upon hydrogenation unsaturated fats are converted into more saturated and solid fats.

WAXES! - Waxes are the esters of fatty acid with complex of monohydric alcohols in place of glycerol. e.g. beeswax. Waxes are insoluble in water and very resistant to atmospheric oxidation. They also have higher melting points. They are chemically inert and not digested by the fat splitting enzymes.

COMPOUND LIPID! - Compound lipid contain some additional group of elements besides fatty acids and alcohol. These additional group may be phosphorus, nitrogen, sulphur and protein etc.

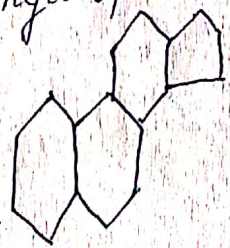
Phospholipid :- This class includes fatty acid, glycerol phosphorus too. The fatty acid found in phospholipid are palmitic, stearic, oleic, linolenic and arachidonic acid. Phospholipids are soluble in ether and alcohol but insoluble in acetone. e.g Lecithin, cephalin, Plasmalogens etc.

B. Phosphoinositides :- Phosphoinositides contain hexahydric alcohol inositol instead of glycerol.

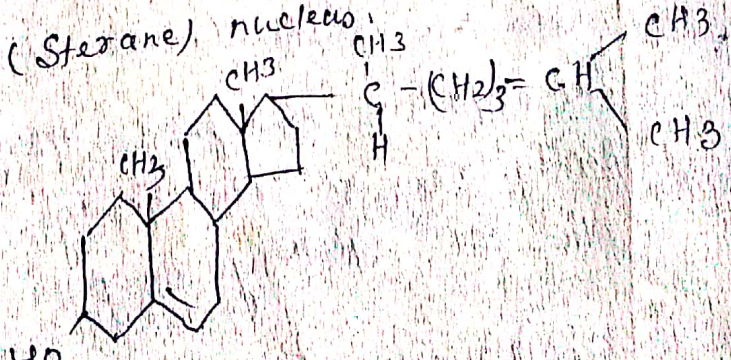
C. Phosphosphingosides :- In these lipids, glycerol is replaced by either sphingosine or phytosphingosine. These lipids are abundant in nervous tissues.

DERIVED LIPIDS :- This group include Sterols, Carotenoids, essential oils, aldehyde, ketone, alcohol etc.

Sterol :- The sterols are solid wax like substances. Chemically, they are alcohols. They all contain a cyclopentaperhydrophenanthrene (Sterane) nucleus.



Sterane



Cholesterol

Sterols are widely distributed in plants, animals and microorganisms. They are found in cell membrane and other cellular components containing lipids.

The best known animal sterol is cholesterol. Unlike other lipids, sterols cannot be saponified and by this process they can be separated from other lipids.

Ergosterol is present in food in small amount. It differs from cholesterol only in the side chain attached to the sterol nucleus.

Essential oils are also grouped under lipid because of their solubility and natural occurrence. Most of the essential oils are terpenes or benzene related. Other derived lipids such as fatty acid, glycerol, aldehyde etc occur only in very small amount as intermediates of metabolic conversion. Besides these, sex hormones, adrenal cortex hormones and carotenoid come under this category.

Significance of Lipids:-

- ① The fat is the chief source of energy. Complete combustion of 1 gm of fat release 9.0 Kcal of energy. Lipids are the one of the structural unit of cells. Phospholipids and steroids are present in biological membrane. Phospholipids possess both acidic and basic groups and they are called Zwitterion. In this way they act as binding agent between hydrophilic and hydrophobic end. Waxes generally form protective covering in plants and animals. They protect the living surface against bacteria and insect.