

LIPIDS

The lipids are a heterogeneous group of substances (Compounds) related to fatty acids and includes fats, oil, waxes and other related substances. These are oily or greasy organic substances, relatively insoluble in water and soluble in organic solvents like benzene, ether and chloroform. They are thus hydrophobic in nature. The term 'lipid' was first used by German biochemist Bloor in 1943 for a major class of tissues components and foodstuffs.

CLASSIFICATION:-

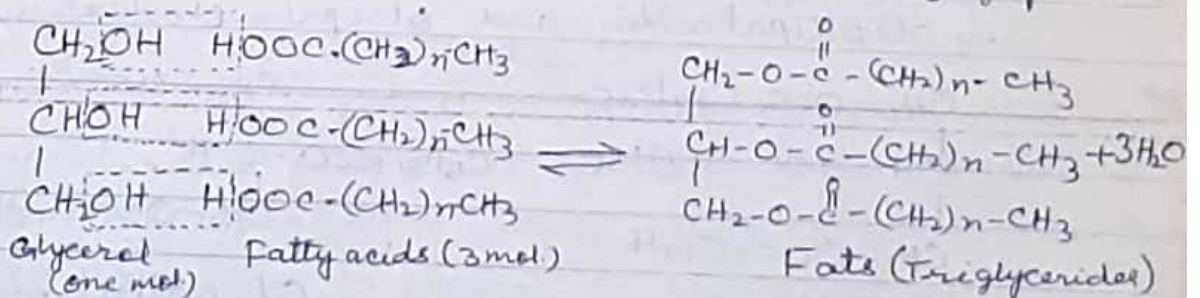
Bloor (1943) has proposed the following classification of lipids based on their chemical composition.

- (A) Simple lipids or Homolipid
- (B) Compound lipids or Heterolipids
- (C) Derived lipids.

(A) SIMPLE LIPIDS:

These are esters of fatty acids with various alcohols.

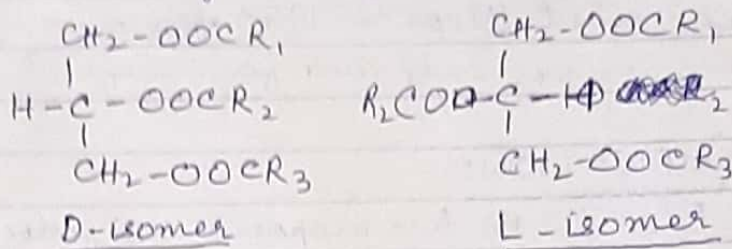
- (i) Fats and Oils (triglycerides, triglycerols), these are ester of fatty acids with trihydroxy alcohol, glycerol. A fat is solid at ordinary room temperature whereas an oil is liquid. In a fat molecule, 3 molecules of fatty acids are joined to one molecule of glycerol.



The triglycerides are the most abundant of all lipids. They constitute about 98% of total dietary lipids, the remaining 2% consists of phospholipids and cholesterol and its esters. They are the major components of storage or depot of fats in plants and animal cells. They are nonpolar, hydrophobic molecules since they contain no electrically charged or highly polar functional groups.

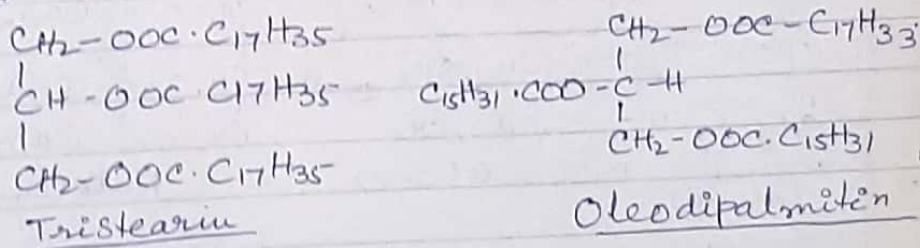
The arctic and antarctic animals such as whales, Seals, Walrus and penguins are amply padded with triglycerides to serve both as energy storage depots and as an insulation against very low temperature.

The naturally occurring fats are of L-type. Others are D-type. The two types are only differ due to asymmetry is created at C₂.



A fat molecules contains 3 molecules of fatty acids which may be similar or dissimilar those containing a single kind of fatty acid in all three position are called simple (or symmetrical) triglycerides, they are named after fatty acids they contain e.g. tripalmitin, tristearin and triolein.

Most of the triglycerides of nature are mixed (or asymmetrical) triglycerides i.e. they contain 2 or 3 different fatty acids unite in the molecule eg. oleodipalmitin and oleopalmitostearin.



Fatty acids are obtained from hydrolysis of fats. Fatty acids are long chain ^{having} fatty organic acids usually 4 to 30 carbon atoms. They have single carboxyl and long chain nonpolar hydrocarbon tails. Natural fat usually contain even number of C-atom (3 to 30) in straight chains derivatives. The chain may be

Saturated (containing only single bond) or unsaturated (containing one or more double bonds). Some fatty may have hydroxyl group(s) in the chain called hydroxy or oxygenated fatty acids and still other may be possess ring structure called cyclic fatty acids.

Saturated fatty acids:-

The general formula of for these acids is $C_nH_{2n+1}COOH$. Saturated fatty acids has high melting point thus they are semi solid at room temperature. The most abundant saturated fatty acids encountered in animal lipids are palmitic (C_{16}) and Stearic (C_{18}) acids. Fatty acids of 10 Carbons atoms or less are rarely present in lipids. Physiologically important saturated fatty acids, their structure and sources are as follows:

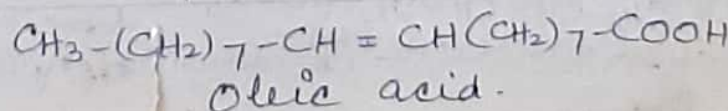
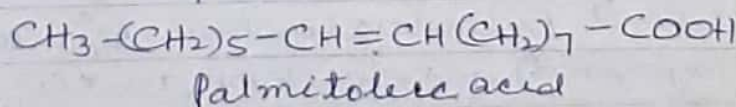
Name	Structure	Common Source
Butyric	$CH_3(CH_2)_2COOH$	Butter
Caproic	$CH_3(CH_2)_4COOH$	Coconut & palm oil
Caprylic	$CH_3(CH_2)_6COOH$	Coconut & palm oil
Capric	$CH_3(CH_2)_8COOH$	Coconut & palm oil
Palmitic	$CH_3(CH_2)_{14}COOH$	Animal & plant fats
Stearic	$CH_3(CH_2)_{16}COOH$	Animal & plant fats
Arachidic	$CH_3(CH_2)_{18}COOH$	Groundnut oil
Lignoceric	$CH_3(CH_2)_{22}COOH$	Papeseed oil Groundnut and

⑥ Unsaturated fatty acids:-

Melting point is greatly lowered. All common unsaturated fatty acids of nature are liquid at room temperature. These may be further subdivided according to degree of unsaturation.

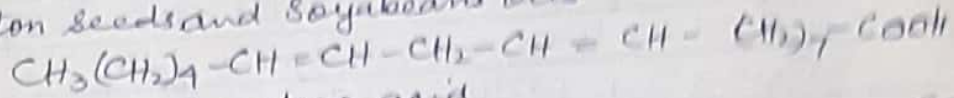
1) Monounsaturated acid:-

One double bond. General formula is $C_nH_{2n-1}COOH$.
Examples: Palmitoleic acid (C_{16}) and oleic ^(C_{18}) acid found in animal lipids.



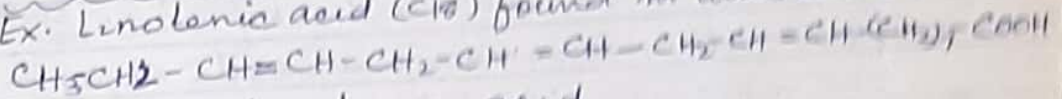
② Polyunsaturated Acids:

① Two double bonds: General formula $C_nH_{2n-2}COOH$
 Example: Linoleic acid (C_{18}) found in Corn, Peanut, Cotton seeds and Soybeans oils



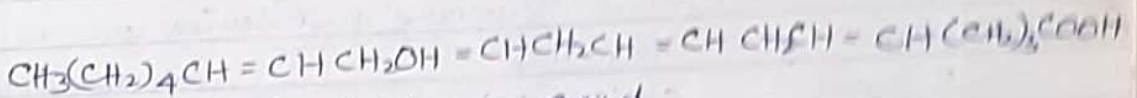
Linoleic acid

② Three double bonds: General formula $C_nH_{2n-6}COOH$
 Ex. Linolenic acid (C_{18}) found in Linseed oil



Linolenic acid

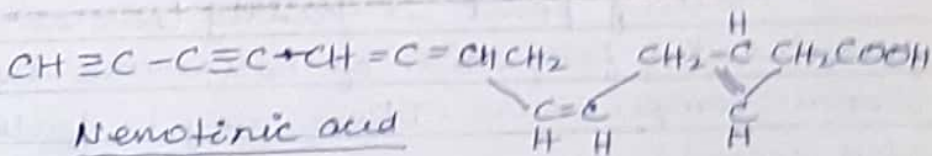
③ Four double bonds: General formula $C_nH_{2n-10}COOH$
 Ex. Arachidonic acid found in peanut oil.



Arachidonic acid

An important group of unsaturated fatty acids, derived primarily from arachidonic acid in metabolism; is that of Prostaglandins. First discovered in 1933 in extracts of human seminal plasma, they have important pharmacologic and biochemical activity on smooth muscle, blood vessels, and adipose tissue.

A most unusual unsaturated fatty acid is neronic acid, having single, double and triple C-C linkages



Neronic acid

Conjugated and Nonconjugated double-bond Systems:

When methylene group ($-CH_2-$) present on either side of double bond is called nonconjugated and when $-CH_2-$ group not present on both side is called conjugated double bond. Ex. Linoleic, Linolenic, Arachidonic acid (Non Conjugated) and oleostearic acid (Conjugated double bond)

