

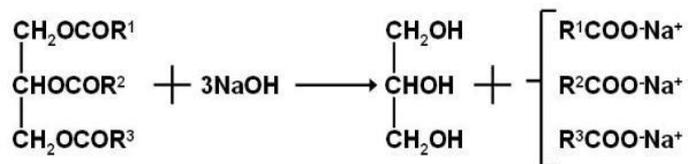
## Identification Characterization of fats and oils

To the identify purity of fat or to assess the degree of adulteration in fat.

- saponification number**: number of NaOH or KOH in mgs required to saponify the free fatty acid.

fat with high no. of COOH groups  $\longrightarrow$  has high saponification no. Ex: butter

fat with low no. of COOH groups  $\longrightarrow$  has low saponification no. Ex: margarine



A triglyceride + sodium hydroxide  $\rightarrow$  glycerol + sodium carboxylates

- Iodine number**: number of iodine in mgs required to saturate the double bond of unsaturated Fatty acids.

**uses** : to know the degree of unsaturation of fatty acids.

sunflowers have high iodine no while butter have low iodine no. Why?



- Acid number** : **uses** : to indicate the degree of rancidity of fat.

## RANCIDITY

What is rancidity?

- Rancidity is the development of unpleasant smells in fats and oils, which are often accompanied by changes in their texture and appearance.
- Two types of rancidity:
  - Hydrolytic rancidity
  - Oxidative rancidity (auto-oxidation)



## 4. Formation of soaps.



**Sodium Na** make the soap hard , while **potassium K** make the soap soft but it is expensive.

To make the soap good lather even with hard water add **Na<sub>2</sub>CO<sub>3</sub>** or **Na silicate** in small amounts.

**phospholipids** : define as compound lipids

consist of : fatty acid + glycerol + phosphoric acid + nitrogen base

fatty acid ----- non polar compound.

glycerol , phos.acid , nitrogen base ----- polar compound.

present in : plants , in every living cell ,in seeds an sprouts,

animals, cell membrane, mitochondria, brain, nervous tissues, egg yolk.

### Properties:

1. as membrane component called selectively permeable or semi permeable.
2. certain molecules can pass through them enter or exit the cell.
3. Molecules dissolve in fat can pass easily , while molecules dissolve in water cannot.
4. Oxygen, carbon dioxide , urea all pass easily through membrane.
5. Large molecules like glucose or ions, sodium, potassium cannot pass easily.  
This helps keep the contents of the cell working properly and separates the inside of cell from the outside.
6. Used for energy.
7. They are found in lungs and joints , where they help lubricate cells.
8. Phospholipids used as part of drugs, because they are easy to absorb.

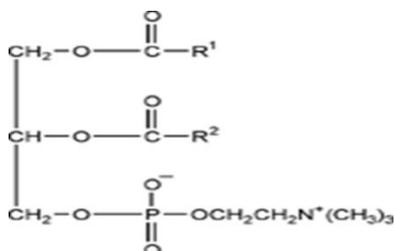
### classification:

1. glycerophosphatides
2. phosphosphingos

1. glycerophosphatides classify in to:

#### a. phosphatidyl choline ( lecithin )

consist of: Fa + glycerol + phos. acid + choline



### Function :

In intestine: lower surface tension of water aid in emulsification of lipid – water mixtures help in digestion and absorption.

In plasma: keep cholesterol and its ester in dissolved state.

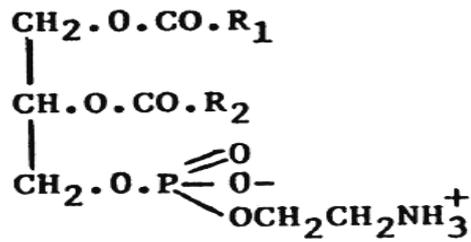
In liver : prevent accumulation of fat in liver(fatty liver).

TG    lecithin , choline → phospholipid

### Functions of choline:

1. prevent accumulation of abnormal amount of fat in the liver.
2. choline is a constituents of acetyl choline which is important in the transmission of nerve impulses.

**b. phosphatidyl ethanol amine (cephalin) :**



F.a + glycerol + phos.acid + ethanol amine

present : in liver , muscles, erythrocytes .

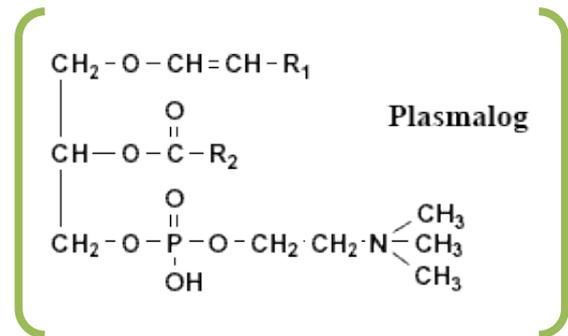
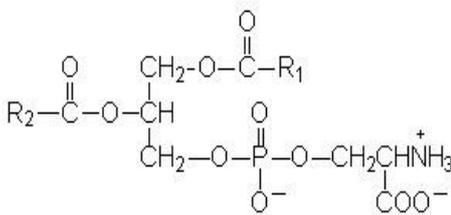
brain and nervous tissues are rich in cephalin.

**Functions:** 1. important in clotting of blood.

2. sources of phos. acid for formation of new tissues.

**c. Phosphatidyl serine(cephalin):**

phospholipid contain amino acid serine in place of ethanol amine.



**d. Plasmalogen:** 10% of total phospholipids are concentrated in brain, nervous tissues, muscle and mitochondria.

The nitrogen base is choline or ethanolamine

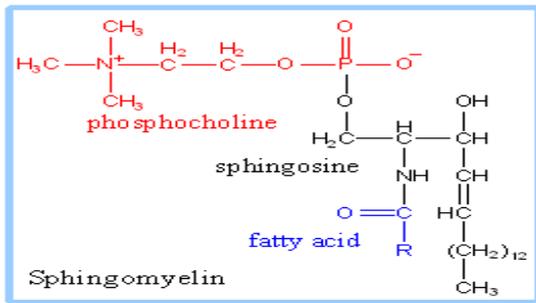
**4-Plasmalogens:**

- **Definition:** Plasmalogens are found in the cell membrane phospholipids fraction of brain and muscle (10% of it is plasmalogens), liver, semen and eggs.
- **Structure:** Plasmalogens resemble lecithins and cephalins in structure but differ in the presence of  **$\alpha,\beta$ -unsaturated fatty alcohol** rather than a fatty acid at C1 of the glycerol connected by ether bond.
- At C2 there is an unsaturated long-chain fatty acid, however, it may be a very short-chain fatty acid

**2. phosphosphingosides:** Ex: **sphingomyelin**

present in large quantities in brain , nervous tissues and in small amounts in other tissues.

consist of : F.a + sphingol alcohol + phos.acid +nitrogen base.



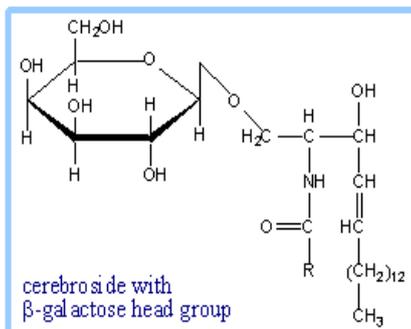
**Niemann – Pick disease** : inherited disorder of sphingomyelin metabolism , cause precipitation of sphingomyelin in liver , spleen and brain in large quantities called **lipid storage disease ( lipidosis )** .

**Glycolipids** : it is a compound lipids

**consist of** : **F.a + sphingol alcohol + glucose or galactose.**

**EX:** cerebrosides

**present:** in large quantities in brain especially in white matter and in nervous tissues.



### **Functions of Phospholipids:**

**1. Role in enzyme action:** Mitochondrial enzyme system involved in oxidative phosphorylation.

**2.Role in blood coagulation:** Conversion of prothrombin to thrombin by active factor.

**3.Role in lipid absorption in intestine:**

Lecithin lowers the surface tension of water and aids in emulsification of lipid water mixtures which help in absorption of lipids from gastrointestinal tract (GIT).

**4. Role in transport of lipids from intestine.**

**Exogenous T.G:** is carried as lipoprotein complex chylomicrons, in which phospholipid takes an active part.

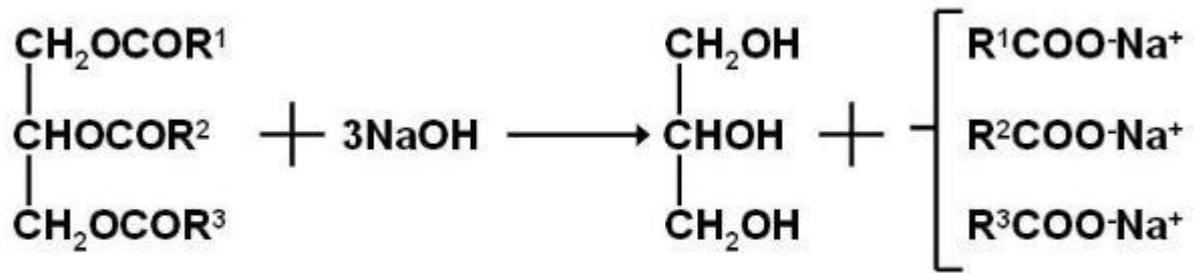
**5.Role in transport of lipids from liver.**

**Endogenous TG:** is carried from liver to various tissues as lipoprotein complex called very low density lipoprotein (VLDL).

**6. Lipotropic action of lecithin.**

Cholin in lecithin act as lipotropic agent prevent fatty liver formation.

## Equation of soap formation



A triglyceride + sodium hydroxide → glycerol + sodium carboxylates

### **Types and causes of Rancidity:**

1. Hydrolytic rancidity
2. Oxidative rancidity
3. Ketonic rancidity

#### **1-Hydrolytic rancidity:**

- It results from slight hydrolysis of the fat by lipase from bacterial contamination leading to the liberation of free fatty acids and glycerol at high temperature and moisture.
- Volatile short-chain fatty acids have unpleasant odor.