

الكيمياء الحياتيه  
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# Lipids

Lipids are organic substances present in plants and animals tissues .. Insoluble in water but soluble in organic solvents such as : ether, benzene, acetone and chloroform.

Chemically : lipids are defined as ester of glycerol with higher fatty acids.

Lipids include fats, oils, waxes and related compounds.

Fats       $\longrightarrow$       solid at room temperature

Oils       $\longrightarrow$       liquid at room temperature

# Presence

1. In cytoplasm
2. Cell wall (membrane)
3. Mitochondria
4. Nervous tissues
5. Store in adipose tissue as fuel

## Functions and importance of lipids

1. Major source of energy.
2. Important dietary constituents, it yields more energy per gram (9.5 cal/gm).
3. Compared with CHO and proteins give (4.0 cal/gm).
4. Some vitamins like A, D, E and K are fat soluble, therefore lipids are necessary for these vitamins.
5. Some lipids in diet supply the body with essential fatty acids for normal growth and healthy.
6. Electrical isolator layer of the body.
7. Formation of bile acid, steroid, hormones and Vit D3.
8. Activators of enzymes.

## Classification of lipids

Lipids are classified into three types:

### **A. Simple lipids :**

Define as esters of fatty acids with different alcohols

Ex : 1. **neutral fats**       $\longrightarrow$  triglycerides =  
triacylglycerol

Define as esters of fatty acids with glycerol

Fats       $\longrightarrow$       solid at room temperature

Oils       $\longrightarrow$       liquid at room temperature

## 2. Waxes

Define as solid esters of fatty acids with monohydroxy alcohols other than glycerol

Ex : \*cholesterol esters  $\longrightarrow$  present in the human body

\*Bees wax : palmitic acid ester of myricyl alcohol

\*Lanoline ( wool fat ): ester of cholesterol

## B. Compound lipids

Define as fatty acid esters of different alcohols with other groups like CHO, phosphate, proteins and nitrogenous base.

Ex : 1. phospholipids consist of

Fatty acid + glycerol + phosphoric acid + nitrogen base

2. Glycolipids

Fa + alcohol ( shingol or sphingosine ) +CHO

Ex : cerebroside and ganglioside

3. Lipiproteins

Fa + alcohol + proteins

4. Sulfolipids ( sulfatides )

Lipids possess sulfate groups present in largely amount in white matter of brain and in less amount in kidney, liver, tests and salivary gland

### c. Derived lipids

Derived from simple or compound lipids by their hydrolysis.

Ex : F.a , glycerol, sterols and alcohols (cholesterol)

#### **Neutral lipids**

1. Triglycerides or triacylglycerol.
2. Cholesterol and cholesterol esters ( called neutral lipids because they are uncharged ).



## Fats

Fats are esters of fatty acid with glycerol

**\*Fats classified into :**

1. Triglyceride.  
consist of : 3 fatty acid + glycerol molecule
2. Diglyceride.  
containing of : 2 F.a + glycerol molecule
3. Mono glyceride.  
consist of : 1 F.a + glycerol molecule

## Fats stored in:

1. Mitochondria oxidized to give energy
2. Fat stored in adipose tissue under the skin → thermal isolator layer
3. Fat stored in adipose tissue around internal organs acts as →  
shock absorbing cushions

## Physical properties

1. Neutral fats are colorless, odorless and tasteless substances. The color and taste of some naturally fats due to presence of carotene and xanthophyll pigments in the diet.
2. Insoluble in water but soluble in organic solvents like benzene, ether, acetone .....
3. Have low specific gravity less than 1.0 hence float on water.
4. Solid fat have high melting point because contain higher saturated F.a so it remain solid at room temp. while oil fats contain lower unsaturated F.a so it have lower melting points hence remain liquids at room temp and called oils .