

Structure and Classification of Fats
(Part I)

By

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Fats are diverse forms of compounds soluble in nonpolar solvents, such as Benzene, chloroform, acetone and ethanol, but insoluble in polar solvents such as water. Basically, they are esters of fatty acids with alcohols but may also possess other compounds such as phosphate, inositol and N-containing bases, monosaccharides and Sialic acids. The fatty acids of lipids may be saturated or unsaturated with different lengths of Carbon chains. The alcohol is mainly glycerol but long chain alcohols, cetyl alcohol, myristyl alcohol, or long chain unsaturated amino alcohol and sphingosine are also found. Lipid fats form important constituents of membrane system of cells. They are also carriers of fat soluble vitamins (A, D, E and K) with food. They are stored as form of energy but an dynamic is catabolized as 20% of them is used and replaced everyday. It provides higher caloric energy (9 Cal gm⁻¹)

Compared to Carbohydrate (6 Calg⁻¹). Subcutaneous deposits of fats act as heat insulators and help in maintaining body temperature in poikilotherms. The myelin sheath of nerve fibres is formed of lipid, which helps in the propagation of nerve impulse. Defect in lipid metabolism leads to obesity, coronary heart disease, blood pressure, Ketoacidosis, atherosclerosis and so on.

Classification of Fats

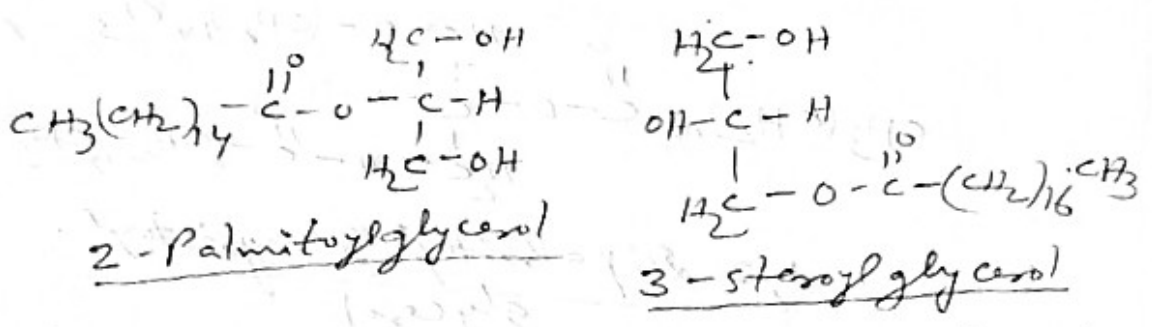
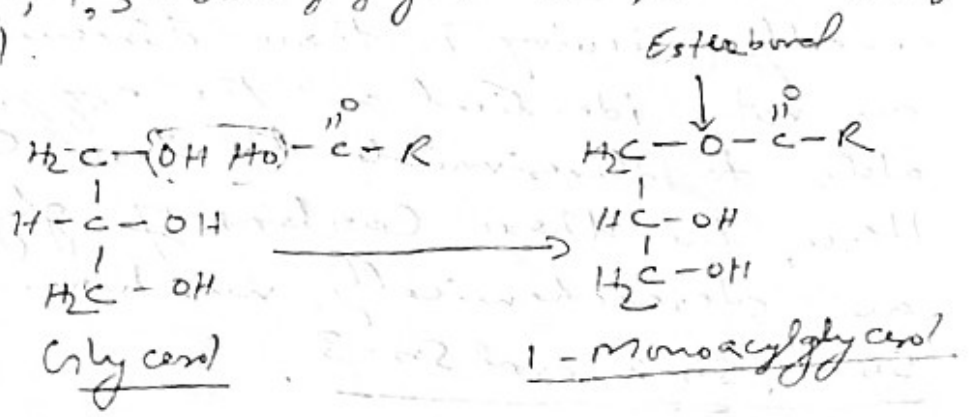
Fats have been classified into two categories —

- 1 Simple Fats and
 - 2 Compound Fats
- 1 Simple Fats → Simple fats are esters of fatty acids with alcohol and are free of any other compound. These are again of two types —

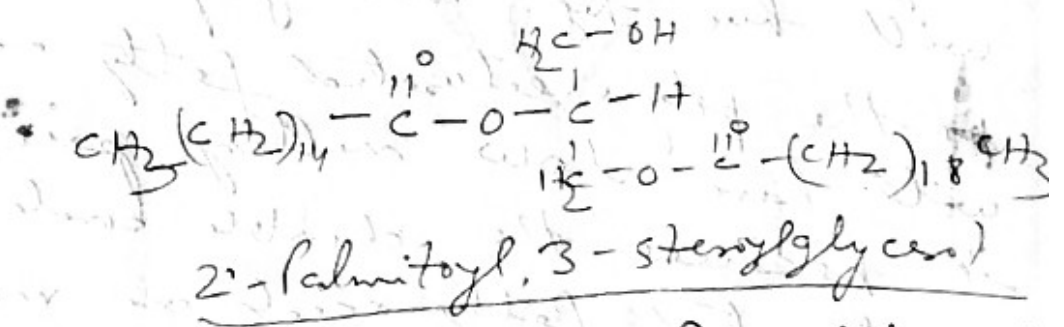
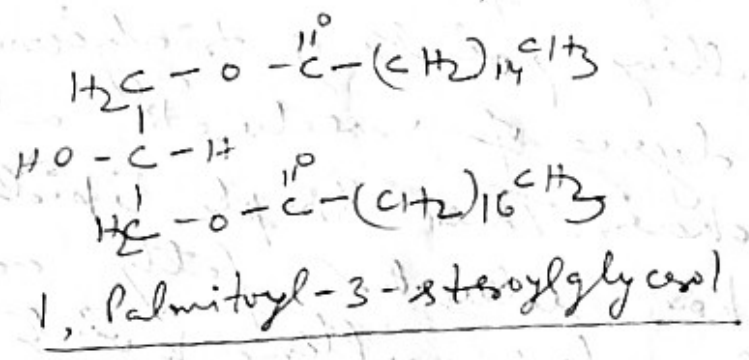
A Acylglycerols and B Waxes.

A Acylglycerols — They are esters of fatty acids with trihydric alcohol glycerol. An acylglycerol is called a fat, if it is solid at room temperature and named oil, if it is liquid at room temperature. When alcoholic group of glycerol forms an ester bond with carbonyl group of fatty acid, an acylglycerol is formed. Depending on the number of fatty acids forming ester bonds with one, two or three carbons of glycerol, the acylglycerols are named monoacyl, diacyl, or

triacylglycerols. respectively. The monoacylglycerols may be 1-monoacyl, 2-monoacyl, or 3-monoacyl glycerol depending on the specific carbon to which the fatty acid is linked. Likewise, diacylglycerols are named 1,2-diacylglycerol, 1,3-diacylglycerol or 2,3-diacylglycerol.

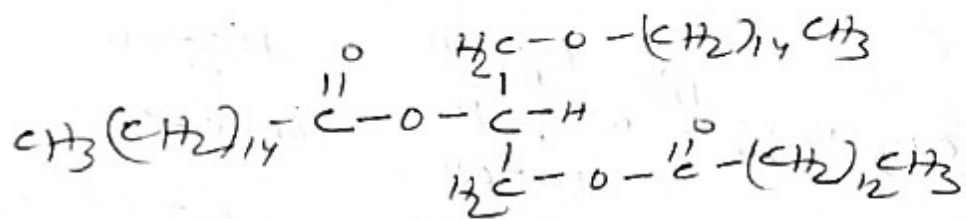


Some examples of Monoacylglycerols



Some examples of Diacylglycerols

likewise, triacylglycerols are also of different types depending on the types of fatty acids and the specific carbons to which they are linked. One may assume grossly that C-1 and C-3 are identical but stereochemically (viewing in three dimensions). They are not identical and the enzymes are able to discriminate the two carbons. Hence, the three carbons of glycerol are stereochemically numbered as Sn-1, Sn-2 and Sn-3.



1,2-Dipalmitoyl 3-myristoyl glycerol

[Example of a triacylglycerol]

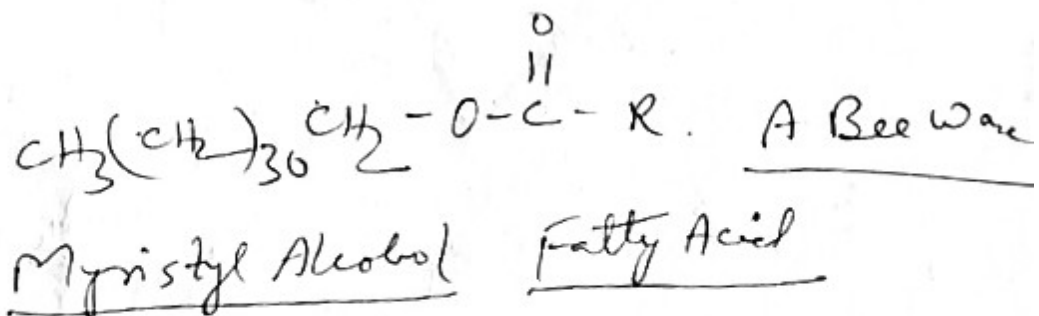
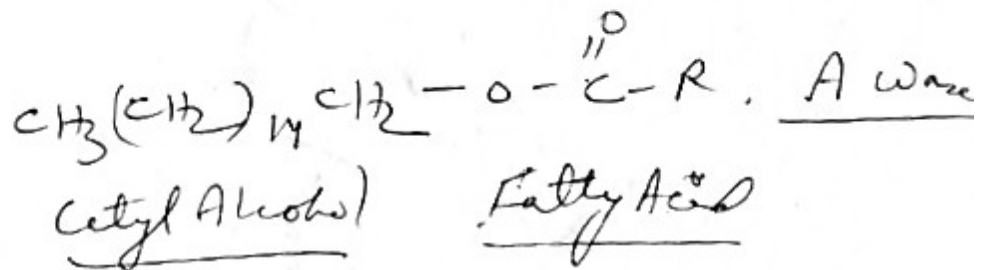
The melting point of triacylglycerol depends on the degree of unsaturation and length of the chains. Thus simple lipids with long chains saturated fatty acids will have high melting points and the polyunsaturated fatty acids will have low melting points. This is because the double bond in unsaturated fatty acids is mostly in *cis* nature. And thus the fatty acid can bend at different points

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depending on the position of double bond. Different molecules of lipids with even length chains are unable to assemble cohesively thus disperse at low temp. Contrary to it, long chain fatty acids without double bonds are linear molecules and are able to assemble cohesively and thus require higher temp. to disperse. Triglycerols are primarily storage form of lipids and are used as energy source. They also perform other functions. Such as subdermal insulation and maintaining body temperature and subdermal cushioning as protection against external injury. They also provide buoyancy in aquatic environment.

B. Waxes

Waxes are esters of fatty acids with long chain monohydric alcohols. such as Cetyl Alcohol and Myristyl alcohol.



Structure of Waxes

Compound fats -- covered in Part II