B.Sc. Part III Zoology (Hons) Paper V

1.3 Structure & Classification of Fats

Fats are diverse forms of compounds soluble in nonpolar solvents, such as benzene, chloroform, acetone and ethanol, but are 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. The fatty acids, the smaller unit of fats may be saturated or unsaturated with different lengths of Carbon Chain.

They 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 storage forms of energy but are dynamic in status as 20% of them is used and replaced everyday. It provides higher calorie of energy ($9 cal g^{-1}$) as compared to Carbohydrates ($6 cal g^{-1}$). Subdermal deposits of lipids act as heat insulator and help in maintaining body temperature in Poikilotherms. The myelin sheath of nerve fibre is formed of lipid, which

helps in the propagation of nerve impulse. Defect in fat metabolism leads to obesity, coronary heart disease, blood pressure, ketonuria, atherosclerosis and so on.

Classification of lipids or fats

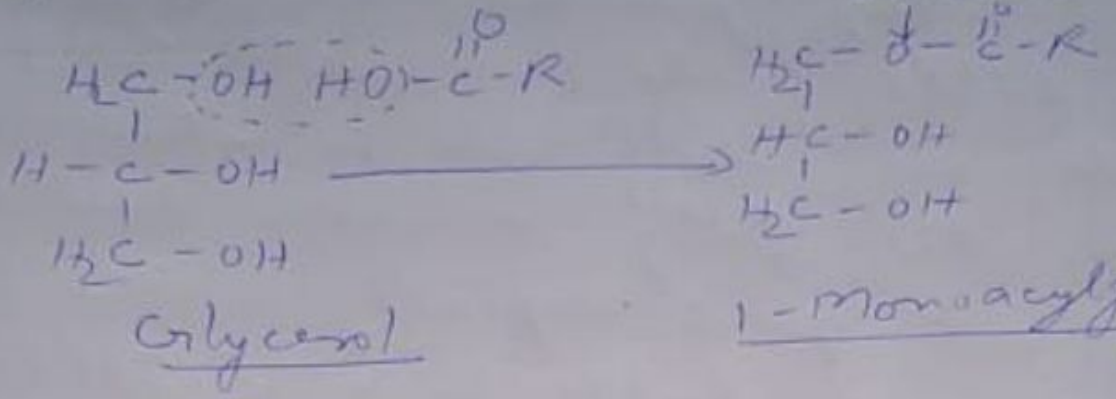
Lipids have been classified into two categories —

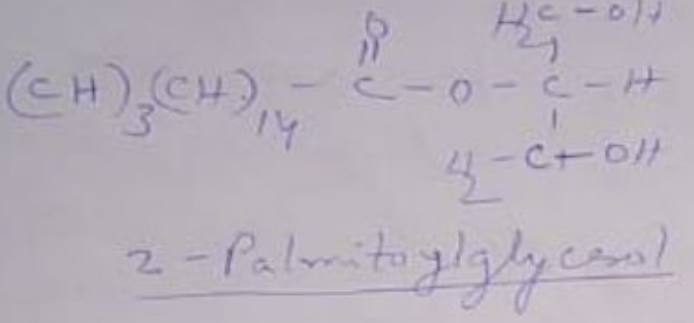
1. Simple lipids or fats
2. Compound lipids or fats

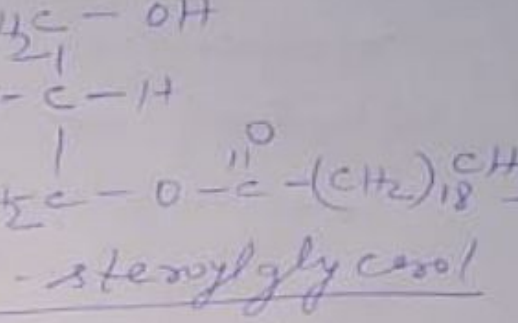
1. **Simple lipids** — Simple lipids or fats are ester of fatty acids with alcohols and are free of any other compounds. They have been classified into two categories - (A) Acylglycerols and (B) Waxes.

(A) **Acylglycerols** — They are esters of fatty acids with trihydric alcohol, glycerol. An acylglycerol is called a fat, if it is solid at room temp. and named oil. When alcoholic group of glycerol forms an ester bond with carboxyl group of fatty acid, an acylglycerol is formed. Depending upon the no. of fatty acids forming ester bonds with one, two or three carbons of glycerol, monoacylglycerols and diacylglycerols and triacylglycerols respectively are

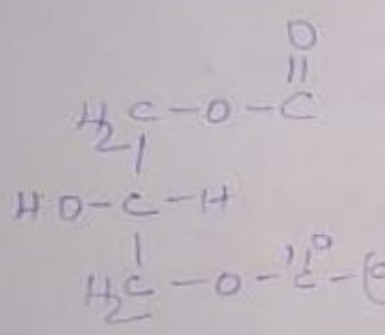
The monoacylglycerols may be 1-monoacyl, 2-monoacyl or 3-monoacylglycerol depending on the specific carbon to which the fatty acids is linked. Likewise, diacylglycerols are named 1,2-diacylglycerol, 1,3 diacylglycerol or 2,3-diacylglycerol.

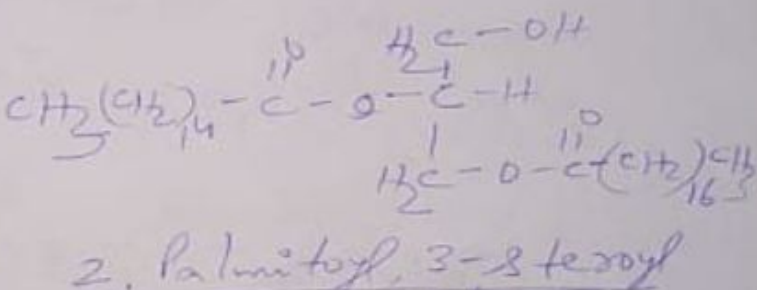






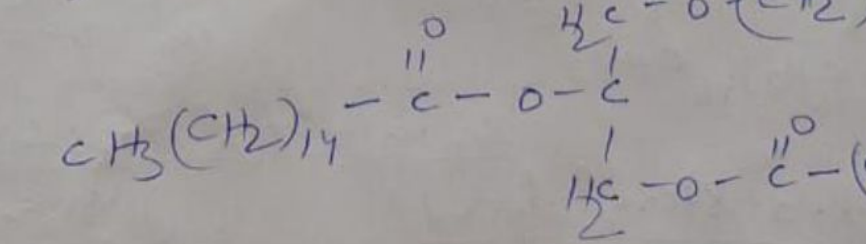
Some examples of Monoacylglycerols



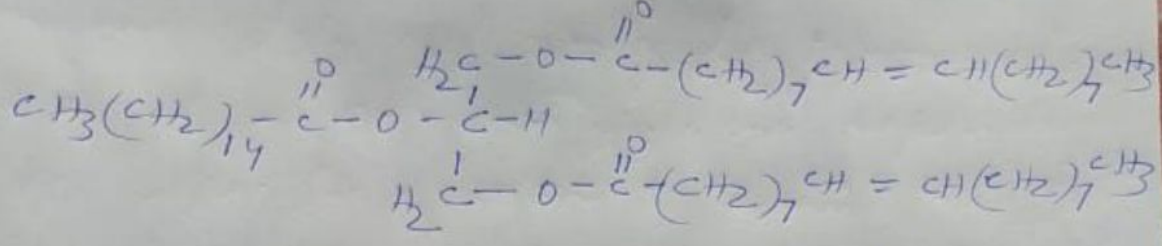


Likewise, triacylglycerols are also of different types, depending on the types of fatty acids to specific carbons to which they are linked.

The melting points of triacylglycerol depend on the degree of unsaturation and length of the chain. Thus, Simple lipids with long chain saturated fatty acids will have high melting point and the poly unsaturated fatty acids will have low melting point. This is because the double bonds in unsaturated fatty acids are mostly cis in nature and thus the fatty acids are bend at different point depending on the positions of double bonds. Different molecules of lipids with such bend chains are unable to assemble cohesively and 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 high temp. to disperse.



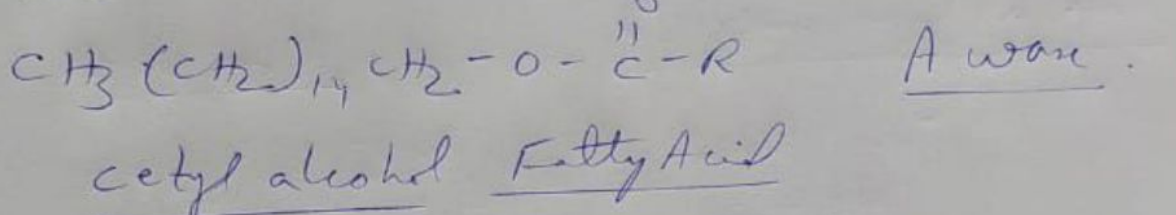
1. 2 - Dipalmitoyl - 3 - myristoylglycerol



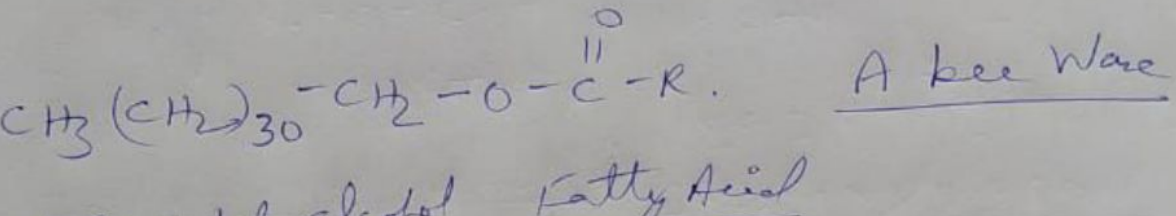
1.3-Dioleoyl-2-palmitoylglycerol

Structure of Some of triacylglycerols

3. **Waxes** → Waxes are esters of fatty acids with long chain monohydric alcohols such as cetyl alcohol and myristyl alcohol.



Cetyl alcohol Fatty Acid — A wax.



Myristyl alcohol Fatty Acid — A bee Wax

Structure of Waxes

I **Compound lipids or Fats** - Compound lipids are esters of fatty acids with glycerol or sphingosine. They also possess other compounds such as phosphate, along with one N-containing base or inositol. Some Compound lipids possess mono [illegible] in place of phosphate

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