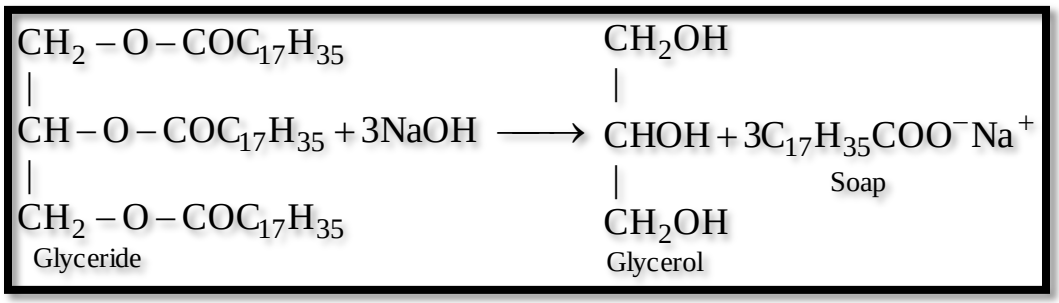
Carbon & its Compounds
Soaps& Detergents

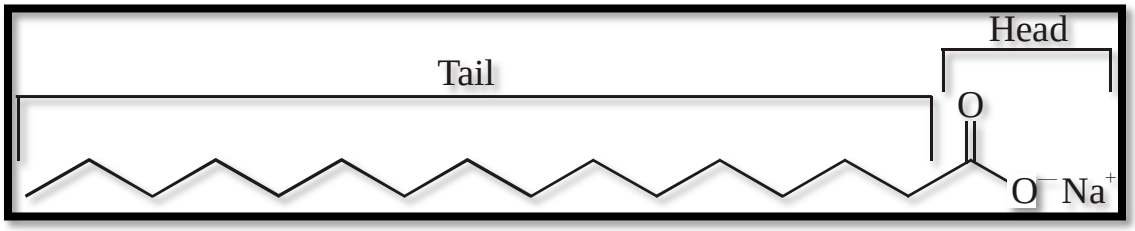
SOAPS AND DETERGENTS:

Soaps are sodium or potassium fatty acids salts, produced from the alkaline hydrolysis of fats (higher fatty acids) in a chemical reaction called saponification. They are of biological origin. Each soap molecule has a long hydrocarbon chain, sometimes called its 'tail', with a carboxylate 'head'. In water, the sodium or potassium ions float free, leaving a negatively-charged head.

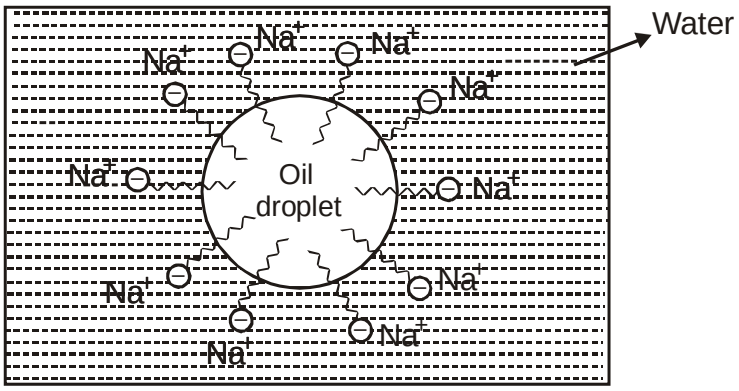


Before dealing with cleaning action or soap let as understand few points:

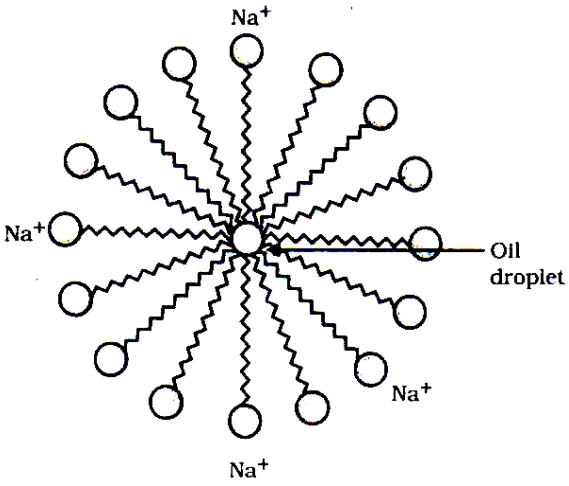
- The salts or fatty acids have an ionic polar head group, the carboxylate and a long non-polar hydrocarbon chain.



- The polar group is hydrophilic (i.e. water-loving), the non-polar portion is hydrophobic (i.e. water-hating) or liophilic.
- As a result aqueous solutions of this type of compound tend to form ordered aggregatcs such as micelles and bilayers.
- Here the polar groups are exposed to the water and the hydrocarbon portions are “buried” within the core, away from the water.



Use of sodium salt of long chain carboxylic acids (Soap) as cleaning agent



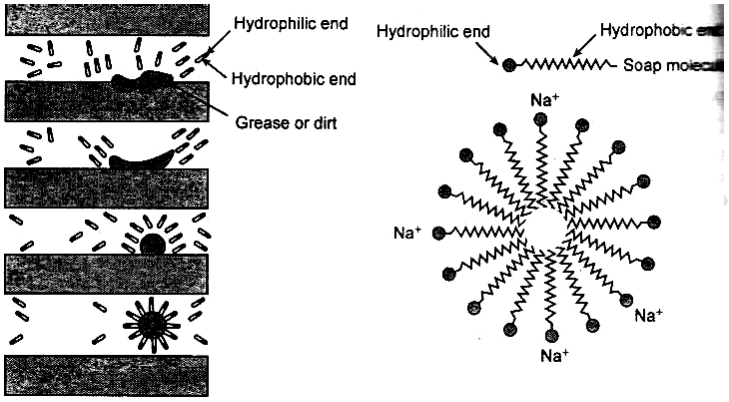
Formation of micelles

This Activity demonstrates the effect of soap in cleaning. Most dirt is oily in nature and as we know, oil does not dissolve in water. The molecules of soap are sodium or potassium salts of long-chain carboxylic acids. The ionic-end of soap dissolves in water while the carbon chain dissolves in oil. The soap molecules, thus form structures called micelles where one end of the molecules is towards the oil droplet while the ionic-end faces outside. This forms an emulsion in water. When we rub the cloth dirt particles with micelle leave the surface of cloth and it become clean thus the soap micelle thus helps in dissolving the dirt in water and we can wash our clothes clean.

MICELLES :

Soaps are molecules in which the two ends have differing properties, one is hydrophilic, that is, it dissolves in water, while the other end is hydrophobic, that is, it dissolves in hydrocarbons.

When soap is at the surface of water, the hydrophobic 'tail' of soap will not be soluble in water and the soap will align along the surface of water with the ionic end in water and the hydrocarbon 'tail' protruding out of water.



EFFECT OF SOAP IN CLEANING

Inside water, these molecules have a unique orientation that keeps the hydrocarbon portion out of the water. This is achieved by forming clusters of molecules in which the hydrophobic tails are in the interior of the cluster and the ionic ends are on the surface of the cluster. This formation is called a micelle. Soap in the form of a micelle is able to clean, since the oily dirt will be collected in the centre of the micelle. The micelles stay in solution as a colloid and will not come together to precipitate because of ion-ion repulsion. Thus, the dirt suspended in the micelles is also easily rinsed away. The soap micelles are large enough to scatter light. Hence a soap solution appears cloudy.

DETERGENT

Have you ever observed while bathing that foam is formed with difficulty and an insoluble substance (scum) remains after washing with water? This is caused by the reaction of soap with the calcium and magnesium salts, which cause the hardness of water. Hence you need

to use a larger amount of soap. This problem is overcome by using another class of compounds called detergents as cleansing agents. Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids. The charged ends of these compounds do not form insoluble precipitates with the calcium and magnesium ions in hard water. Thus, they remain effective in hard water. Detergents are usually used to make shampoos and products for cleaning clothes.