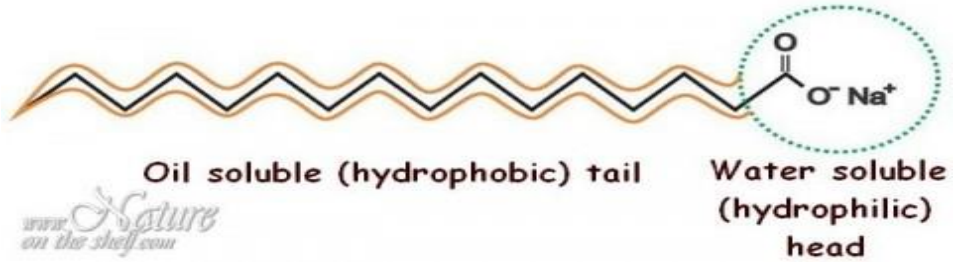
Notes on surfactant, micelle formation and electrical double layer

Prepared by *NIRMAL DAS*

SURFACTANTS OR SURFACE ACTIVE AGENTS

Surfactant is a surface active agent which has very interesting behaviour on surface and interfaces . They lower the surface tension between the different faces and can be emulsified the detergents, forming the agent. They are having the property of amphiphilic where the molecule is composed on the non polar hydrophobic portion and a polar hydrophilic portion. The hydrophobic parts are usually elongated chain which is also called tail and hydrophilic polar portion is called head.



Surfactant or surface active agent has the capacity aggregate in a solution under specific environmental condition. The aggregation process is depend on the amphiphilic species in which they absorb. The narrow concentration range over which many physiochemical properties changes occur is called critical micelle concentration (CMC) and the molecules aggregates above the critical micelle concentration (CMC) area are called micelle. They are dynamic equilibrium with monomer in solution. (The no. Of surfactant monomer required to form micelle is called aggregation)

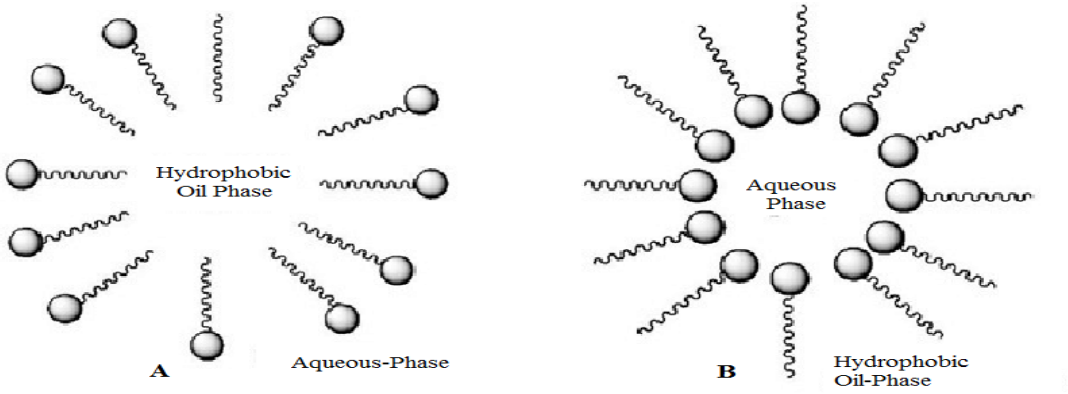


Fig: Normal micelle (A) and reverse micelle (B)

REVERSE MICELLE

In non polar solvent the hydrophilic head groups were exposed to the surrounding solvent energetically unfavourable that giving rise to water in oil system . In this case the hydrophilic group are sequestered in the micelle core and the hydrophobic group extent away from the centre . This inverse micelle are proportionally less likely to form on increasing charge on head group since hydrophilic group sequestered are highly unfavourable electrostatic interaction.

REASON OF MICELLE FORMATION

The main reason for micelle formation is the attainment of the minimum free energy state. The main driving force for the entropy that occur when hydrophobic surfactant reagent remove from water molecule and other

structure of the water molecules are remove or lost

STRUCTURE OF MICELLE

Structure of micelle formed by ionic surfactant consists of—

(a) A hydrophobic core (non-polar core) : It is composed of the hydrocarbon chain of surfactant molecule.
(b) A stern layer surrounding the core which is concentric shell of hydrophilic head group with (1-α)N and counter ions where α is the degree of ionisation and N is the aggregation number.

(c) Gouy-Chapmann electric double layer: Surrounding the stern layer which is diffused layer containing the α and counter ions required to neutralise the charged on the micelles. The thickness of double layer is depend on the ionic strength of solution and its gravity compressed in the electrolyte.

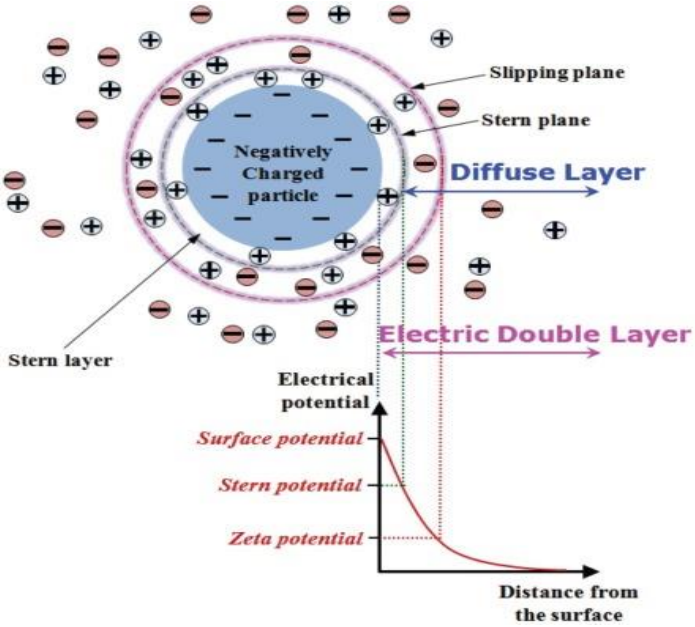


Fig: stern layer and Gouy-chapman layer is shown in ionic micelle.

Micelle formed by ionic surfactant is larger than ionic counter part and may sometime be elongated in an ellipoid or rod-like structure.