Surface Chemistry

Thomas Graham (1861) studied the process of diffusion of dissolved substances through a parchment paper or an animal membrane. He divided substances into two classes: (i) crystal-loids and (ii) colloids. Substances like sugar, urea, common salt, etc. which readily passed through the membrane while in the dissolved state were called crystalloids. Substances like starch, glue, gelatine, etc., which in the dissolved state either do not pass at all or pass through very slowly are called **colloids.**

This arbitrary division of substances into crystalloids and colloids was soon proved to be wrong since a crystalloid could behave as a colloids under different conditions and vice versa. For example, common salt, a typical crystalloid in an aqueous solution, behaves as a colloid in the benzene medium while soap, a typical colloid in water behaves as a crystalloid in alcohol. A 'colloidal substance', therefore, does not represent a separate class of substances. We now speak of the colloidal state of matter into which every substance can be obtained by a suitable method. The nature of the substance whether colloid or crystalloid depends upon size of the solute particles. When the size of the solute particles lies between 1 to 1000 nm, it behaves as a colloid. On the other hand, if size of solute particles is greater than 1000 nm, it exists as suspension and if particle size is less than 1 nm, it exists as true solution and behaves like a crystalloid. Thus, colloid is not a substance but is a particular state of the substance which depends upon size of its particles. The colloidal state is intermediate state between true solution and suspension.
It may be noted that a colloidal solution is heterogeneous in nature and always consists of at least two phases; the disperse phase and the dispersion medium.

Disperse phase. It is the component present in small proportion and consists of particles of colloidal dimensions (1-1000 nm).

Dispersion medium. The medium in which colloidal particles are dispersed is called dispersion medium. In a colloidal solution of sulphur in water, sulphur particles constitute disperse phase and water constitutes dispersion medium.
The two phases, namely dispersed and dispersion can be solid, liquid or a gas. Thus, different types of colloidal solutions are possible depending upon the physical state of the two phases. It should be borne in mind that gases between themselves cannot form a colloid due to their property of diffusion to give homogeneous mixtures.

Lyophilic and Lyophobic sols

Depending upon the interaction between the disperse phase and the dispersion medium, the colloidal solutions are classified into two types:
1. Lyophilic sols; and 2. Lyophob'ic sols.

1. Lyophilic Sols

In this type of colloidal solutions, the disperse phase has great affinity for the dispersion medium. In such colloids, the dispersed phase does not get easily precipitated and the sols are quite stable. The solids obtained after evaporation may be reconverted to the sol state by simply agitating them with the dispersion medium. Examples of lyophilic sols include sols of gum, gelatine, starch, proteins and certain polymers in organic solvents. Such sols are called reversible sols. If water is the dispersion medium, these are called hydrophilic sols.

2. Lyophobic Sols

In this type of sols, disperse phase has little affinity for the dispersion medium. These sols are relatively less stable than lyophilic sols. These sols are easily precipitated (or coagulated) on the addition of small amounts of electrolytes, by heating or by shaking. These are irreversible as their precipitated mass cannot be brought back into the colloidal state by simply shaking them up with the dispersion media. Examples of lyophobic sols include sols of metals, and their insoluble compounds like sulphides and oxides. They need stabilizing substances for preservation. If water is the dispersion medium, these are known as hydrophobic sols.