A colloid is not a substance, but it depicts a particular state of a substance that depends upon the size of its particles. The size of a particle in a colloidal system is between 1-100 nm. A colloidal system is a two phase heterogeneous system in which one phase is called the dispersed phase and the other is called the dispersion medium.

Dispersed phase: It is the component present in a small proportion.

Dispersion medium: It is the component present in excess.

For example, in a colloidal solution of silver in water, silver is the dispersed phase and water is the dispersion medium.

How do we classify colloids?

Based on the physical state of the dispersed phase and dispersion medium, colloids can be classified into different types.

One important class of colloidal system is sols. In sols, the dispersed phase is solid and dispersion medium is liquid.

Depending upon the nature of the interaction between the dispersed phase and dispersion medium sols can be classified into two types.

1. Lyophilic sols
2. Lyophobic sols

What are Lyophilic Sols?

The word meaning of lyophilic means ‘liquid-loving’ or ‘solvent- attracting’. This means that in this colloidal solution there is a strong attraction between the dispersed phase and dispersion medium, i.e., the dispersed phase has great affinity for the dispersion medium that results in the extensive solvation of the colloidal particles. In such solids, the dispersed phase does not easily precipitate and the sols are quite stable. These sols are reversible in nature. The dispersed phase obtained by the evaporation can be easily converted to the sol state by simply agitating it with the dispersion medium. Additional stabilisers are not required during their preparation. If water is used as the dispersion medium, lyophilic sols are called hydrophilic sols. Starch, gum, gelatin, egg albumin etc. are examples of lyophilic sols.

- **Starch Sol**

Starch forms lyophilic sol when water is used as the dispersion medium. The formation of sol is accelerated by heating. Starch sol can be prepared by heating it and water at 100 °C. It is quite stable and is not affected by the presence of any electrolytic impurity.

- **Gum Sol**

Like starch, gum also form lyophilic sol with water. Instead of boiling water, warm water is used to for the preparation of sol because gum is quite soluble in warm water.

- **Egg Albumin Sol**

Egg albumin which is obtained from eggs forms lyophilic sol with cold water. The sol is quite stable and is not affected by the presence of traces of impurities.

What are Lyophobic Sols?

The word lyophobic means 'liquid-hating'. That means in these sols, there is little or no interaction between the dispersed phase and the dispersion medium ie, dispersed phase has little affinity for dispersion medium. These sols are easily precipitated by the addition of small amounts of electrolyte, by heating or by shaking, therefore these sols are relatively less stable than lyophilic sols. They need stabilising agents for their preparation. If water is used as the dispersion medium, lyophobic sols are called hydrophobic sols. Examples of lyophobic sols include sols of metals and their insoluble compounds like sulphides and oxides.

- Ferric Hydroxide Sol

Ferric hydroxide forms lyophobic sols on treatment with water. Ferric hydroxide sol is prepared by the hydrolysis of ferric chloride with boiling distilled water. The reaction takes place is as follows.

$$\underset{\text{Ferric chloride}}{FeCl_3(aq)} + 3H_2O(l) \xrightarrow{\text{Boil}} \underset{\text{Red sol}}{Fe(OH)_3(S)} + 3HCl(aq)$$

The hydrolysis reaction produces insoluble ferric hydroxide particles which undergo agglomerisation to yield bigger particles of colloidal dimensions. These particles absorb Fe3+ ions preferentially from the solution to give positive charge to the sol particles. Stability of sol is due to the charge on the sol particles. Hydrochloric acid produced during hydrolysis must be removed from the sol because it destabilizes the sol. HCl can be removed from the sol by dialysis process otherwise sol will not be stable.

- Aluminium Hydroxide Sol

It is also hydrophobic in nature and is obtained by the hydrolysis of aluminium chloride.

$$\underset{\text{Aluminium chloride}}{AlCl_3(aq)} + 3H_2O(l) \xrightarrow{\text{Boil}} \underset{\text{White sol}}{Al(OH)_3(s)} + 3HCl(aq)$$

Hydrochloric acid produced during the hydrolysis is removed by dialysis because aluminium hydroxide sol is affected by the presence of ionic impurities.

- Arsenious Sulphide Sol

It is a lyophobic sol obtained by the hydrolysis of arseniuos oxide with boiling distilled water, followed by passing H_2S gas through it.

$$\underset{\text{Aresenious Oxide}}{As_2O_3(aq)} + 3H_2O(l) \xrightarrow{\text{Boil}} \underset{\text{Aresenious hydroxide}}{2As(OH)_3(s)}$$

$$2As(OH)_3(s) + 3H_2S(g) \rightarrow \underset{\text{Yellow sol}}{As_2S_3(s)} + 6H_2O(l)$$

Comparison between Lyophilic and Lyophobic sols

Lyophilic Sol	Lyophobic Sol
Relatively stable as strong force of interaction exists between dispersed phase and dispersion medium	Less stable as weak force of interaction exists between dispersed phase and dispersion medium.
Can be prepared directly by mixing dispersed phase with dispersion medium.	Cannot be prepared directly by mixing dispersed phase and dispersion medium.
No need of stabilisers during preparation.	Additional stabilisers are required during preparation.
They are reversible in nature.	They are irreversible in nature.
These are usually formed by organic substances like starch, gum, proteins etc.	These are usually formed by inorganic materials like metals and their oxides, sulphides etc.
They are highly viscous and have higher viscosity than that of the medium.	They have nearly the same viscosity as that of the medium.
They are highly hydrated.	They are not much hydrated.
Particles cannot be detected even under an ultramicroscope.	Particles can be detected under an ultramicroscope.
Charge on the lyophilic sol can be postive, negative or netural.	Charge on the lyophobic sol can be postive or negative. As_2S_3 sol is -ve and $Fe(OH)_3$ sol is +ve in nature.
Depending on the charge, their particles migrate to either direction of an electric field.	Depending on the charge, their particles migrate only in one direction of an electric field.
Surface tension is usually lower than that of the dispersion medium.	Surface tension is nearly the same as that of the dispersion medium.