COLLOIDAL STATE

INTRODUCTION: Thomas Graham originally classified all substances in two group-

1. Crystalloids: These substances can easily be obtained in the crystalline from and their solution can diffused rapidly through a vegetable or animal membrane [eg; parchment membrane] eg. Sugar, urea, salts, acids etc.
2. Colloids: The substances which deffued slowly through membrane were called colloids, eg. Gelatin, albumin, glue, gums, starch etc. The term colloids obtained from Greek word "KOLLA" meaning glue –like.

This classification of substance is not always convenient.

These are substances which behave like colloids in some solvents and like crystalloids in others. For example, sodium chloride behaves as a crystalloid when dissolved in water but fields a colloidal solution when dissolved in benzene.

" Colloidal state of matter is, therefore a state in which the size of the particles is such 10 A – 1000 A that they can pass through filter paper but not through animal membrane.

Difference between suspension, colloidal sol and True solution-

The particle size of suspension is range from 10^{-3} - 10^{-5} cm. eg. Clay+water. The diameter of particle size of colloidal solution us 10^{-4} – 10^{-7} cm

eg glue, gum gelatin etc. The diameter of particle size of true solution is 10^{-7}-10^{-8} cm. examples are sugar and water or salt and water.

Colloidal systems are heterogeneous in nature and consists of two phases A substance distributed in a solvent in the colloidal state is called Disperse Phase and the solvent itself is called the dispersion medium.

The disperse phase may not necessarily be a solid always. It may be a liquid or even a gas as well. Similarly , the dispersion medium may be a gas or a liquid or even solid. Thus , several different –types of colloidal systems are possible.

Types of colloid system:

S. N.	Dispersed	Dispersion medium	Name	Examples
1.	Solid	Solid	Solid Sol	Some Colloid glasses
2.	Solid	Liquid	Sol	Some Painto, muddy water
3.	Solid	Gas	Aerosol	Smoke dust
4.	Liquid	Solid	Gel	Chese ,Butter, jellies
5.	Liquid	Liquid	Emulsion	Milk, hair cream
6.	Liquid	Gas	Aerosol	Fog, Mist

7.	Gas	Solid	Solid foam	Pumice store
8.	Gas	Liquid	Foam	Frottn, whipped Cream
9.	Gas	Gas		

True Solution:

S. N.	Property	True Solution	Colloidal	Suspension
1.	Political size	< 10 A^0	10- 1000A^0	>1000 A^0
2.	Fillratablity	Pass Through ordinary filter paper as well as animal membrane	Pass through ordinary filter paper but not through animal membrane.	Do not pass through filter and animal membrane
3.	Settling	Do not settle	Do not settle	Settle on standing
4.	Visibility	Particles are invisible	Scattering of light by the particle is observed under ultra – microscope	Particles are visible to naked eye under a microscope.
5.	Diffusion	Diffuse quickly	Diffuse Slowly	Do notdiffuse
6.	Appearance	Clear and TransParent	Transluscent	Opagne.

CLASSIFICATION OF COLLOIDS- Colloids may be classified in to two categories-

1. Lyophilic or reversible colloids
2. Lyophobic irreversible colloids.

1. **Hyophilic or Reversible Colloids-** A colloidal system obtained readily on simple warming or shaking the substance with a suitable solvent is known as lyophilic colloid (lyo- liquid ; philic- love), eg, gelatin, starch, protein, gum, and rubber. Hyophilic colloids are also known as "Reversible Colloids" since on evaporating the dispersion medium the residue can again be easily reconverted in to colloidal state simply by addition of the liquid. These sols are quite stable and cannot be easily precipitated.

2. **Lyophobic colloids-** Colloids formed with difficulty are termed as lyophobic colloids (lyo-liquid,pholic-hate) such colloids are formed by substent like as $2S_3$,$Fe(OH)_3$, gold and other matals witch are sparingly soluble and thus their molecules do not pass readily into colloidal state. Lyopholic colloids are known as irreversible colloids since the residue (obtained by evaporating the disperser medium) can not readily be reconverted into SOC by ordinary means. These sols are readily precipitated and hence are not stable

Difference between lyophilic and lyophobic sols -

S.N.	Property	Lyophilic sols	Lyophobic sols
1	Reversibility	These are reversible	These are irreversible
2	Surface tension	Surface tension is usually lower than that of the dispersion medium.	Surface tension is of the same order as that of be dispersion medium
3	Viscosity	Viscosity is much higher than that of the dispersing medium.	Viscosity range is about the same as that of the dispersion medium.
4	Visibility	The particles cannot be readily detected even under ultra microscope..	The particles can be readily deducted under ultra microscope.
5	Action of electrolytes	Much large quantities of electrolytes are required to cause precipitation.	Addition of small quantities of electrolytes causes precipitation.
6.	Influence of electric field	The particles may or may not migrate under the influence of an electric field.	The particles migrate either to cathode or to anode under the influence of an electric field.
7.	Hydration	Ouring to the presence of a	The particles are not

		number of polar groups in the molecules the particles are appreciably hydrates.	hydrated to an appreciable extent

Solid dispersed in liquid (SOL)-

Preparation of colloids- The lyophilic sols can be readily prepared since colloidal materials, when added to water swell up and brake into matter of colloidal range. The lyopholic sols, however required special technique for their preparation.

[A] Dispersion methods:

1. **Mechanical Dispersion-** In this method the coarser particles are broken to smaller particles of colloidal size.
2. **Electrical dispersion-or Bredig's are method-** In an electric are is struck between two electrodes of a metal , like gold, silver, platinum or copper in water having traces of an alkali the metal is found to be converted into colloidal solution alkali act as stabilizers whole system was kept in ice both during preparation of colloid.
3. **Peptization–** Certain freshly formed precipitate can be converted in to colloidal solution by the addition of a small amount of a suitable electrolyte. An electrolyte having an ion in common with the material to be dispersed is required for sol formation. The peptization action is due to the preferential adsorption of one of the ions of the electrolyte by the particles of the material. The preferential adsorption of t e ion which is

more closely related chemically to the precipitate, the particles closely related chemically to the precipitate, the particles acquire a positive or a negative charge depending upon the charge on the ion adsorbed . Because of the presence of the same type of charge, the particles of the precipitate are pushed apart. The precipitate thus gets dispersed resulting in the formation of a stable sol. Eg. $Fe(OH)_3$ sol is obtained when a small quantity of $FeCl_3$ solution is added.