

#### **CLASSIFICATION BASED ON INTERACTION OF PHASES**

# LYOPHILIC AND LYOPHOBIC SOLS

Colloidal solutions in which the dispersed phase has considerable affinity for the dispersion medium, are called lyophilic sols (solvent - liking).

**For example:** Dispersion of gelatin, starch, gum and proteins in water. Colloidal solutions in which the dispersed phase has no affinity or attraction for the medium or for the solvent are called Lyophobic colloidal (Solvent hating) solutions.

## COMPARISON OF LYOPHOBIC AND LYOPHILIC SOLS

Property		Lyophilic sol (Emulsoid)	Lyophobic sol (suspensoid)
1.	Preparation	Can be easily prepared by shaking or warming the substance with solvent	Can not be prepared easily special methods are required
2.	Stability	are more stable	are less stable
3.	Reversibility	are reversible	are irreversible
4.	Viscosity	Viscosity is much higher than that of solvent	Viscosity is nearly same as that of the solvent
5.	Surface tension	Surface tension is usually low	Surface tension is almost same as that of solvent
6.	Hydration or solvation	These are highly solvated as the particles have great affinity for solvent	These are less solvated as the particles have less affinity for the solvent
7.	Charge	The particles have little charge or no charge at all	The particles carry a characteristic charge either positive or negative
8.	Visibility	Particles can not be seen under microscope	Particles can be seen under microscope

Property		Lyophilic sol (Emulsoid)	Lyophobic sol (suspensoid)
9.	Coagulation or precipitation	Precipitated by high concentration of electrolytes	Precipitated by low concentration of electrolytes
10.	Tyndall effect	Less Scattering	More Scattering
11.	Migration in electric field	May or may not migrate as they may or may not carry charge.	Migrate towards anode or cathode as these particles carry charge.
12.	General Ex.	Mostly or organic nature Ex. Gelatin, Starch, Gum, Albumin & Cellulose Solution	<b>Mostly of Inorganic nature</b> Ex. Transiton metal salt in water like Gold, As etc.

#### PEPTIZATION

The dispersion of a freshly precipitated material into colloidal solution by the action of an electrolyte in solution is termed as peptization. The electrolyte used is called a **Peptizing agent**.

**Hardy Schulze Rule:** This rule states that the precipitating effect of an ion on dispersed phase of opposite charge increases with the valency of the ion.

The higher the valency of the flocculating ion, the greater is its precipitating power. Thus for the precipitation of  $As_2S_3$  sol (-ve) the precipitating power of  $Al^{3+}$ ,  $Ba^{2+}$ , and  $Na^+$  ions is in the order  $Al^{3+} > Ba^{2+} > Na^+$ .

Similarly for preating  $Fe(OH)_3$  sol (positive) the precipitating power of  $[Fe(CN)_6]^3$ ,  $SO_4^{2-}$  and  $CI^-$  ions is in the order.

$$Fe(CN)_{6}]^{3-} > SO_{4}^{2-} > Cl^{-}$$

The minimum concentration of an electrolyte in milli moles required to cause precipitation of 1 litre sol in 2 hours is called FLOCCULATION VALUE. The smaller the flocculating value, the higher will be the coagulating power of the ion.

Flocculation value 
$$\alpha \frac{1}{\text{Flocculation power}}$$

### **GOLD NUMBER**

The number of milligrams of a hydrophilic colloid that will just prevent the precipitation of 10 ml of standard gold sol on addition of 1 ml of 10% NaCl solution is known as *Gold number* of that protector (Lyophilic colloid).

The precipitation of the gold sol is indicated by a colour change from red to blue when the particle size just increases.

The *smaller the gold number* of a protective Lyophilic colloid, *greater is its protection power*.



Gelatin and startch have the maximum & minimum protective power.

Protection Capacity  $\alpha \frac{1}{Protection Number}$ 

(Gold number)

# TYPES OF COLLOIDS ACCORDING TO THEIR SIZE

Multi Molecular	Macro Molecular	Associated colloids
Formation by aggregation of a large number of atoms or smaller molecules of substance.	Formation by aggregation of big size molecules. These are polymer with high molecular mass.	These are the substances which behave as normal electrolytes at low concentration but get associated at higher concentration and behave as colloidal solutions. These associated particles are also called micelles.
$Ex. \rightarrow Gold Sol (Au)$ Sulphur sol (S <sub>8</sub> )	Ex. → Starch, Cellulose, Protein etc.	Ex. → Soap & Detergent

# COMPARISON OF PHYSI-SORPTION AND CHEMI-SORPTION

	Physical Adsorption	Chemical Adsorption (Activated ad.)
1.	It is caused by intermolecular vander waal's forces.	It is caused by chemical bond formation.
2.	It is not specific.	It is highly specific.
3.	It is reversible.	It is irreversible.
4.	Heat of adsorption is low. (20–40) KJ/mol	Heat of adsorption is high. (80–240 KJ/mol)
5.	No appreciable activation is energy is involved.	High activation energy involved.
6.	If forms multimolecular layers on adsorbent surface.	If forms unimolecular layer under high pressure.

#### **Critical temperature increases**

#### **Ease of liquification increases**

Extent of adsorption increases (true for physisorption)

## **GENERAL CHARACTERISTICS OF CATALYSTS**

(i) A catalyst remains unchanged in mass and chemical composition but can change their physical state.

- (ii) Only a very small amount of catalyst is sufficient to catalyse a reaction.
- (iii) A catalyst does not initiate a reaction.
- (iv) Solid catalyst is more efficient when used in finely divided form.
- (v) generally catalyst does not change the nature of products.
- (vi) A catalyst does not change the equilibrium state of a reversible reaction but helps to achieve the equilibrium state or position of equilibrium in lesser time.
- (vii) The catalyst are generally specific in nature.
- (viii) Changes rate constant of reaction.
  - (ix) Does not change free energy of reaction.
  - (x) Participates in mechanism or reaction.

**Charge on colloidal particles:** Colloidal particles always carry an electric charge. The nature of this charge is same on all the particles in a given colloidal solution and may be either positive or negative. The charge is due to preferential adsorption of ions from solution.

#### Origin of charge on colloidal sol particles:

- Colloidal sol particles carry charge. Charge on sol particles may arise due to any of the following reasons : by friction, ionisation and adsorption.
- Colloidal sol particles adsorb their own ions from the solution and become charged, e.g., when KI is added to AgNO<sub>3</sub> solution, silver iodide, AgI is formed which adsorbs silver ions, Ag<sup>+</sup> and becomes positively charged.

 $AgI / I^+$ 

• However when AgNO<sub>3</sub> is added to potassium iodide solution, silver iodide is precipitated which adsorbs iodide ions from the solution and becomes negatively charged.

Positively Charged Sols	Negatively Charged Sols
Hydrated metallic oxides. e.g., $Al_2O_3 \cdot xH_2O$ , $Fe_2O_3 \cdot xH_2O$ , metal hydroxides, $Fe(OH)_3$ , $Al(OH)_3$ , basic dye stuff like Prussian blue, haemoglobin (blood).	Metals, e.g., Cu, Ag, Au, Metallic sulphides – e.g., $As_2S_3$ , CdS, acidic dyes like eosin, congo red, etc., sols of gelatin, gum, starch, etc.

AgI / I<sup>-</sup>

