**BP 403T. Physical Pharmaceutics-II (Theory)**

**Unit1 (Part II)**

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Unit -1. 7 hours.

**Colloidal dispersions:** Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

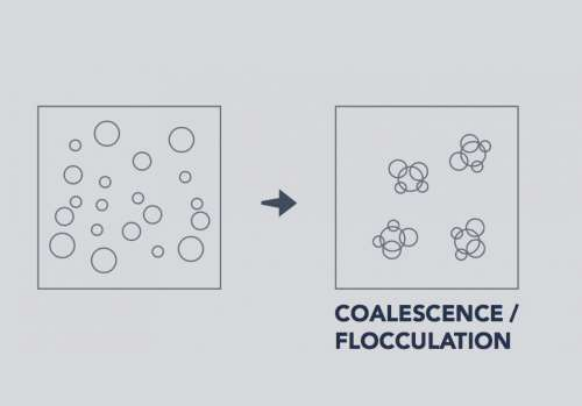
## STABILITY OF COLLOIDAL DISPERSIONS

- Stabilization serves to prevent colloids from aggregation.
- The presence and magnitude, or absence of a charge on a colloidal particle is an important factor in the stability of colloids.
- Two main mechanisms for colloid stabilization:

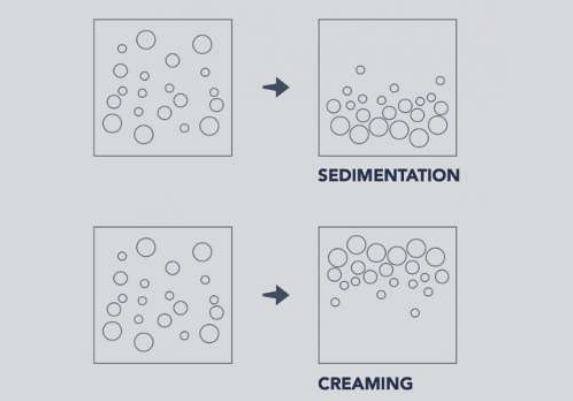
1-Steric stabilization i.e. surrounding each particle with a protective solvent sheath which prevent adherence due to Brownian movement

2-electrostatic stabilization i.e. providing the particles with electric charge

Colloidal stability relates to particle size change (e.g. aggregation or agglomeration). If particles are not subject to size variation, the dispersion is considered colloidally stable.




Gravitational stability refers to the ability of particles to resist particle migration (e.g. sedimentation or creaming) and mainly depends on the rheological properties of the colloidal dispersion such as viscosity and density of the continuous phase, size, and density of the particles. For diluted colloidal particles in a Newtonian fluid, this migration phenomenon can be described by Stokes law.

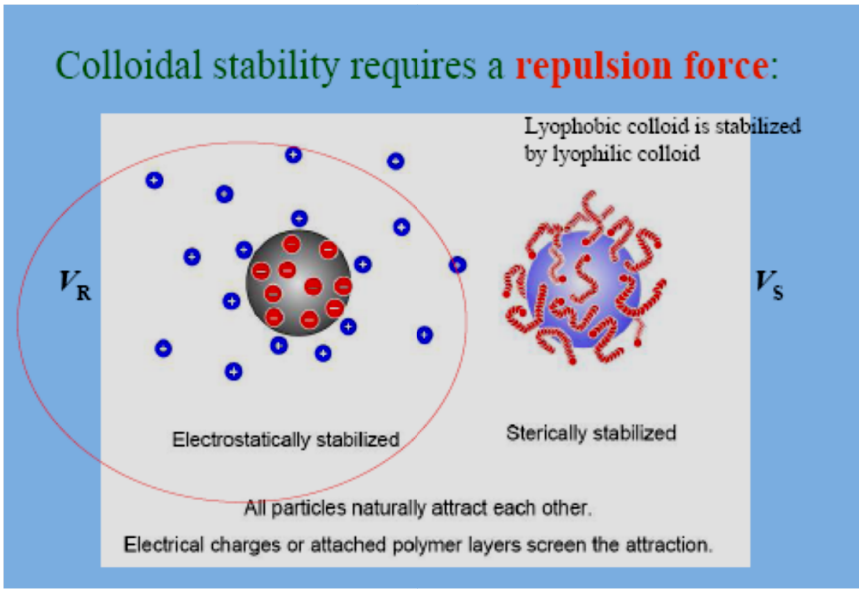



Electrophoretic light scattering (ELS) is a common technique used to evaluate the potential of dispersion to remain stable. ELS allows measuring zeta-potential of a dispersion, which provides information about electrostatic interactions and, by extrapolation, to their tendency to agglomerate. The zeta-potential is considered to be a reliable indicator of dispersion stability.

**Effect of electrolytes**

- The particles stabilized only by the presence of electrical charges on their surfaces through the addition of small amount of electrolytes.
- The like charges produce repulsion which prevents coagulation of the particles and subsequent settling.

Addition of electrolytes beyond necessary for maximum stability results in accumulation of opposite ions and decrease zeta potential, which results in coagulation and finally precipitation of colloids.



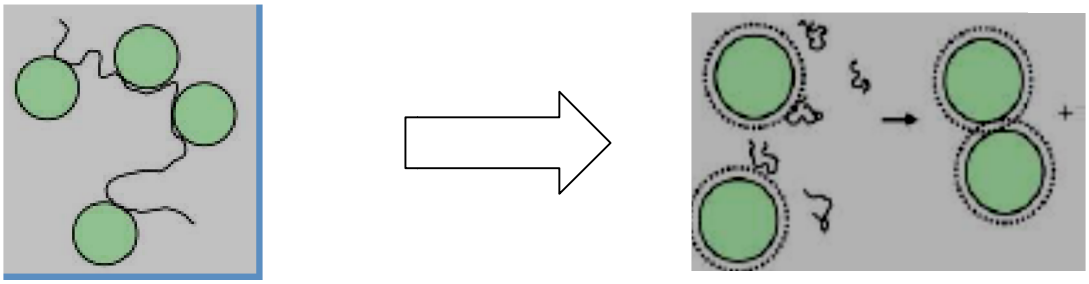

**Addition of large amounts of electrolytes**

- Anions arranged in a decreasing order of precipitating power: citrate > tartrate > sulfate > acetate > chloride> nitrate > bromide > iodide
- The precipitation power is directly related to the hydration of the ion and its ability to separate water molecules from colloidal particles.

**Coacervation:**

- Definition: the process of mixing negatively and positively charged hydrophilic colloids, and hence the particles separate from the dispersion to form a layer rich in the colloidal aggregates (coacervate)
- ***Sensitization****:* the addition of small amount of hydrophilic or hydrophobic colloid to a hydrophobic colloid of opposite charge tend to sensitize (coagulate) the particles.
- Polymer flocculants can bridge individual colloidal particles by attractive electrostatic interactions.

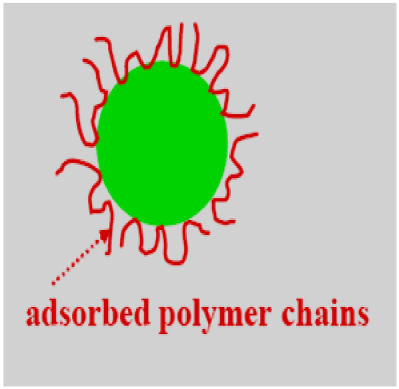
For example, negatively-charged colloidal silica particles can be flocculated by the addition of a positively-charged polymer.



**Protective colloidal action:**

- Protection: the addition of large amount of hydrophilic colloid (protective colloid) to a hydrophobic colloid tend to stabilize the system.
- This may be due to:

The hydrophile is adsorbed as a monomolecular layer on the hydrophobic particles.



Note: **GOLD NUMBER IN COLLOIDAL SYSTEM**

The Gold Number is the minimum weight (in milligrams) of a protective colloid required to prevent the coagulation of 10 ml of a standard hydro gold sol when 1 ml of a 10% sodium chloride solution is added to it.

| Protective Colloid | Gold Number |
|---|---|
| Gelatin | 0.005-.01 |
| Egg Albumin | 0.15-0.25 |
| Potato Starch | 20-25 |
| Dextrin | 125-150 |

**Peptization**

The process of converting a freshly prepared precipitate into a colloidal solution is known as peptization. In this method as the electrolyte in smaller amounts is added which is known as peptization agent or peptizing agent. Cause of peptization is the adsorption of the ions of the electrolyte by the particles of the precipitate. Important peptizing agents are sugar, gem, gelatin and electrolyte.

**Examples:**

1. Freshly prepared ferric hydroxide can be converted into the colloidal state by shaking it with water contains Fe3+ or OH– ions i.e. FeCl3 or NH4OH respectively.

Fe(OH)3 + FeCl3 → (Fe(OH)1 Fe)+3 + 3Cl– precipitate electrolyte

2. A stable sol of stannic oxide is obtained by adding a small amount of dilute HCl to stannic oxide precipitate similarly a colloidal solution of Al(OH)3 and AgCl are obtained by treating the corresponding freshly prepared with a very dilute solution of HCl and AgNO3 or KCl respectively.