# Colloidal Dispersion:

Consist of particulate matter (dispersed phase), distributed throughout a continuous phase (dispersion medium). size of colloidal particles are in range of 1- 1000 nm while size of true suspension is more than 1000 nm and true solution less than 1 nm .

The colloidal particle cannot be seen with naked eye and that the reason to see the colloidal system as homogenous mixture but in reality are heterogeneous mixture .

They are classified according to the particle diameter of the dispersed material:

1- Molecular dispersions (less than 1 nm):Particles invisible in electron microscope .Pass through semipermeable membranes and filter paper . Particles do not settle down on standing .Undergo rapid diffusion E.g. ordinary ions, glucose.
2- Colloidal dispersions (1 nm - o.5 um).Particles not resolved by ordinary microscope, can be detected by electron microscope. Pass through filter paper but not pass through semipermeable membrane. Particles made to settle by centrifugation Diffuse very slowly E.g. colloidal silver sols, naural and synthetic polymers
3- Coarse dispersions (> 0.5 um) Particles are visible under ordinary microscope .Do not pass through filter paper or semipermeable membrane. Particles settle down under gravity .Do not diffuse E.g. emulsions, suspensions, red blood cells

Colloidal Dispersion are classified according to the physical state of dispersion and continuous state :

| Medium/Phase | Dispersed phase | | |
|---|---|---|---|
| | Gas | Liquid | Solid |
| Gas | None (All gases are mutually miscible) | Liquid aerosol (fog, hair sprays) | Solid aerosol (smoke cloud, air particles) |
| Liquid | Foam (whipped cream, shaving cream) | Emulsion (milk mayonnaise) | Sol (blood pigmented ink) |
| Solid | Solid foam (aerogel, pumice polystyrene foam) | Gel (agar, gelatine jelly, opal) | Solid sol (jewel, gemstone) |

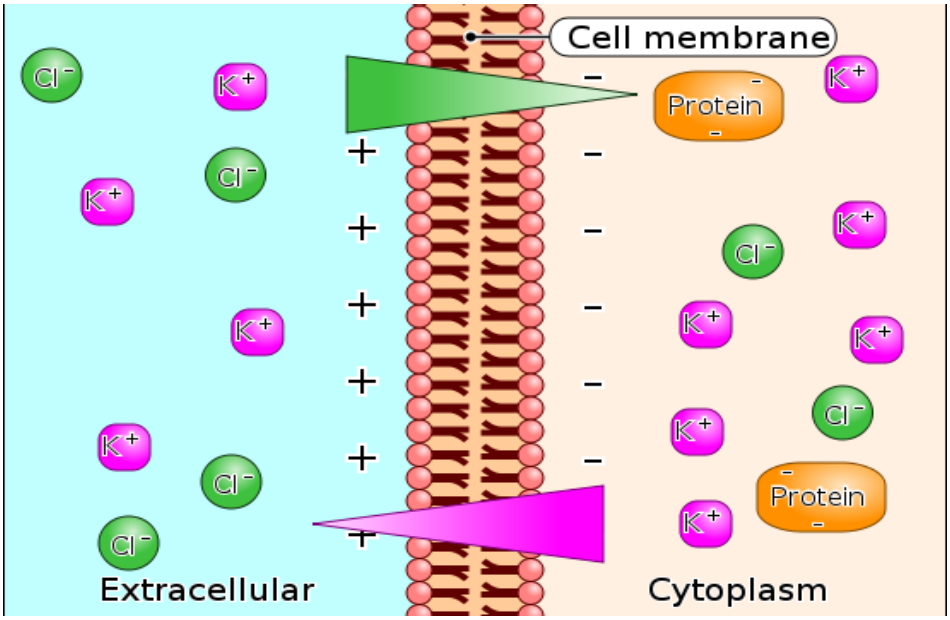
Colloidal Dispersion are classified according to the interaction between the dispersion and continuous state:

- Hydrophilic: disperse spontaneously and have high affinity to continuous phase.
- Hydrophobic: unstable dispersion needs surfactant.

| Lyophobic | Lyophilic |
|---|---|
| • Weak interaction / liquid hating is a colloidal dispersion in which there are little interaction between the dispersed phase and continues phase . dispersed phase in lyophobic colloidal is not solvated by the dispersed media . If the continues phase is water it also called hydrophobic colloids. | • Strong forces of interaction liquid loving lyophilicity is the tendency of particles , surface or functional gr to become extensively wetted solvated swollen or dissolved by solvent s. |
| • Same viscosity as medium .<br>• Can not be prepared directly by mixing colloid with liquid need stabilizers like SAA | • More viscous than medium<br>• Papered directly . |

## Donnan's effect:

Donnan law, Donnan equilibrium, or Gibbs–Donnan equilibrium) is a name for the behaviour of charged particles near a semi-permeable membrane that sometimes fail to distribute across the two sides of the membrane. The usual cause is the presence of a different charged substance that is unable to pass through the membrane and thus creates an uneven electrical charge. For example, the large anionic proteins in blood plasma are not permeable to capillary walls. Because small cations are attracted, but are not bound to the proteins, small anions will cross capillary walls away from the anionic proteins more readily than small cations.




Some ionic species can pass through the barrier while others cannot. The solutions may be gels or colloids as well as solutions of electrolytes, and as such the phase boundary between gels, or a gel and a liquid, can also act as a selective barrier. The electric potential arising between two such solutions is called the Donnan potential.

## Tyndall effect:

The Tyndall effect is seen when light-scattering particulate-matter is dispersed in an otherwise-light-transmitting medium (colloidal system ) , when the cross-section of an individual particulate is the range of roughly between 40 and 900 nanometers, i.e., somewhat below or near the wavelength of visible light (400–750 nanometers).

The scattering of short wave length light gives the sky its blue color.in contrast transmitted light has a yellow color at sunrise and sun set.

# DLVO theory:

The forces of colloidal particle in a dispersion medium are due to:

1. Electrostatic repulsion. repulsion potential $V_r$
2. London-type Vander Waals attraction. attraction potential $V_A$

When combined together forming the curve for the composite potential energy $V_T$.

There is a deep potential of attraction near the origin and a high potential barrier of repulsion at moderate distance.

A shallow secondary trough of attraction or minimum is some time observed at longer distance of separation the present of secondary minimum is significant in the controlled flocculation of coarse dispersion.

So the differences between lyophilic and lyophobic according this theory are

| | lyophobic | lyophilic |
|---|---|---|
| Formation of dispersion | Dispersion usually with high interfacial Surface free energy due to increase in the surface area on formation . it is thermodynamically unstable ( a positive $\Delta G$ ) | Dispersed spontaneously in a solvent interfacial free energy is low . it is stable thermodynamically . |
| Stability | controlled by charge in particle | controlled by charge and solvation of particle |
| Viscosity | Low viscosity even at high concentration because of low solvation and low attraction | Usually high at sufficient high concentration of dispersed phase gel may be formed |
| Effect of electrolyte addition | Very sensitive to adding it leading to aggregation in an irreversible manner | Stable in the presence of it if sufficient salt is added agglomeration and sedimentation may occur (salting out ) |