Colloidal Dispersion

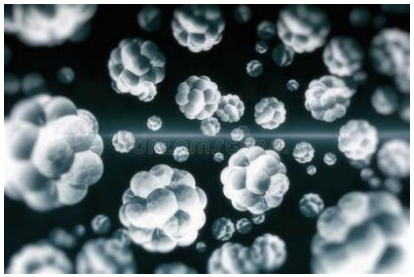
✓ Introduction

A mixture of dispersed phase and the dispersion medium is known as a colloid. The colloidal particles range from 1-1000nm.

The heterogenous system which is made up of a dispersed phase and dispersion medium is called as colloidal dispersion.

In this, one substance is dispersed as very fine particles in other substances called dispersion medium.

Example: glue, starch, gelatin.



✓ Classification of dispersion system colloids

- Molecular dispersion.
- Colloidal dispersion.
- Coarse dispersion.

GENERAL CHARACTERISTICS:

Sr.no	Properties/ characteristics	Molecular Dispersion	Colloidal Dispersion	Coarse Dispersion
01	Particle size	less than 1nm	1nm to 1000nm	More than 1µm
02	visibility	Invisible in microscope	Visible under electron microscope	Visible under normal microscope
03	nature	homogenous	heterogenous	heterogenous
04	appearance	Transparent	cloudy	opaque
05	Diffusion rate	rapid	Very slow	No diffusion occurs

✓ Classification of dispersion phase

- On the basis of their dispersed phase and dispersion medium

Sr.no	Dispersed phase	Dispersion medium	Common name	example
01	Solid	solid	Solid solution	Colored glass
02	Liquid	Liquid	Emulsion	milk
03	Gas	Solid	Solid foam	Foam rubber

➢ Classification based on interaction between the phase

lyophilic colloids
- solvent loving
- 2 types
- hydrophilic
- lipophilic

lyophobic colloids
- solvent hating
- thermodynamically unstable

association colloids
- amphiphilic colloids
- thermodynamically stable

➢ Classification based on the molecular size

There are 3 types.

- ✓ Macromolecular colloids.
- ✓ Multi molecular colloids.
- ✓ Associated colloids.

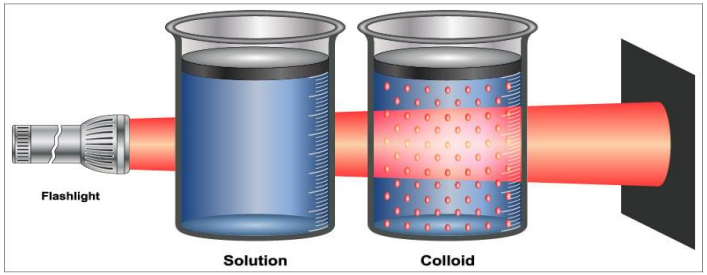
✓ Properties of colloids

- optical properties
- kinetic properties
- electrical properties

Optical properties:

➢ Tyndall effect:

It was first discovered by Tyndall in 1869.When a strong beam of light was allowed to pass through a colloidal solution kept in a dark surrounding, the beam of path got illuminated and those illuminated path is known as Tyndall cone. This scattering of light by the colloidal particle known as Tyndall effect.



- Light microscopy

  A beam of light after passing through a colloidal dispersion gets absorbed, scattered & transmits through the sample undistributed.

  Examples:

  1. Gold chloride particles absorb lights of deep red color.
  2. Silver iodide particles absorb lights of yellow colour.

- Ultra microscopy

  Size of colloidal particles is so small that they are not clearly visible under an optical microscope.

  When a colloidal dispersion contained cell is observed through an ultra-microscope against a dark background of incident light.

- Electron microscopy

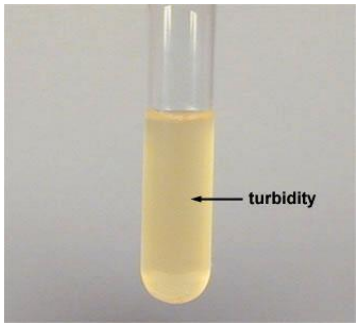
  Electron microscope are used to study colloidal dispersions when ultra-microscope fail to resolve some lyophilic colloids.

  The increasing resolving power of electron microscope has increased its efficiency.

- Turbidity

  The molecular weight of the solute and the concentration of the dispersed particles can be determined by this instrument discussed

  It can be measured by the following 2 instruments of turbidity.



(A) Spectrophotometer.
(B) Nephelometer.

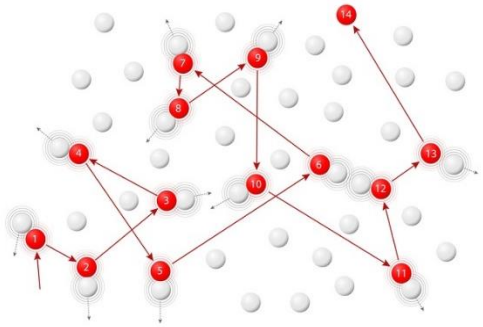
Kinetic property

✓ Brownian motion

Robert brown, a Scottish botanist discovered the Brownian movement in 1827.

When colloidal solution is examined under a powerful microscope, the colloidal particles were found to be moving in a random zig-zag path due to the colloidal particles.

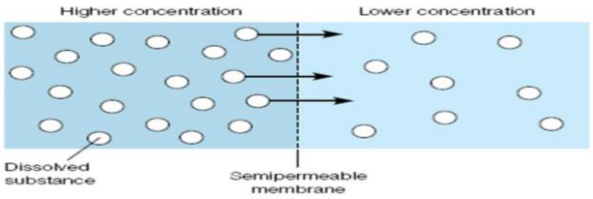
This random zig-zag movement of the particles of colloidal solution is known as a Brownian motion.



✓ Diffusion

It is the movement of particles from an area of higher concentration to the area of lower concentration.

It is based on Fick's first law that particles diffuse continuously until equilibrium reached

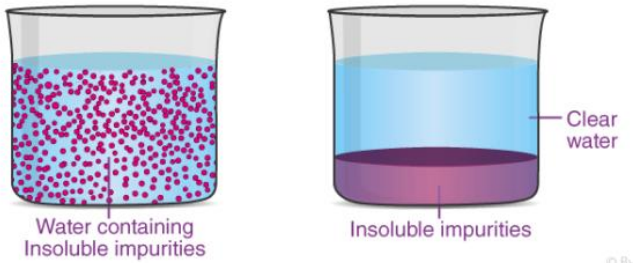


✓ Sedimentation

Settling of particles suspended in the colloidal solution due to the effect of gravity or centrifugal field is known as sedimentation.

It depends upon the molecular weight of colloidal particles.

It is also depends upon the density difference of dispersed phase to the dispersion medium.



✓ Viscosity

It is the resistance to fluid to flow under an applied stress.it is depends upon the shape, size, molecular weight, interaction between dispersed phase and dispersed medium

$$\eta = \eta_0(1+2.5\Theta)$$

where,

η_0= Viscosity of dispersion medium

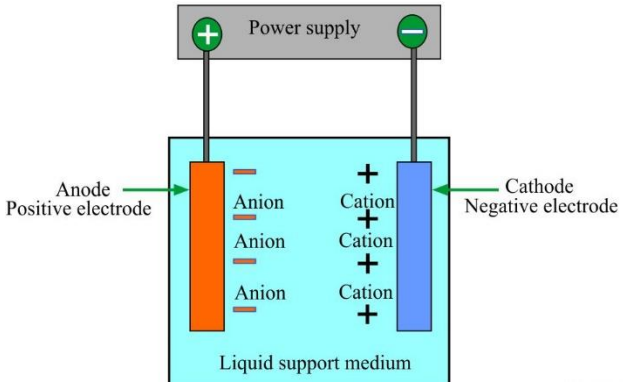
η = Viscosity of dispersion

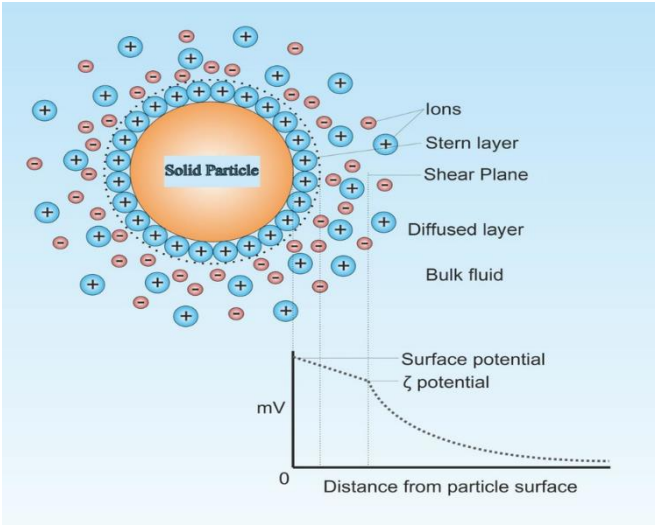
Θ = Volume fraction.

Electrical properties

- ✓ Electrophoresis

  The phenomenon of movement of colloidal particles under an applied electric field is called electrophoresis.





- ✓ Electrical double layer

  Electrical double layer form whenever two conducting phases meet at an interface.

  The double layer refers to 2 parallel layers of charge surrounding the object.

  The 1st layer, the surface charge consists of ions absorbed. The layer is tightly packed to the layer

  The 2nd layer is loosely associated with in the surface of the particle.

  The two layer are separated by some molecular distance.

  (A) Surface potential.
  (B) Stern potential.
  (C) Zeta potential.

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