

## Kinetic properties

### Brownian motion:-

As per the scientist Robert Brown the name has been given as Brownian motion.

→ The colloidal particles don't settle due to their smaller particle.

→ The particles are in random motion and the thermal energy keeps the particles in motion.

→ They collide with each other and with the walls of the container.

→ Hence they change their direction velocity of particle.

→ This molecular collision keeps the particles in motion, which can be observed under light microscope.

→ When the particle size increases the velocity decreases and the Brownian motion decreases.

## Diffusion

- As the particle size of the colloids is small they can diffuse through the membrane
- Diffusion is a spontaneous process occurring from higher concentration to lower concentration
- This can be explained by Fick's law.
- There is an relationship bet<sup>n</sup> diffusion coefficient and molecular weight of the particle which can be explained below.

$$D = \frac{RT}{6\pi\eta_0 N} \sqrt{\frac{4\pi r^2}{3MV}}$$

where,  $D$  = diffusion coefficient of the polymer.

$R$  = molar gas constant

$T$  = absolute temp.

$\eta_0$  = ~~viscosity~~ viscosity of the dispersion medium

$N$  = Avogadro's no

$M$  = molecular weight of the polymer

$v$  = partial specific volume of particle

According to ~~Fick's~~ 1st law of diffusion,

$$dq = -Ds \frac{dc}{dx} dt$$

where,  $dq$  = amount of substance

diffusion

$D$  = diffusion coefficient

$dt$  = change of time

$dc$  = change of concentration

$ds$  = distance travelled

$S$  = surface area of the medium

### viscosity

⇒ viscosity of a colloid can be affected by variety of factors.

→ shape of the dispersed particle

→ The spherical particle impact relative low viscosity in compare to linear shape which will be more viscosity.

⇒ Affinity of the particle to the medium :-  
If linear particles are placed in the medium then low affinity to particles they tend to assume spherical shape viscosity falls.

### ⇒ Type of colloid

Lipophilic colloid have viscosity greater than that of dispersion medium whereas

lipophobic colloid have same viscosity as that of dispersion medium.

⇒ molecular weight of the particle :-

→ higher the molecular particle greater will be the viscosity and vice-versa

→ Einstein's equation for a dilute colloidal system where:

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

where,  $\eta_0$  = viscosity of dispersion medium

$\eta$  = viscosity of dispersion

$\phi$  = volume fraction of particles

$$\frac{\eta}{\eta_0} = 1 + 2.5\phi = \eta_{rel} = \text{Relative viscosity}$$

$$\frac{\eta}{\eta_0} - 1 = 2.5\phi = \text{specific viscosity}$$

$\eta_{sp}$

$$\boxed{\frac{\eta_{sp}}{\phi} = 2.5}$$

## Sedimentation

→ The velocity of sedimentation of spherical particles is obtained by Stokes' law.

→ Sedimentation is influenced by gravitational force.

→ As the colloidal dispersion exhibits brownian motion, hence the sedimentation is minimum, so here a stronger force is applied on bringing the sedimentation of the particle.