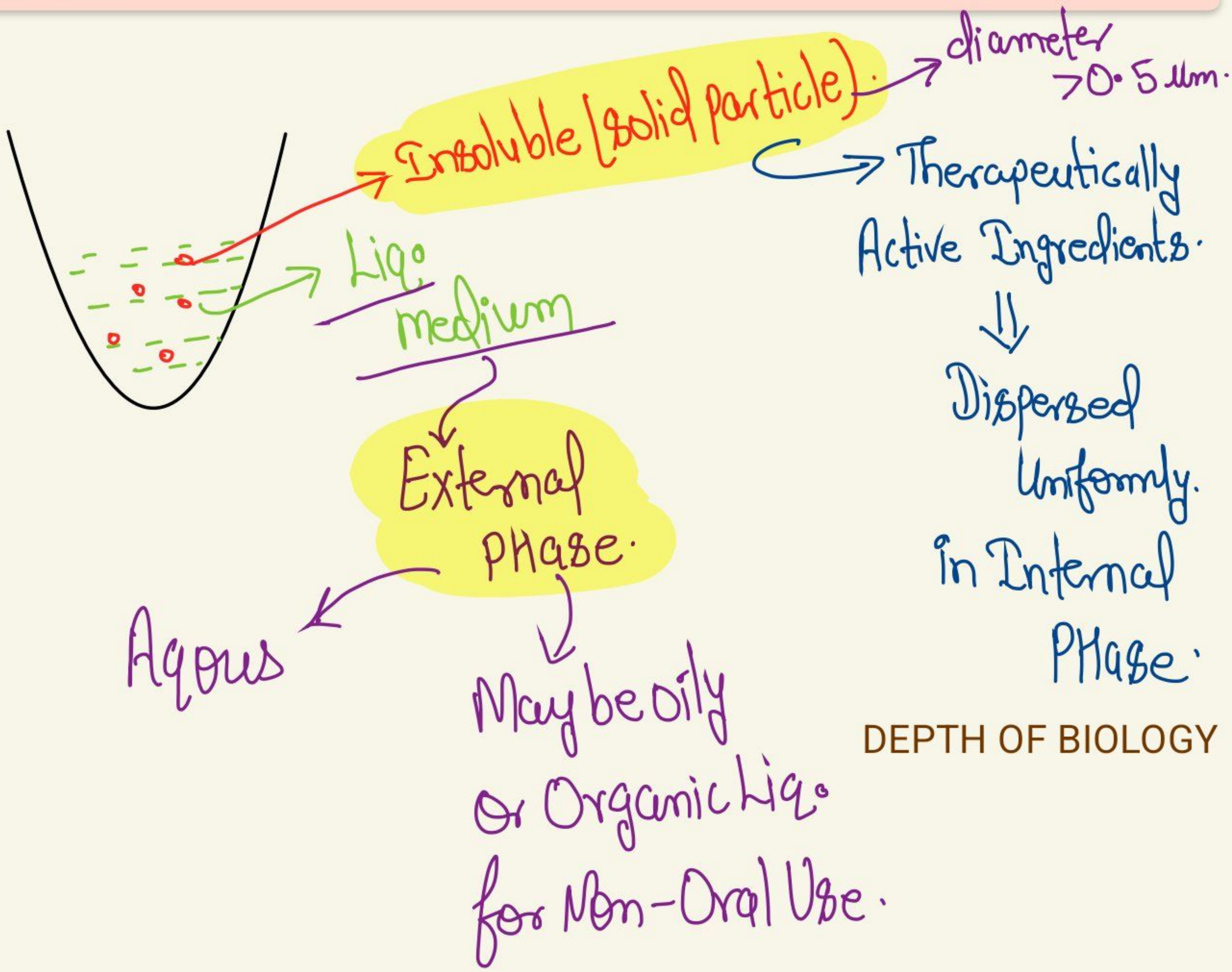
Physical Pharmaceutics Unit-3

UNIT-III **10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

Coarse Dispersion

pharmaceutical suspension is a coarse dispersion in which insoluble solid particles are dispersed in a liquid medium (usually water or water-based vehicle). Generally, the particles have diameters greater than 0.5μm. The concentration of dispersed phase may exceed 20%.



☆ It is Biphasic System.

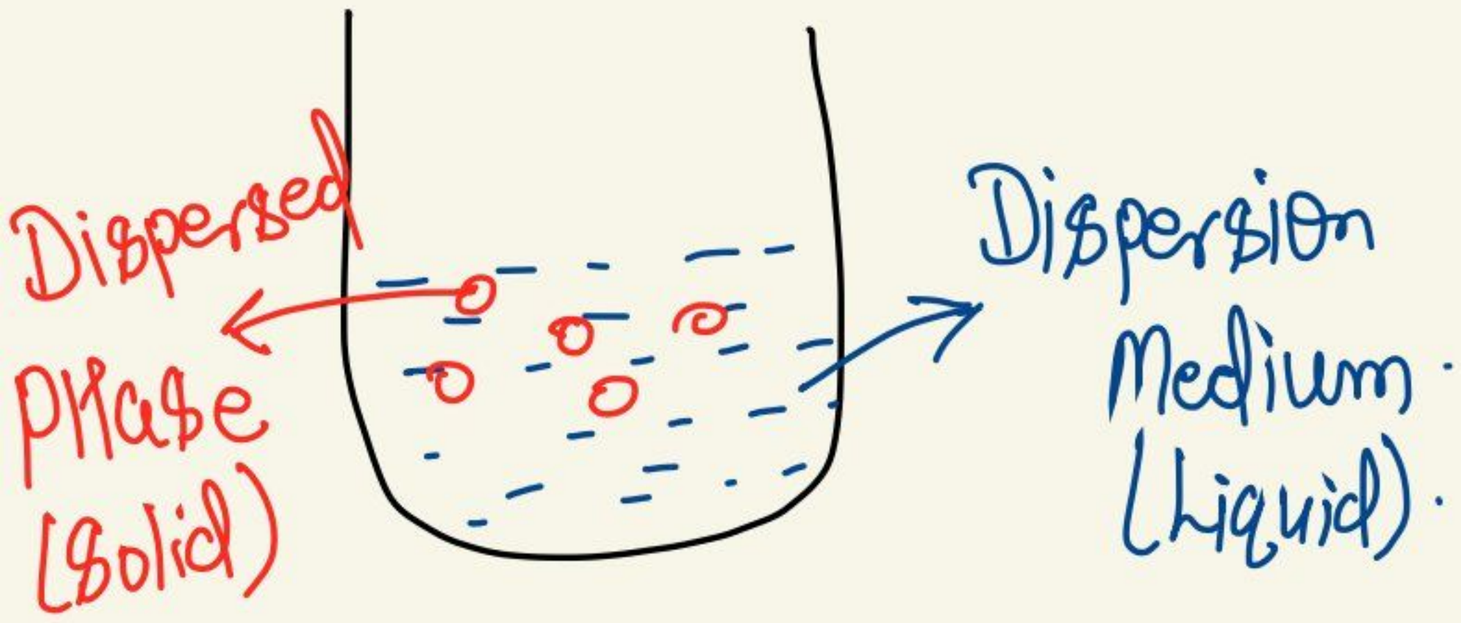
☆ Heterogenous.

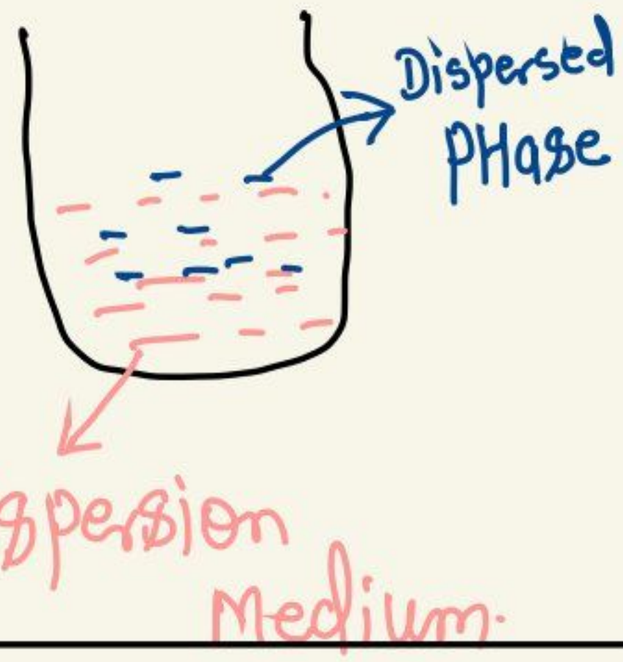
Coarse Dispersion

Suspension

Emulsion
- Oil in water
- H_2O in Oil.

⇒ Liq. in Liq.



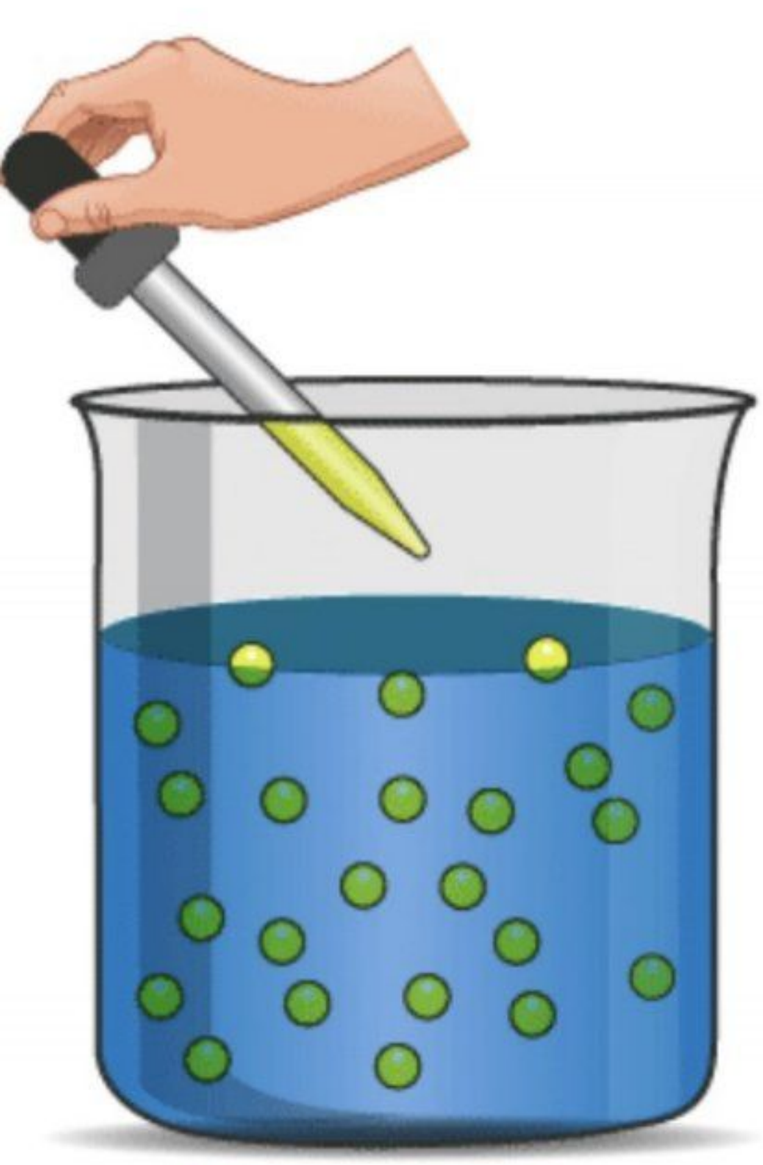


Particle Size Small

1. Suspension

- Generally taken Orally.
- Also by Parentrally.

A suspension is defined as **a heterogeneous mixture in which the solid particles are spread throughout the liquid without dissolving in it**



Suspension → Biphasic Liq. dosage form.

- Also Used in External application (Topical).
- Both Phases are Visible.

Ideal properties of Suspension.

Qualities of Good Suspension

1. Dispersed particle settled slowly.
2. Should be Chemically Inert → Non reactive.
3. Not form Cake.
4. Free from Large Particle.
   - → Because Large particle Spoil it's apperance.
   - → Large particle Cause Irritation.
5. Readily redispersed on Gentle Shaking.

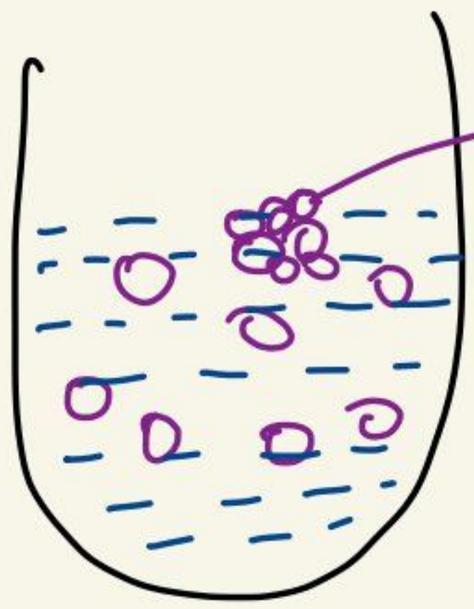
DEPTH OF BIOLOGY

DEPTH OF BIOLOGY

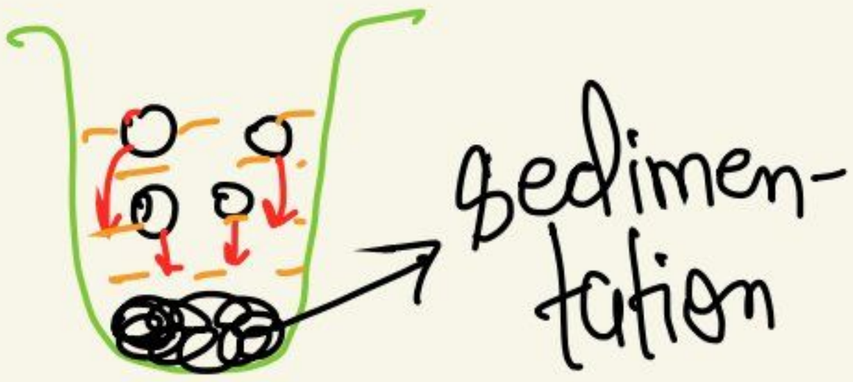
Types of Suspension

Floculated

① Individual particle are in Come Contact with each other & form a Network Like structure



② Rate of Sedimentation is High.

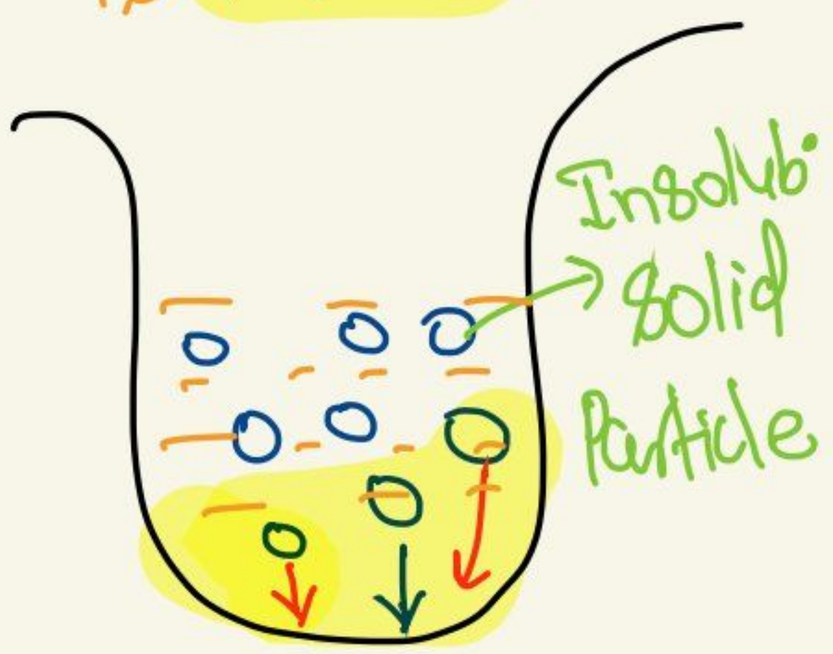


DEPTH OF BIOLOGY

Deflocullated

① Individual particle Exist as a Separate Entity.

② Rate of Sedimentation is low.



DEPTH OF BIOLOGY

Flocculated suspension	Deflocculated suspension
1. Particles exist as loose aggregates.	1. Particles exist as a separate entities.
2. Rate of sedimentation is high.	2. Rate of sedimentation is low.
3. Sediment formed rapidly.	3. Sediment formed slowly.
4. Consist of loosely packed particles possessing a Scaffolding structure a hard dense cake does not form and the sedimentation can easily be redispersed.	4. Sediment becomes very closely packed as the repulsive forces between the particles are overcome a hard cake is formed which is difficult to redisperse.
5. Elegant preparation is obtained due to the uniform distribution of loosely bonded flocs.	5. Unsightly preparation results due to the formation of sedimentation.

⇒ Floccule Stick on the Side of Bottles. (Cap Locking)

6. Stable↑

6. Stable↓

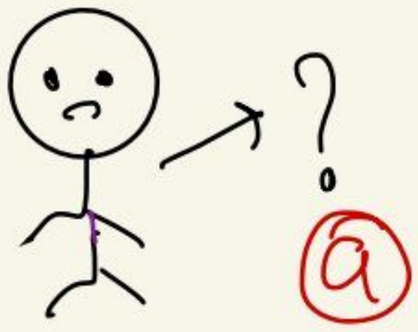
In Suspension Interface is formed b/w Two Phases which Influence the Stab. of Suspension.

Interfacial Property of Suspended particle

Suspension form → Small Partide Size req. → Surface Area ↑ → Surface free Energy ↑

Because it form Hard Cake

→ Thermodynamically Unstable.



⇒ So, we Use Wetting Agent / Surfactant.

Surface free Energy ↓ → Stab. ↑

(b) → Particle form floccule → Surface Area ↓

Surface free Energy ↓ → Stab. ↑

① Surface free Energy.

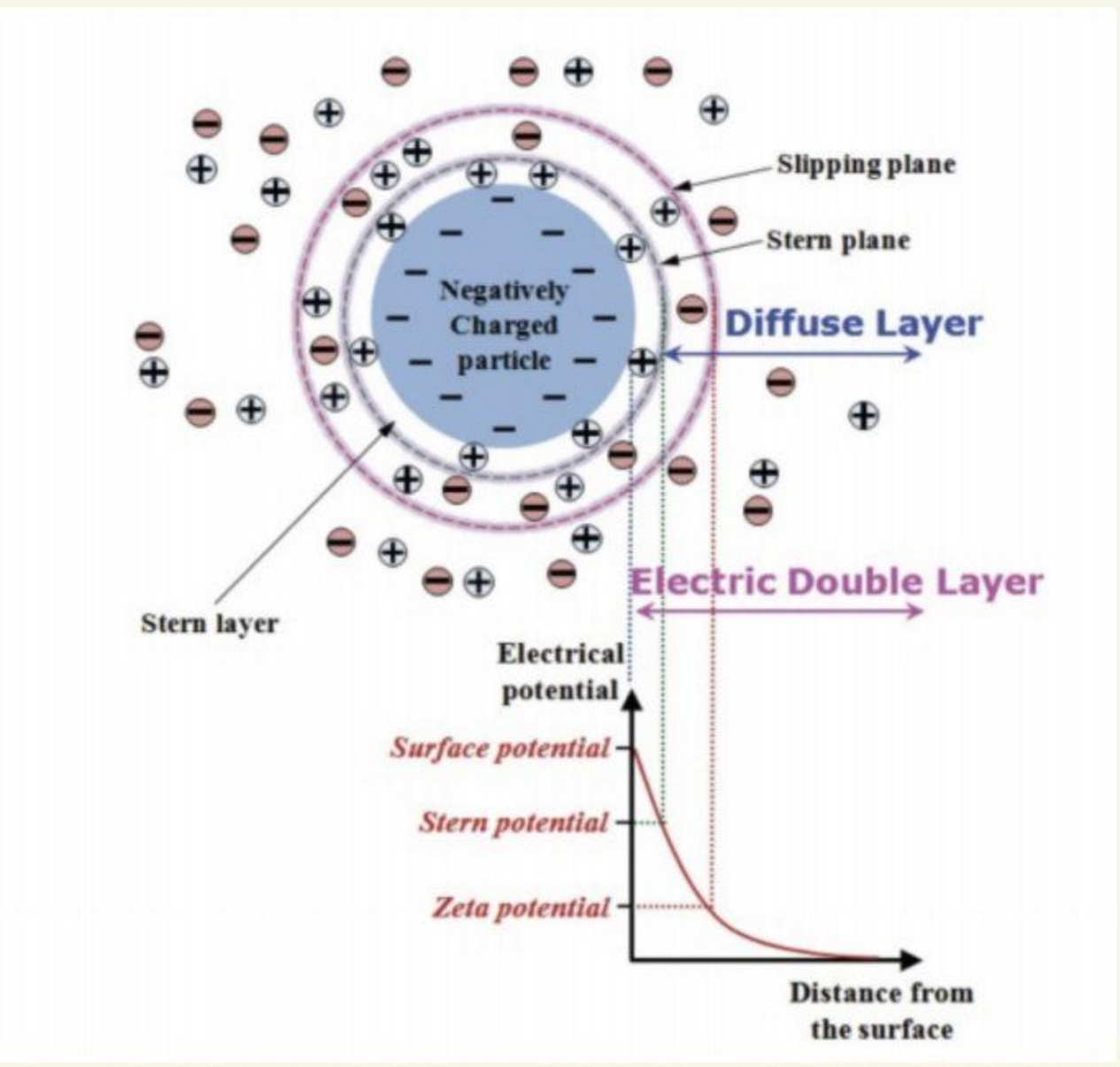
$$\Delta G = \gamma_{SL} \cdot \Delta A$$

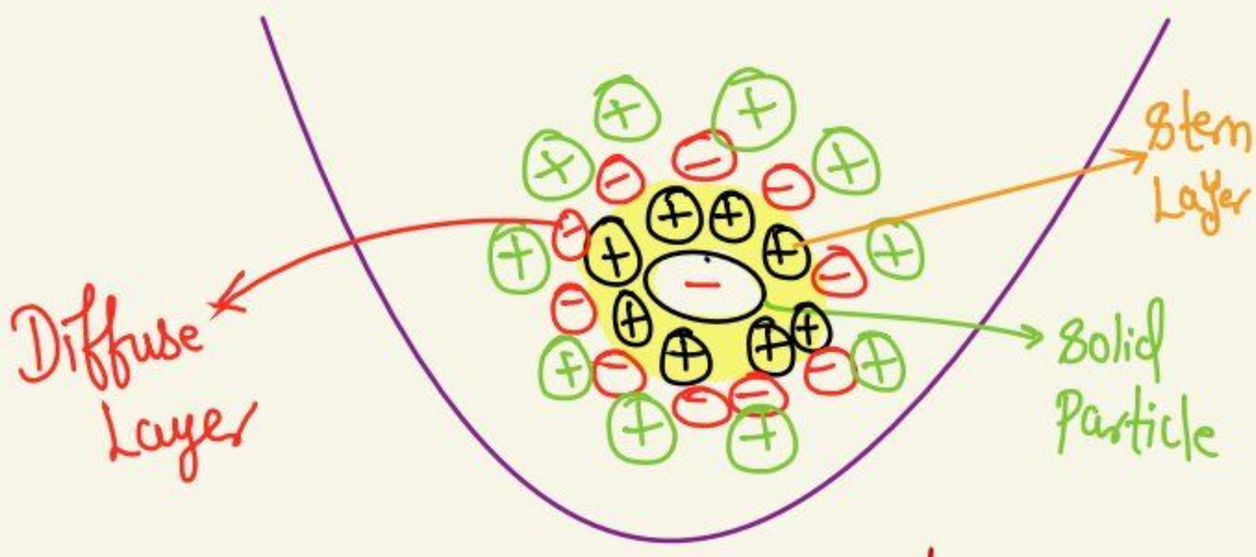
- ΔG → Surface free energy
- γ_{SL} → Interfacial tension b/w solid & liq.
- ΔA → Change in surface Area

Examples of wetting agents include propylene glycol, sodium lauryl sulphate, polysorbate, docusate sodium, sorbitan fatty acid esters, and glycerin.

② Formation of Electrical double Layer.

The electric double layer consists of two layers. The first, called the Stern layer, results from accumulating the counterions on electrode surface. Then the diffusion layer extends outward from the Stern surface; this second layer is called the Gouy-Chapman layer.





It Looks Like floccule.

So → High electrolyte Concn.

↓

flocculated.

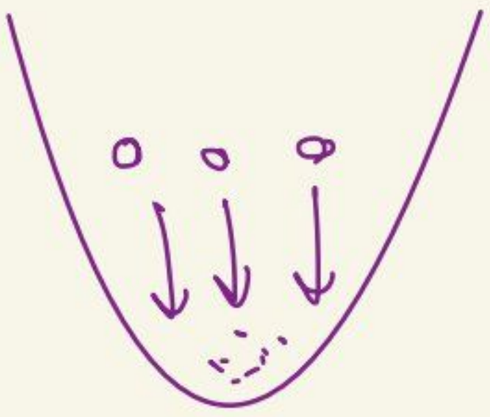
Interaction b/w particle ↑

Interaction b/w Particle ↓

Low electrolyte Conc. → Non flocullated.

⊙ Settling of suspension

↳ Sedimentation rate.



Settling & Sedimentation (Unstable).

It is explained by Stoke's Law ⇒

$$V = \frac{d^2 (\rho_1 - \rho_2) g}{18\eta}$$

- V → Rate of Sedimentation Or Rate of Settling.
- d → diameter of particle
- ρ_1 → density of suspended particle
- ρ_2 → density of solvent
- g → gravity
- η → Viscosity of dispersion Medium.

(a) Diameter of particle ↓

(b) Viscosity of dispersion Medium ↑ → Good suspension.

Formation of flocculated & deflocculated Suspension.

Methods → ⓐ Wetting Agent ⓑ Controlled flocculation.

ⓒ Structure Vehicle.

ⓐ Wetting Agent →

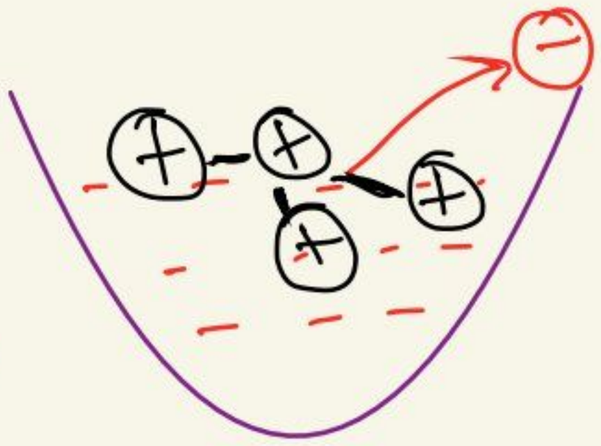
Surface Energy ↓ → Stab ↑

ⓑ Controlled flocculation →

In this method we add electrolyte to the suspension.

Charge Genrate on both phase but opposite.

& opp. Charge of Solvent attract Insoluble Solid particle



Particle repel each other

⇓

flocculation Controlled

Leads to More Stable Suspension.

(3) Structure Vehicle ↗

Here we (↑)se Viscosity of dispersion Medium

⇓

Solid particle Not Settle Easily. (does not sediment early).

⇓

Remain Dispersed.

eg→ Acacia, Tragacanth.