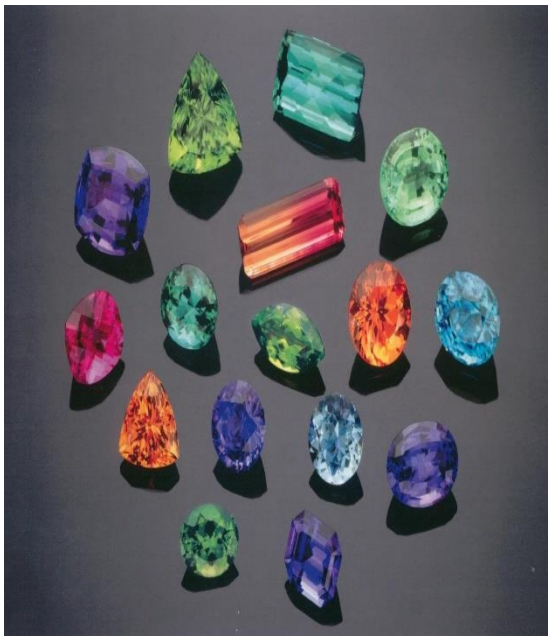
Practical plant physiology 2018- 2019 (4th Grade)

Colloid

A **colloid** is a solution in which the particle size ranges between 10^{-7}cm and 10^{-5}cm For example, milk, blood, honey, smoke, ink, gum, starch solution etc.

- Every colloid consists of two parts: colloidal particles and the dispersing medium. The dispersing medium is the substance in which the colloidal particles are distributed.



1. Classification Based on the physical state of the Dispersed Phase and Dispersion Medium:

1. **Sol:** In this system the dispersion medium is liquid and the dispersed particles are solid. For example starch in water.

2. **Gel:** in this system the dispersion medium is solid and the dispersed particles (phase) is liquid. For example water in gelatin.

1. **Emulsion:** In this system both the dispersion medium and dispersed phase are liquid. For example diluted milk.

2. **Aerosol:** In this system the dispersion medium is gas and the dispersed (phase) is liquid or a solid. For example fog.

2. Classification Based on the Nature of Interaction between Dispersed Phase and Dispersion Medium:

- Colloidal systems, depending on the nature of attraction between the dispersed phase and the dispersion medium are classified into **lyophobic** (solvent hating) and **lyophilic** (solvent loving).

- Examples of lyophilic colloids include gum, gelatin, starch and proteins.
- Examples of lyophobic sols include sols of metals.

Lyophilic Sols	Lyophobic Sols
1. They can be prepared easily by directly mixing with the liquid dispersion medium. 2. They are quite stable and are not easily get precipitated. 3. They are reversible in nature once precipitated can reform the colloidal sol by simply remixing with dispersion medium. 4. Their surface tension is lower than dispersion medium.	1. They cannot be prepared directly can be prepared by the special methods only. 2. They can be easily precipitated by addition of a small amount of the electrolyte. 3. They are irreversible in the nature once precipitated cannot form the colloidal sol by simple addition of dispersion medium. 4. Their surface tension is nearly same as the dispersion medium.

Properties of colloids

- **Tyndall Effect:** Tyndall observed this phenomenon in 1869. He observed that when a beam of light is allowed to pass through a colloidal solution, the path of light gets illuminated. This phenomenon is known as Tyndall Effect. It occurs because light is scattered by particles present in colloidal solution.

- **Brownian movement**: There are continuous collisions between the colloidal particles and molecules of dispersion medium which are in constant motion and passes kinetic energy to colloidal particles by striking it from all sides. This results into zigzag movement of colloidal particles. This zigzag movement of colloidal particles is known as **Brownian movement.**

Brownian movement of Colloidal Particles

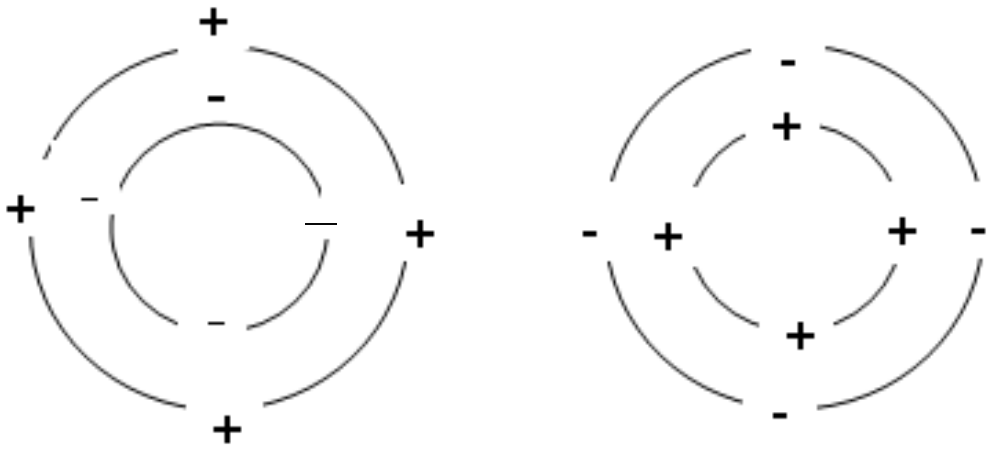
❖ Electrical properties

1.The colloidal particles possessing large surface area.

2.Electrophoresis: The movement of colloidal particles under the influence of electric field is called Electrophoresis.

- When an electric field is applied across the colloidal solution, the colloidal particles migrate to oppositely charged electrode where they get neutralized, because the colloid particles charged electrically with (+) or (-) charges. This phenomenon is known as electrophoresis.

3.Electrical double layer theory: The colloidal solution is in an electrically equilibrium state, because each charge or each particle of the colloid posited with another charge in the continuous medium, this is called the electrical double layer theory.



Electric double layer

4.Electro Osmosis: When electrophoresis of dispersed particle in a colloidal system is prevented by some suitable means, it is observed that dispersion medium itself begins to move in an electric field. This phenomenon is known as electro osmosis.

5.Adsorption: Adsorption is the adhesion of molecules of gas, liquid, or dissolved solids to a surface. It differs from absorption, in which a fluid permeates or is dissolved by a liquid or solid.

Practical Part:

1. Tyndall phenomenon

Procedure

1. Prepare a colloidal solution, for example a starch solution (2g starch + 100ml d.w.).
2. Add this solution into a beaker and direct a strong beam of light at one side view of the beaker after putting it in a dark place (a box for example).
3. Note the illuminated path of the beam of light.

Repeat this experiment by using true solution (2g NaCl + 100ml d.w.), are you see the illuminated path of light or not, and why?

Compare between the two experiments and discuss the results.

2. Brownian movement

Procedure

1. Put a drop of a colloidal solution on the slide then put the cover on it.
2. See the slide by the large power of microscope and note the movement of the colloidal particles.

We can see this movement also by spreading the fresh pollen grains on a drop of distilled water on the slide.

3. Proving that the colloid particles electrically charged

Procedure

Determination of electrical charges of colloids can be done by using uncharged ash-less filter paper, as follows:

1. Wet the paper with water, thus the paper will acquire OH^- ions from water and becomes negatively charged, because the OH^- ions are stronger as compared with H^+ ions.
2. Add 2-3 drops of eosin dye (acidic dye - negatively charged) and 2-3 drops of safranin or methylene blue (basic dyes - positively charged) to the negatively charged ash-less filter paper.
3. Dose the dye particles are aggregates or dispersed on the filter paper, compare between them?
4. The particles of each one of the dyes aggregates and each one dispersed on the paper? Write the reason behind.