Imbibition in plant lab-5

Imbibition

- Imbibition is a special type of diffusion that takes place when water is absorbed by solids-colloids causing an increase in volume
- Solid substance or adsorbent which take part in imbibition are called Imbibants.
- The liquid which is imbibed is known as Imbibates.
- Presence of attraction between imbibants and imbibates. e.g. rubber imbibes by ether but does not imbibes by water.
- When seeds are placed in water, a sharp gradient is generated, and imbibition of water take place.

Factors affecting Imbibition

Temperature: With an increase in temperature the rate of imbibition increases. Perhaps the increased temperature increases the kinetic energy of the system. The situation is reverse at low temperature

Texture of the imbibant: The cohesion of molecules of the imbibant largely affects the amount of water imbibed. Thus a closely packed imbibant imbibes less amount of water compared to loosely packed one.

Pressure: Imbibition pressure comprises hundreds of atmospheres. Thus colloidal particles can imbibe water against lot of pressure.

pH: Imbibition is also dependent upon the acidity and alkalinity or pH of the medium. Thus cellulose which is negatively charged colloid imbibes maximum in alkaline medium while it will absorb least in the acidic medium.

The Affinity Between Imbibant and Imbibate: The imbibant needs to have an affinity for the imbibate for imbibition to occur.

Concentration of solute in the medium.

Role of imbibition in plant

Imbibition has important roles to play in the process of plant development.

1. Seed germination and initial stages of plant growth. Seed germination begins with the breaking of the seed coat. Water is imbibed when the seed coat is broken. After the seed coat is broken and the seedling grows, it needs to ascent through the soil above it.

2. Absorption of water by roots: roots are the main tissues required for collecting water from the soil. Water moves into the root hair by imbibition. Imbibition also plays a major part in the ascent of sap through the plant body.
3. The plant keeps its cells moist by transferring water from adjacent cells through imbibition

Significance of imbibition

- It is the dominant and first step of water absorption.
- Imbibition is the first step of seed germination.
- Seedling is able to come out of soil due to development of imbibitional pressure.
- Imbibition pressure generated during germination of seeds is so enormous that it can break asphalt roads and concrete pavements.

Imbibing capacity

- Imbibing capacity varies in different imbibants.
- Proteins being hydrophilic colloids have maximum imbibing capacity. As compared, starch has lesser and cellulose has the least capacity.
- As a result, when soaked in water, protein containing seeds e.g. pea swell more than starch storing grains of wheat, maize.

What to do?

- Dry amount of wheat seed or pea in oven (100^{o}c),30 minute
- After that coolness it to room temperature in (desiccate).
- Prepare 100 ml from NaCl solution in concentration (1, 2, 3, 4) molar concentrations.
- Weight five groups of seeds (each group 10 gram).
- Put each group in Petri dish, mark the first one, 1,2,3,4 (1, 2, 3, 4 means solution concentration) leave the last Petri dish empty.
- Add to each Petri dish the prepared solution in which the concentration of solution compatible with the dish mark, and don't forget to add distilled water to the last Petri dish.
- After 48 hour take out the seeds and weight it again.
- Calculate the imbibing water percent for each concentration

$$\text{Imbibition percent} = \frac{\text{Weight after imbibition - weight before imbibition}}{\text{Weight after imbibition}} \times 100$$

Due to seed imbibitions, the volume and the weight of the seeds showed a significant increase.

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