Lab (7)

Imbibition

Man has known the strong ability of plant matter to absorb water since ancient times, to the point that the ancient Egyptians used to insert pieces of wood into the cracks of huge stones and then pour water on them. The wood was absorbed by the water and its size increased greatly inside the narrow cracks. This resulted in enormous pressure that caused the huge rocks to break into smaller rocks. It is easy for them to transport and use.

Imbibition: It is a special type of diffusion, which is the process of adsorbing water molecules on the surface of colloidal particles. The transfer of water from the area of high concentration to the area of low concentration creates a pressure called imbibition.

- Hydrophilic colloid particles show a strong tendency to adsorb water molecules around them with their coatings. Water in this case is called bound water, which leads to an increase in the mass and size of the colloids. Also, the various colloidal materials are characterized by the presence of stomata, gaps, and tiny channels, and thus they have a huge internal surface area, which makes High water absorption capacity.

- Plant materials that have the ability to absorb water are many and include protein, starch, cellulosic, pectin, and others. Water reaches these materials according to the laws of diffusion, and some of the water moves through colloidal materials by capillary action.

The benefit of imbibition:

The imbibition process plays an important role in plant life, including:

1. It is of great importance in the seeds' access to water during germination, and its importance is reduced or non-existent in adult plant cells that are filled with water.

2. Water absorption from the root area.

Imbibition conditions:

1. There must be a tendency for the water potential between the surface of the absorbing material (soaking) and the imbibing liquid (i.e. a difference in concentration between the absorbing material and the medium).

2. There is a connection between the impregnated material and the imbibition medium. A substance, such as rubber, may be impregnated with ether and not with water.

Phenomena that occur as a result of the imbibition process

As a result of imbibition, several phenomena occur, including:

1. Increase seed size.

2. Energy is generated in the form of heat, and the reason for the increase in temperature is the result of the adsorption process of water molecules that possess energy, and upon adsorption, they lose energy in the form of heat on the surfaces of the colloidal particles.

Factors affecting imbibition

1. Temperature: As the temperature increases, the speed of the imbibition process increases, but the total amount of imbibition water is not affected.

2. The osmotic pressure of the external solution: The speed of the imbibition process decreases, as does the amount of imbibition water, as the osmotic pressure of the external solution increases, as the gradient in the water potential between the impregnated substance and the external solution will decrease.

Imbibition pressure

It is defined as the force necessary to prevent the swelling of colloids resulting from water absorption. The forces of imbibition pressure are so great that they may reach hundreds of atmospheric pressure, similar to the values measured when soaking any colloidal matter such as gelatin or agar in water. Imbibition pressure is of utmost

importance for germination, as it causes the seeds to swell and the shoot to rupture.

Experiment (1)
Imbibition of Water by Gelatin and Wood
Materials used:

Gelatin pieces, petri dishes, balance, filter papers, 95% ethyl alcohol, wooden cubes, and tweezers.

The Method of Work:

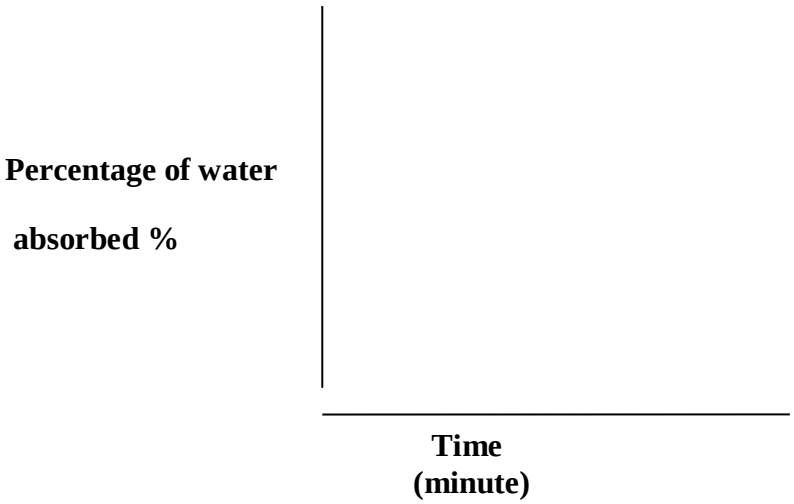
The method of work:

1. Weigh one of the dried gelatin pieces.
2. Place the piece in a petri dish containing an appropriate amount of water, leave it for 15 minutes, then re-weigh it using a filter paper with a known weight.
3. Put the piece back in the water again and leave it for 15 minutes, then re-weigh it as in the previous step.
4. Repeat the process every quarter hour for an hour and a half.
5. After that, transfer the piece to a Petri dish containing 95% ethyl alcohol and leave it for 20 minutes, then calculate its weight.
6. Calculate the amount of water absorbed each time, then draw a curve showing the relationship between the percentage of water absorbed and the different time periods.
7. Repeat the same previous steps using a cube of wood instead of a piece of gelatin, then compare the absorption of water by gelatin and wood, then explain the results you obtained.

Note: Try to dry both the wood piece and the gelatin with tracing paper so that the water does not affect the weight.

The percentage of water absorbed= $\frac{Imbibition\ after\ weight\ piece - Imbibition\ before\ weight\ piece}{Imbibition\ after\ weight\ piece}$ x 100

Time (minute)	Weight of a piece of wood (gm)	Percentage of water absorbed %	The weight of a piece of gelatin (gm)	Percentage of water absorbed %
0				
15				
30				
45				



Experiment (2): Imbibitional Pressure

Materials used:

Pea or chickpea seeds, calcium sulfate or plaster, filter paper, and a glass funnel.

The Method of Work:

1. Fix the glass funnel in a vertical position using the iron stand and the holder so that the wide opening is at the top.
2. Fix a filter paper into the glass funnel.
3. Place an amount of plaster paste in the funnel to half its capacity, then sprinkle a number of pea seeds or plaster on the surface of the paste.

4. Add another amount of dough to the funnel so that it is full, then leave the dough to dry.

5. Take the cone out after it dries completely, then place it in a petri dish containing an appropriate amount of water, with the base of the cone facing down, and observe what happens after (24) hours have passed.