B.Sc. Botany (Sub.) II
Group: C
Topic: Diffusion
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Diffusion

This may be defined as the tendency of any substance ,when it occurs as a gas or in solution, to become eventually distributed throughout the whole space available to it by moving from regions of greater to regions of lesser concentration.

The movement of the molecules of gases, liquid or solutes from the regions of higher concentration to the regions of lower concentration until the molecules are evenly distributed throughout the available space is known as 'Diffusion'.

If a bottle filled with volatile substance such as perfume or ethyl ether is opened at a corner of the room, the odour of perfume or ether after some time can be smelled from another corner. Similarly, if a small crystal of water soluble dye is placed at the bottom of a beaker and then filled with water (Fig.1). Dye molecules will dissolve and the colour will spread slowly throughout the water. These two examples clearly indicate that the molecule have diffued out from higher concentration to all the directions. Diffusion is, therefore, the movement of molecules or ions of a solute or solvent, be it a solid, liquid or gas from the region of its higher concentration to that of its lower concentration. Nautrally, the molecules or ions are in high partial pressure when concentrated and thus, these molecules are diffused out from the region of high partial pressure to the region of low partial pressure as a result of their inherent kinetic energy. The molecules continue to move until an euqilibrium is obtained.

The direction of diffusion of one substance is independent of the direction in which a second substance is diffusing. i.e., when diffusion of more than one substance takes place in different directions, the movement is independent of each other. The rate may slow down a bit

because of collisions between the two different kinds of particles, but their direction remain unchanged.

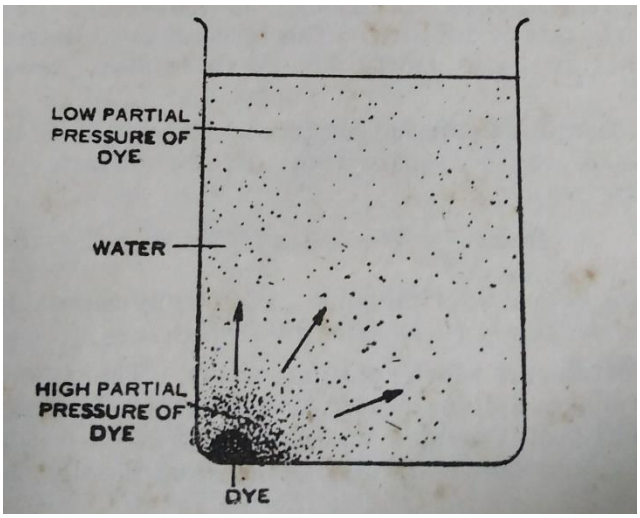

Fig. 1 Demonstration of diffusion

Diffusion Pressure:

The diffusing molecules or ions exert a pressure called diffusion pressure. This can be defined as the potential ability of a molecule or ion i.e., solid, liquid or gas to diffuse from an area of its greatest concentration to an area of lesser concentration or the number of diffusing particles i.e., greater the concentration of diffusing particles in the system, their diffusion pressure will also be greater and vice versa.

Factors influencing rate of Diffusion

A number of external and internal factors control the rate of diffusion in any plants.Some of the important factors are summarized below-

i. **Temperature:** Temperature greatly influences the rate of diffusion. If the temperature is raised diffusion is accelerated because the velocity of the diffusing is increased.

ii. **Density of the diffusing substrate:** The rate of diffusion is inversely proportional to the square root of the density of the diffusing substance.

$D\alpha 1/\sqrt{d}$ where D = Diffusion and d = density

This is known as graham's Law of diffusion. In general, larger the molecule, slower is the rate of its diffusion.

iii. **Medium in which diffusion occurs:** The rate of diffusion will be slower if the medium is more concentrated. That means, an increase in the number of 'foreign' molecules causes the rate of diffusion to decrease. e.g., a gas diffuses more rapidly through a vacuum than air.

iv. **Diffusion pressure gradient:** The term diffusion pressure gradient implies the application of concentration differences over a specific distance. In general the diffusion pressure gradient, more rapid will be the net diffusion of molecules.

Significance of diffusion in plants:

i. The exchange of gases for example CO_2 intake O_2 output in photosynthesis and CO_2 output and O_2 intake in respiration takes place by the principle of independent diffusion.

ii. The process of diffusion is involved in the transpiration of water vapours.

iii. The ions are absorbed by the simple diffusion during passive salt uptake.

iv. Diffusion is an effective means of transport of substance over a very short distance and helps in the translocation of food material.