Ex. No. 6: Determination of Water Potential of Potato Tubers.

Aim: To determine the water potential of potato tubers.

Principle: Water potential is the potential energy unit volume relative to pure water in reference conditions. The measure of the relative tendency of water to move from one area to another, and is commonly represented by the Greek letter Ψ (Psi).

Water potential (Ψ) is a measure of the driving force that governs the movement of water from the soil into plants and finally into the atmosphere. Water potential is the amount of energy per unit volume (or pressure) contained in a system (like a plant cell, tissue, or soil) and is expressed in units of megapascals (Mpa). For reference, pure water in a free standing solution has a water potential of zero, while most plant cells have a negative water potential. Water potential of a plant cell is made up of two important components, and the relationship among these components is expressed mathematically as:

$$\Psi = \Psi s + \Psi p$$

Ψ is the overall water potential of a cell.

Ψs is the solute or osmotic potential and represents the contribution made by dissolved solutes to Ψ.

Ψp is the pressure potential and represents the contribution made by pressure to Ψ.

Procedure:

1) Prepare the following sucrose solutions *i.e.*, 0.0 (distilled water), 0.2, 0.4, 0.6, 0.8 and 1.0 M sucrose.
2) Cut 6 cylinders from a potato and trim each cylinder to 4 cm in length with a knife.
3) Quickly blot the cylinders on paper towels to remove any excess moisture and weigh the cylinders. Record the weights in following table. After weighing, quickly transfer one cylinder to each beaker and ensure that they are fully immersed in the solution.
4) After 45 minutes, remove the cylinders, blot excess moisture with paper towels, and reweigh them, exactly as in step 3. Record the weights in following table.

Observations and Calculations:

Record the observations and calculate as shown in the following table. Then plot graph using the per cent change in weight at Y-axis and different concentration of sucrose on X-axis. Using this graph determine the exact concentration of sucrose that would cause no change in weight in the potato tubers. The water potential of this solution will equal the water potential of the potato tissue. *For drawing the graph please refer last page figure 2.*

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Table: Weight change in potato tissues in sucrose solutions of different concentration.

	Sucrose					
	0 M	0.2M	0.4M	0.6M	0.8M	1.0M
Initial weight						
Final weight						
Difference in weight						
Difference in %						

In an open solution where there is no turgor pressure, the Ψp is equal to zero. Thus, the Ψ of such a solution is equal to the Ψs of a solution. Calculate the Ψs of the solution causing no change in weight of the potato tissues using the following formula:

Ψs = -miRT
m = molarity
i = ionization constant *i.e.,* 1 for sucrose
R = gas constant *i.e.*, 8.31 J K^{-1} mol^{-1}
T = room temperature in K (ºC + 273 = K)

(For example [-0.4 x 1 x 8.31 x {25+273}] = -990.55)

Report: Water potential of the given potato tuber cells is ____ Mpa

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