

# EXPERIMENT

3

## Aim

To study osmosis using a potato osmometer.

## THEORY

### OSMOSIS

It is the net movement of water molecules or solvent molecules through a differentially permeable or semipermeable membrane from the region of low solute concentration to the region of high solute concentration till a state of equilibrium is reached. The rate of osmosis depends on the permeability of the separating membrane. Permeability is the ability of a membrane to allow passage of gases, liquids and liquid dissolved substances through it. The membrane that allows passage of all types of substances through it, is called permeable membrane, while the membrane that allows passage of only certain molecules or ions through it is called semipermeable membrane. Osmosis is measured by an instrument called osmometer.

### Types of Osmosis

Osmosis is of two types:

1. **Endosmosis:** When the cell is placed in a hypotonic solution (i.e. osmotic potential is lower than the cell sap), the solvent or water moves inside the cell. During endosmosis, the cells swell up due the entry of water and become turgid.
2. **Exosmosis:** When the cell is placed in a hypertonic solution (i.e. osmotic potential is higher the cell sap), the outward flow of water or solvent takes place. During exosmosis, the cells tend to and become flaccid.

The net direction of molecules and rate of osmosis depend on two factors:

1. Pressure gradient
2. Concentration gradient

**Reverse osmosis** is expulsion of pure water from solution through a semipermeable membrane under the influence of external pressure, higher than the osmotic pressure of solution

### MATERIAL REQUIRED

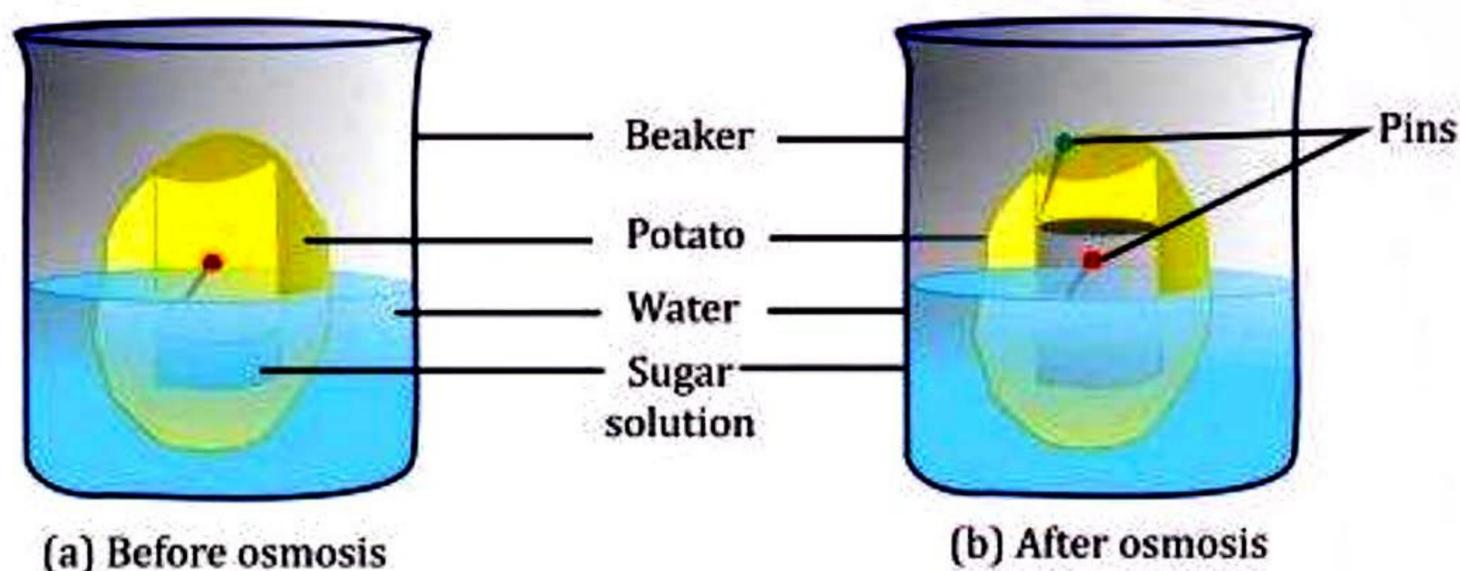
A fresh big potato, peeler or scooper, 10-20% sugar solution (or concentrated salt solution), Petri dish, blade, beaker, water and pins or needles marked with ink (waterproof).

### PROCEDURE

1. Cut the potato into two equal halves with blade. Peel off the outer skin of potato and shape the two halves into squares to give it a flat and even base.
2. Make a square or circular-shaped cavity in the centre of the potato by scooping the soft parenchyma with the help of a peeler or scooper. The cavity prepared by scooping should have minimum thickness at the bottom.
3. Place the potato on its flat cut end in a Petri dish, half-filled with water in such a way that 2/3rd of the potato is dipped in water.
4. Fill half the cavity of the potato with 10-20% sugar solution and mark the level of sugar solution inside the

cavity with the help of a pin or dissecting needle. This prepared apparatus works as an osmometer.

5. Leave this osmometer undisturbed for about 2-3 hours.
6. Observe the level of sugar solution.
7. Repeat this experiment using water in potato cavity and sugar solution in Petri dish.



### OBSERVATION

The level of sugar solution in the potato cavity (which acted as an osmometer or osmoscope) rises after sometime due to the entry of water from the beaker into as a result of endosmosis.

### RESULT

A water potential gradient is established between sucrose solution in the potato cavity and the external water. The cell membrane enclosing the cells of potato acts as a selectively permeable membrane for the movement of water and osmosis takes place successfully.

### PRECAUTIONS

1. The potato cavity should be deep enough to keep only a thin layer of tissues at the base.
2. The potato block should be flat at the lower end to keep it stable in the Petri dish.
3. Sugar solution should be highly concentrated, as compared to the cell sap of potato cells for osmosis to take place.

## VIVA VOCE

**Q1. How is osmosis different from diffusion?**

**Ans.** Osmosis is a special type of diffusion, in which solvent molecules move from a region of their higher concentration to the region of lower concentration through semipermeable membrane.

**Q2. What is semipermeable membrane?**

**Ans.** It is biological / unit membrane which allows the movement of only few selected molecules across it.

**Q3. Name some semipermeable membranes.**

**Ans.** Membrane of urinary bladder or membrane present inside the egg shell.

**Q4. Give an example of osmosis occurring in biological system.**

**Ans.** Swelling of raisins when kept in water.

**Q5. Why do we remove peel of potato while making a potato osmometer?**

**Ans.** The skin of potato is thick and makes it impermeable for water to move across it. Therefore, it must be peeled off before making it as an osmometer.

**Q6. Can we use some other material for conducting this experiment?**

**Ans.** Yes, we can take other plant material like any of the root vegetable to make an osmometer.

**Q7. Why do we use potato for making an osmometer or osmoscope?**

**Ans.** Potato is an easily available living material and can be handled easily, therefore it is used as an osmometer or osmoscope.

**Q8. What do you mean by osmotic pressure?**

**Ans.** It is the pressure which has to be applied to prevent the flow of pure water into concentrated solution under ideal osmotic condition.

**Q9. Define the following terms:**

**(i) Exosmosis**

**(ii) Endosmosis**

**Ans. (i) Exosmosis:** The outward movement of water from the cell when kept in a hypertonic solution is called exosmosis.

**(ii) Endosmosis:** The inward movement of water inside the cell when kept in a hypotonic solution is called endosmosis.

**Q10. Give difference between hypotonic and hypertonic solutions.**

**Ans.** The solution, whose osmotic potential is lower than that of the cell sap is called hypotonic solution, while the solution whose osmotic potential is higher than that of the cell sap is called hypertonic solution.