Osmosis & Reverse Osmosis

Osmosis:

Physical process by which a liquid starts to diffuse through a semi-permeable membrane when there is a difference in concentration of certain solutes. Osmosis is a process where no energy is required.

Semi-permeable membrane = the membrane that is permeable to water but not for solute.

From the below figure, the osmosis process can easily be understood. The general physics is that; a less concentrated solution must have a natural tendency to migrate to higher concentrated solution. From the figure, it is clear that two different concentrated sugar solution is separated by a semi permeable membrane. After a certain period of time, the solvent from the lower concentration migrated to the higher concentrated parts; hence the volume level gets increased.

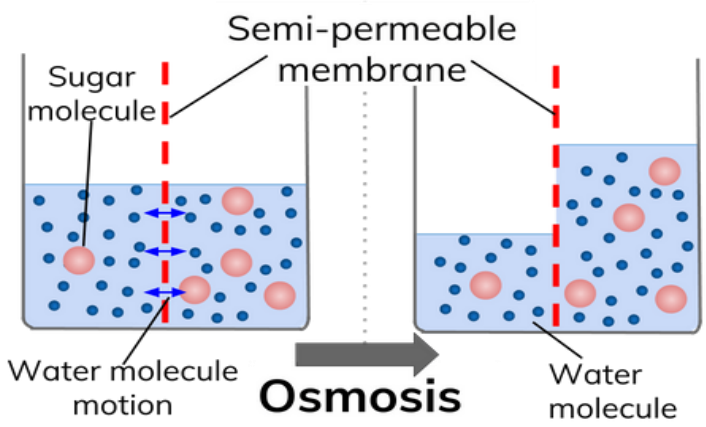

Figure: Osmosis

Basically, osmosis is the diffusion of water or other solvents through a semi-permeable membrane. When a solution is kept separated from the pure solvent by a semi-permeable membrane, the solution will become more dilute by absorbing solvent through that semi-permeable membrane.

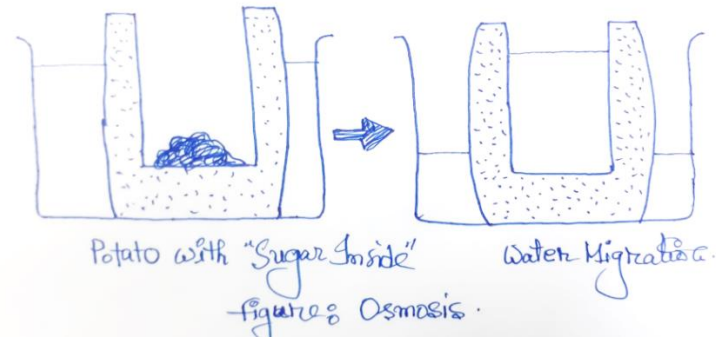

Figure: Osmosis [in potato]

A hydrostatic pressure is required for resisting the movement of solvent molecules is called the osmotic pressure. The osmotic pressure in an ideal solution is affected by temperature and volume.

Semi Permeable Membrane:
Semi permeable membrane is a membrane which allows the passing of some selective molecules and atoms. It means that, all items are not allowed for passing through the semi permeable membrane.

Types of osmotic condition

- Hypertonic condition
- Isotonic condition
- Hypotonic condition

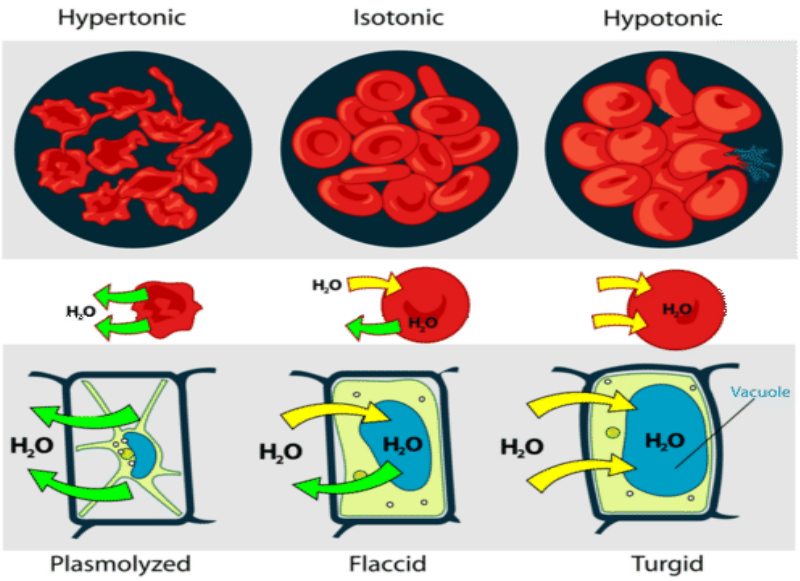

Figure: Hypertonic, Isotonic, Hypotonic condition

In a hypertonic solution a body cell will lose water from itself and finally the body cell gets squeezed.
In an isotonic solution a body cell will be stable as water movement inside and outside is stable.
In a hypotonic solution a body cell will gain water through osmosis & finally can blast.

Osmosis is a very important natural occurring process. Osmosis is a solvent transferring process. In this process the solvent tends to migrate to a stronger concentration from its lower concentration.

Reverse Osmosis:

Reverse osmosis is a process by which pressure is applied to take out water from its low concentration to its high concentration.

Basically, reverse osmosis is a special type of filtration process where a semi-permeable, porous membrane is used which allows only pure water to pass through it by filtering the larger molecules of impurities.

It was early noted that, osmosis is a process where no energy is required. It means that if we want a reversal process then we must need to apply a force against it.

Reverse Osmosis Membrane is such kind of membrane which allows only water molecule to pass through it. As the osmosis process is non force activities, so for the reverse osmosis a high pressure is applied to perform the process.

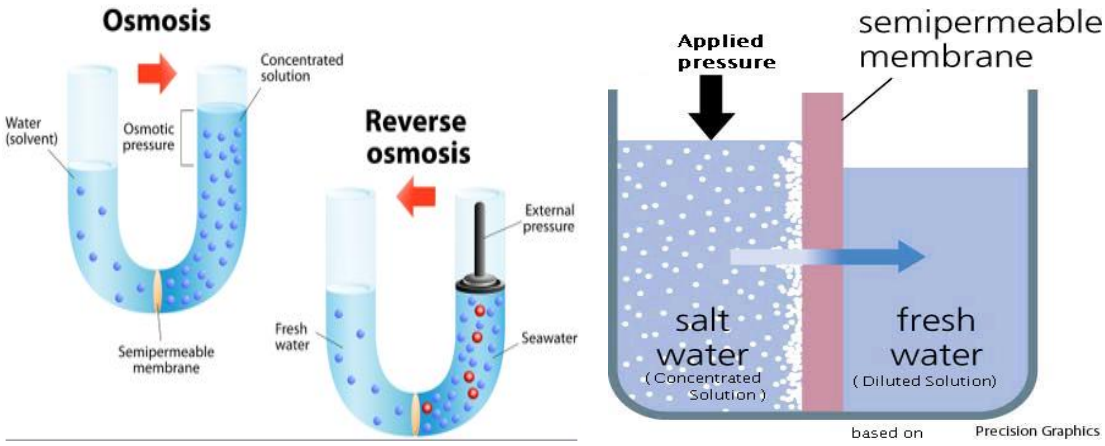

Figure: Reverse Osmosis

In industry, reverse osmosis is used to get very low hardened water.

Reverse osmosis generally works by reversing the principle of genuine osmosis. Suppose, a salt solution is taken and the solution is subjected to be pressurized and pressed against a semi-permeable membrane. When the applied pressure is greater than the osmotic pressure, then water molecule gets reversed from its high concentration to its low concentration.

During reverse osmosis, 99% of dissolved salt particles, colloids, micro-organisms etc. can be removed. Mentioned contaminants are separated by the RO-membrane on the basis of size and charge. Reverse osmosis cannot remove gases as they are not highly ionized [eg. CO_2]

Reverse Osmosis Function:

In a reverse osmosis plant a high pressure pump is used. This high pressure pump force's the water across the semi permeable membrane of RO system. This forcing will leave all around 95% - 99% of dissolved salt into the rejected/concentrated water. the amount of pressure required depending on the salt concentration of feed water. The fact is that; the more concentrated feed water will require the more pressure for RO system.

Permeate Water = The water that is demineralized or deionized in the process.
Reject/Concentrated Water = The water that contains concentrated contaminants & do not pass through the RO system.

Differences in between Osmosis & Reverse Osmosis:

Osmosis	Reverse Osmosis
Natural process	Artificial pressurized process
Works along the potential gradient	Works against the potential gradient
Works aligning with osmotic pressure	Works against osmotic pressure
Water movement from its high concentration to its low concentration	Water movement from its low concentration to tis high concentration