Reverse Osmosis

When two solutions having different concentrations are separated by a semipermeable membrane, flow of solvent molecules from the region of low concentration to high concentration takes place, untill the concentration becomes equal on the both sides. The phenomenon is called osmosis. Osmosis is thus the movement of water molecules from pure water to the solution side. The driving force in this phenomenon is called osmotic pressure. Water can also be made to flow in the reverse direction i.e from solution side to the pure water by applying a hydrostatic pressure in excess of osmotic pressure, on the concentrated or solution side. *This process of reversing the flow of solvent molecules by applying hydrostatic pressure in excess of osmotic pressure, on solution side is known as reverse osmosis. (Fig. 9.12 b).*

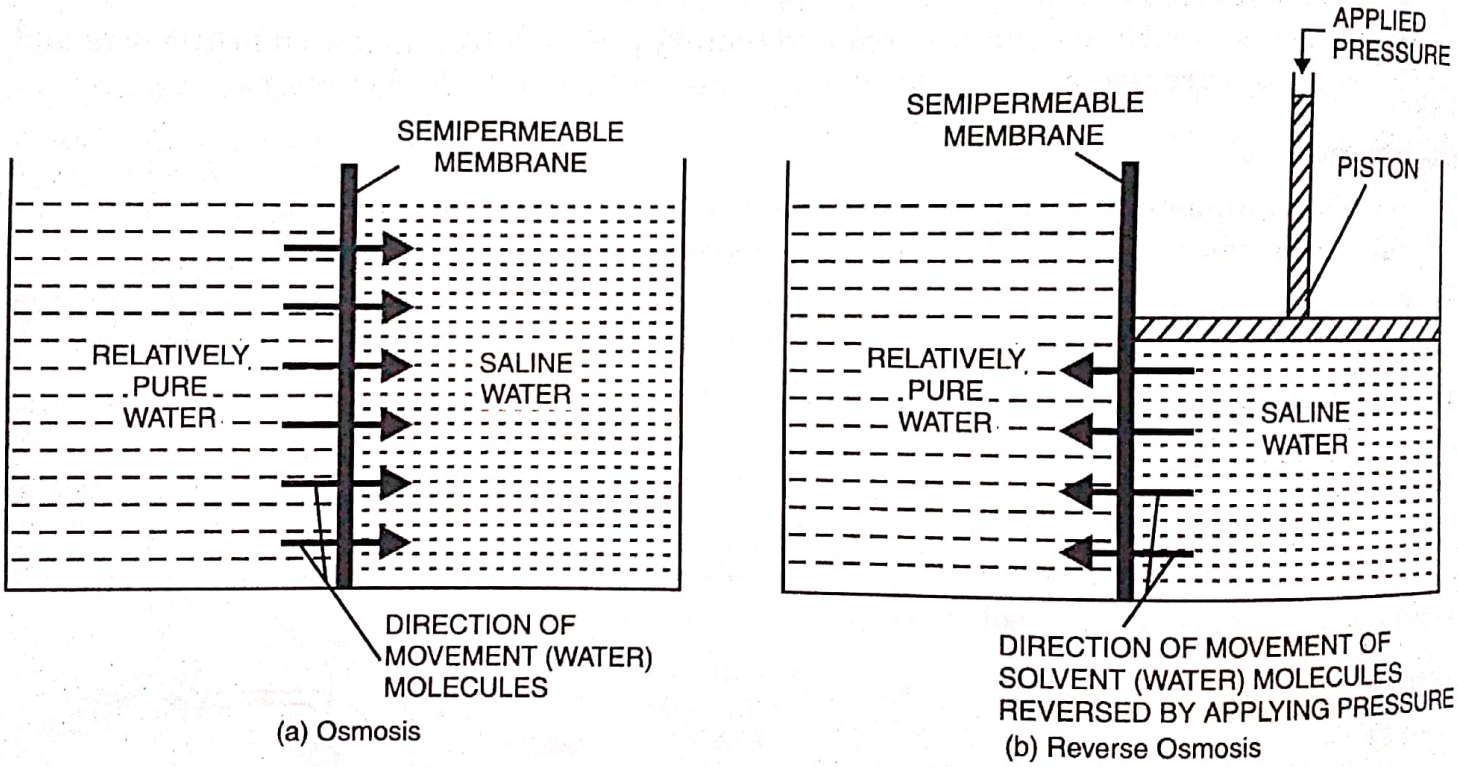

Fig. 9.12 Schematic Representation of Osmosis and Reverse Osmosis

Thus is reverse osmosis, water is separated from the dissolved salts through membrane filteration. This is sometimes called hyper filtration or super filtration.

Desalination of water through the technique of reverse osmosis involves the application of pressure of the order of 15-40 $kgcm^{-2}$ to the impure water (sea water/brackish water) which thereby forces its pure water out through the semipermeable membrance. A major problem in reverse osmosis is to find membranes strong enough to withstand the high pressure required and at the same time impermeable to the solute particles dissolved. Synthetic membranes made up of nylon or cellulose acetate have been developed to meet these requirements. More recently the membranes made up of polymethacrylates and polyamide polymers are being used.

Advantages

(i) Purification through reverse osmosis removes ionic as well as non ionic, colloidal and high molecular weight organic matter.

(ii) The energy requirement is 30% lower than that of distillation process.

(iii) The maintenance cost includes mainly the replacement of semipermeable membrane the life time of which is quite high, extending to about 2 years.

Thus purification of water through reverse osmosis is gaining importance because of its simplicity, high reliability and low capital cost.

DOMESTIC ULTRA VIOLET PURIFICATION SYSTEM

The use of ultra-violet (uv) rays is now a days, a common method adopted for disinfection of drinking water at homes, offices, schools and various organizations. Excellent sterilization occurs when uv rays of sufficient intensity irradiate a thin film of water. UV rays sterilization unit is installed immediately before the point of use.

A common uv sterilization system is shown in Fig. 9.13. Usually it contains the following units-

(i) A filter Candle.

(ii) Activated Carbon Chamber

(iii) Ultraviolet sterilization chamber

Water is first passed through the filter candle, which has multilayered filtering system to strain out physical impurities present water. Then it is passed through the activated carbon chamber which removes colour, odour, organic impurities and free gases. And finally it is subjected to u.v chamber where u.v rays kill the micro organisms. The rate of flow of water is controlled through the U-tube to ensure complete disinfection.

An electronic monitoring system monitors the purification process.

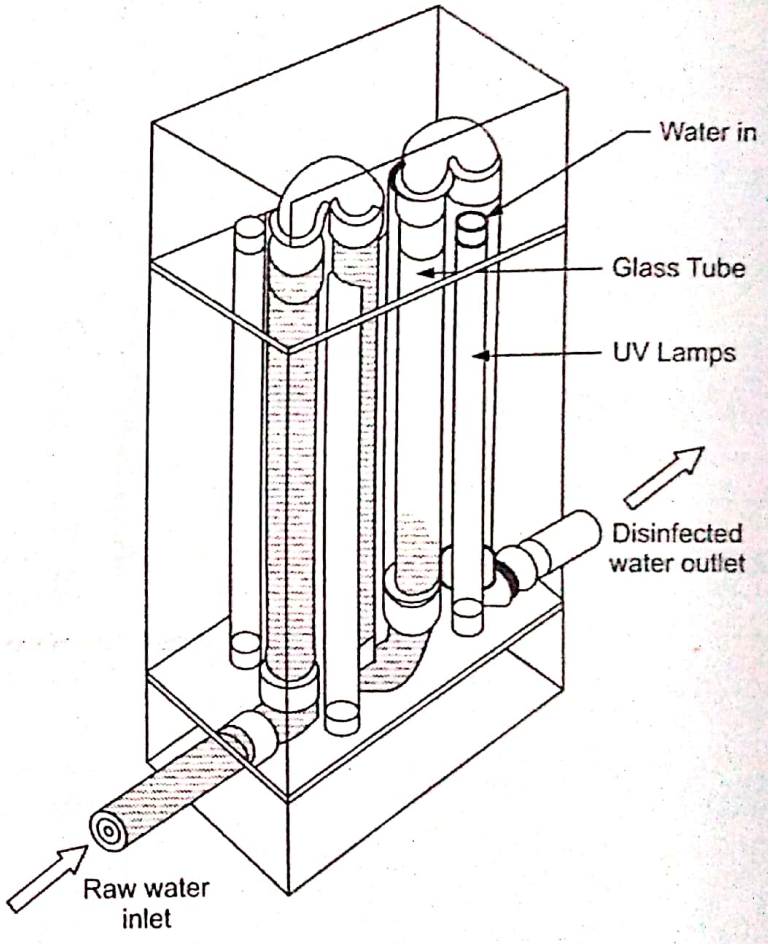

Fig. 9.13 U.V. Sterilizer

RO SYSTEMS

Drinking Water Purification through Reverse Osmosis Units

Another method for purification of drinking water is through Reverse Osmosis Units: The reverse Osmosis process is highly effective in removing a wide range of contaminants from water including heavy metals, chemicals, dissolved salts and micro-organisms. The water is forced through an extremely fine semi-permeable membrane rejecting the contaminated water and leaving only pure, clean and healthy water. Reverse Osmosis is the only effective way to remove fluroride from water.