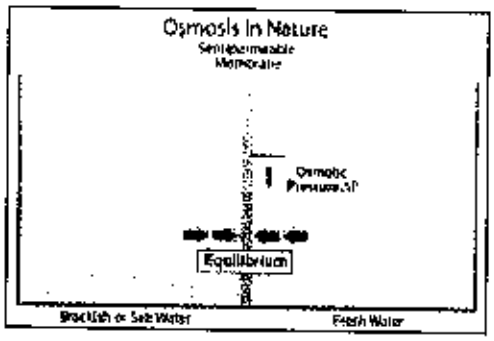
Fundamentals of Reverse Osmosis

"Reverse osmosis explained"

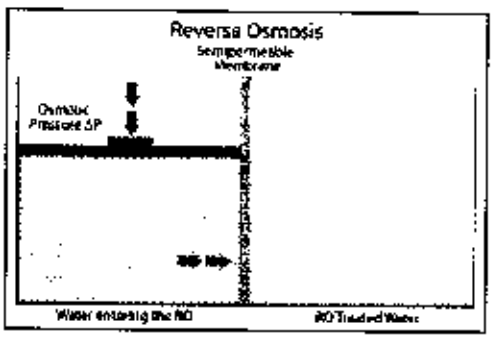
Reverse osmosis is the opposite of the osmosis process that occurs in nature. Osmosis is the passage of a liquid through a semi-permeable membrane. In nature, osmosis drives a liquid with a low level of dissolved solids (usually water) through a semi-permeable membrane into a solution of higher dissolved solids concentration. It continues until the osmotic pressures of both liquids have equalized. This natural process tends to mix the concentrations of the solutions on both sides of the membrane. The natural osmosis process, therefore, works great in pushing the more concentrated tree sap up to the tallest leaves of an oak tree, but it uses up pure water to do it.



To treat water using the osmotic process, the natural forces of osmosis must be reversed. In the reverse osmosis process, the water from a liquid with a high concentration of dissolved solids is forced to flow through the membrane to the low concentration side where this water can be collected. The process is achieved by applying enough pressure to overcome the natural osmotic pressure forces on a membrane. The semi-permeable membranes used in the process are engineered to only allow the passage of the water molecule. The result is high quality water.

"How it works"

The heart of the RO system is the semi-permeable membrane which acts as a molecular filter to remove up to 99% of all dissolved solids.* The semi-permeable membrane allows water molecules to pass through while blocking other salt molecules. So as pressure is applied to the concentrated solution, water is forced through the membrane from the concentrated side to the dilute side. The dissolved and particular materials are left behind.



Water molecules penetrate the thin layer of the membrane and diffuse through it molecule by molecule. Dissolved salt ions do not diffuse through this layer because the solubility of the salt ions is much less than that of the water. Thus, the water moves through more readily and separation from the other molecules present occurs. The driving force is furnished by both the pressure and the concentration differentials across the membrane. For water, the pressure effect is the most important, and for dissolved mineral ions the concentration difference is most important. Therefore, increases in pressure increase the product water flow without a corresponding decrease in the quality of the product water. This process removes up to 99% of most dissolved mineral salts, virtually all of the particulate matter, and many dissolved organic compounds.

The semi-permeable membrane must be made of a highly durable material since it must withstand pressure higher than the pressure differential between the concentrated side and the diluted side of the membrane which can be very high – as in the case of seawater, where it is up to 350 psi (25 kg/cm²).