# Osmosis - Nature's Water Pump

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Osmosis is a rather remarkable process. Without it, plants would not be able to pull water from the soil; nor would living things be able to draw nutrients through their cell walls.

From a scientific perspective, osmosis is the process whereby water is drawn through a semi-permeable membrane from an area of low solute concentration to an area of high solute concentration. Putting this in less intimidating terms, nature really likes to have everything in a state of balance or harmony. Picture the roots of a plant with a weak sugar solution called "sap" inside them. Outside the roots, there is water in the soil which contains dissolved nutrients, but no sugar. Sensing this imbalance in the sugar concentration, water from the soil will begin to permeate through the root membrane to dilute the concentration of the sugar. Once the moisture is drawn into the root, the plant sends the diluted sap up to the leaves where the moisture and nutrients from the soil are used. The sap, which has now been concentrated back to its original sugar level, then travels back down to the roots to pick up more moisture, and so the cycle continues.

The flow of sap in maple trees during the late winter is what gives us the starting material for maple syrup. By removing the excess water from the sap, we get the delicious syrup which is over 66% maple sugar.

Osmosis can also be used in food processing to remove moisture as a preservation step. Those of you who have enjoyed dried mango slices may have unknowingly sampled the results of what is known as "osmotic dehydration".

Typically, the cells of mangoes contain various sugars, along with a great deal of moisture. On average about 84% or so of a mango's weight is water. One way to remove this moisture is to cut the material into slices and blow hot air across them to evaporate the water. However, this requires heat which may have a negative impact on the flavour or texture. A simple yet effective way to remove a great deal of the water is to sprinkle dry sugar crystals on the surface of the mango slices and let nature take its course.

The sugar begins to dissolve in the film of water on the surface of the mango. The mango cells then sense a high sugar concentration on their outside surface and begin to send water out of the cells to equalize the sugar concentration. The result is a loss of moisture within the mango slice and the formation of a syrup on the outside of the slices. Once the osmotic dehydration process has been completed, the mango slices are removed from the syrup. The remaining moisture within the mango slices is then removed by a relatively short, mild, heating step in a forced-air dryer to reach the

desired final moisture content.

If you want to try your hand at “osmotic dehydration” at home, its easier than you may think. All you need is an apple, some table sugar, and a plastic sealable container. Prepare some apple rings (or slices) by peeling and coring an apple. Spread a few slices on the bottom of the plastic container and sprinkle a layer of sugar over them. Put the lid on the container and let it stand for a few hours. You should then notice a liquid syrup beginning to form. If you leave it overnight, you will be surprised at just how much syrup is formed. All the moisture that went into forming the syrup came from the apple slices.

Although I would not recommend eating the partially dried apple slices if they have been standing at room temperature overnight, this little experiment will give you an idea of how the process of osmotic dehydration functions.

**Photos of apple slices with table sugar sprinkled on them**