

## Ion Exchange

Ion exchange is the process of exchanging ions in a liquid medium. In the context of water treatment, ion exchange specifically refers to the process of water softening or the exchange of sodium ions for calcium and magnesium ions in order to remove hardness. Hard water has the potential to form scale and plug piping. Ion exchange softeners are commonly used to reduce hardness in residential and commercial water systems.

The softener unit is a tall tank that contains small beads called ion exchange resins. These resins contain sodium ions on their surface. When the softener is submerged with hard water, sodium ions leave the resins and diffuse into the solution. Calcium and magnesium, on the other hand, get adsorbed by the resins. Sodium ions do not have the tendency to form scale like calcium and magnesium and the water becomes softer as a result. Therefore, ion exchange simply replaces one type of ions with another, much like exchanging apples for oranges!

Once all the sodium gets exhausted from the resins, the process ceases. At this point it becomes necessary to replenish the resins with a fresh load of sodium. Softener systems have a control valve and an auxiliary brine tank for backwash. When the backwashing cycle starts, brine solution flows from the salt tank to the softener bed, submerging the resins with salty water that contains sodium ions. Now the reverse process occurs; calcium and magnesium are released into the solution while the resins adsorb sodium ions again. Once this process finishes water is flushed down the drain to get rid of the accumulated hardness. The resin bed becomes ready to treat hard water again.

Ion exchange adds sodium ions to make soft water, and some people mistakenly believe that this has detrimental health effects especially on individuals with strict dietary requirements. According to the Canadian Water Quality Association, the amount of sodium in soft water is too small to be significant. In fact, we obtain most of our sodium intake from food, and so consumption of soft water is safe.



Ion exchange resins



A water softener system  
with a brine tank