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Water Softeners

Hard water and water softeners

Hard water¹ is water that has lots of minerals in it. **Soft water**² is low in minerals. In some areas, water is “hardened” as it flows through



Mineral buildup inside a water pipe

limestone and chalk, picking up **inorganic molecules**³ like calcium and magnesium. These molecules cause

soaps to not work as well by making **lathering**⁴ and rinsing difficult. This leaves water spots on dishes. They also form scum and scaly buildup in pipes and machines that process water (like humidifiers and coffee makers). This buildup leads to clogs in pipes and can make machines stop working. To fix hard water, some homeowners and water treatment plants install **water softeners**⁵,

which take out the inorganic compounds. Hard water isn't toxic. Installing a softener is a personal choice, but one that can increase the life of household appliances, keep pipes clear, keep dishes looking cleaner, and save you money on soap.

Did You Know?

While hard water isn't toxic to humans, it will kill some species of aquarium fish.

How do water softeners work?

Ecobottle Sample

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¹ **Hard water:** water that has lots of minerals in it

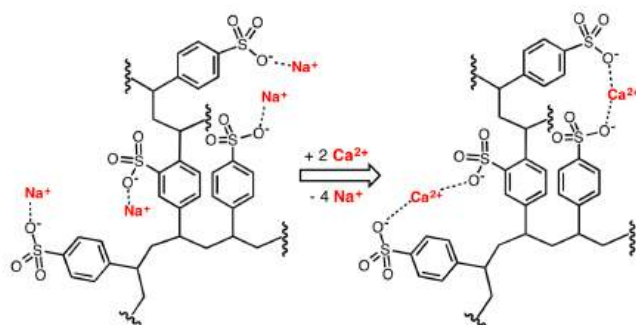
² **Soft water:** water that has a low mineral content

³ **Inorganic molecules:** molecules that are not made by living things and do not have carbon in them

⁴ **Lathering:** making bubbles

⁵ **Water softeners:** machines that remove inorganic compounds from water

Calcium and magnesium have a positive charge. Positive and negative charges attract. Because of this, beads “catch” calcium and magnesium as water flows through the tank. To “clean” the beads, the water flow is first reversed to wash dirt out of the tank. Next, saltwater from the other tank flows through. Sodium (a part of salt) is positively charged. It knocks the calcium and magnesium off the beads. Calcium and magnesium are washed down the drain. Extra salt is washed out, the saltwater tank is refilled, and the mineral tank is ready for more hard water. When the softened water leaves the tank, it is still carrying sodium ions. This can be dangerous for people with high blood pressure, or people on low sodium diets. However, for healthy individuals, the added sodium isn’t dangerous.



Sodium/calcium exchange

Central: Industrial water softeners have one tank. This tank holds sand and a chemical, usually

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Mineral buildup in a humidifier.

How do you know if your water is hard?

Generally, if your soap is hard to lather, you might have hard water. You may also notice water stains on dishes and a mineral buildup (usually whitish) inside certain appliances that process a lot of water. In the case of humidifiers, the minerals will build up on the heating element until the machine stops working. If this occurs, a simple fix is to let it soak in vinegar

overnight, then scrub it with a bristle pad.

If you'd like to perform a quick test at home, try adding dish detergent one drop at a time to 350 mL (12 oz) of water. After each drop, shake the sample and look for suds (bubbles of soap and air). Keep adding drops until you see suds appear.

Number of soap drops until suds appear	Classification
10	Soft
20	Slightly hard
30	Moderately hard
40	Hard
50	Very hard

Reading Comprehension Questions

1. What is “hard” water?
2. How is
3. How does hard water affect people?
4. How do
5. How do you know if you have hard water?
6. If you
7. What

Extension Questions – Answer Key

8. What is a mineral and how is it different from a rock?

Access the video via the URL or QR code below to answer questions 8 and 9.



<https://goo.gl/2i9Eqc>

9. What percentage
10. What happens

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