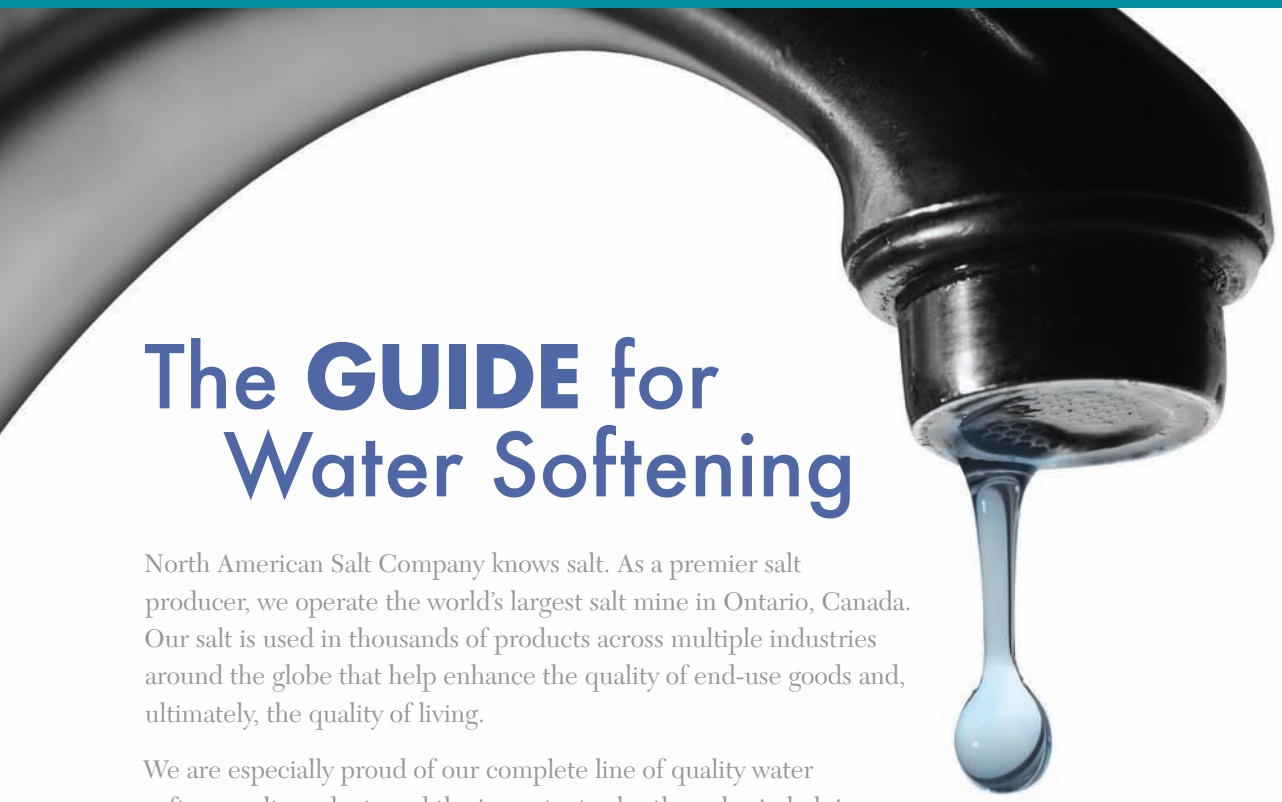

The **GUIDE** for Water Softening

North American Salt Company knows salt. As a premier salt producer, we operate the world's largest salt mine in Ontario, Canada. Our salt is used in thousands of products across multiple industries around the globe that help enhance the quality of end-use goods and, ultimately, the quality of living.

We are especially proud of our complete line of quality water softener salt products and the important roles they play in helping make people's water purer and lives healthier:

- SureSoft®
- Natural Salt™
- Nature's Own®

Your success is important to us. North American Salt Company is committed to serving you one-on-one to hear feedback, answer questions, solve problems, and provide the best services in the industry. From our coast-to-coast sales network, on-line ordering capabilities and toll free customer service hotline, our professional and knowledgeable staff is ready to help you in any way it can. In fact, that is the whole purpose behind this comprehensive water softening guide.

Bottom line? Think of us as your efficient, economical, and reliable salt partner. Call us today at 1-800-755-SALT.

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Terms in bold can be found in the glossary

WHAT IS HARD WATER?

Hard water is water that contains more dissolved **minerals** than ordinary water. The most common of these minerals, which results naturally from exposure to rocks and sediment, are **calcium** and **magnesium**.

Because these are the minerals that cause hard water, the more calcium and magnesium in the water, the harder the water. Fortunately, the solution is as simple as using a **water softener.**

WHAT ARE THE NEGATIVE EFFECTS OF HARD WATER?

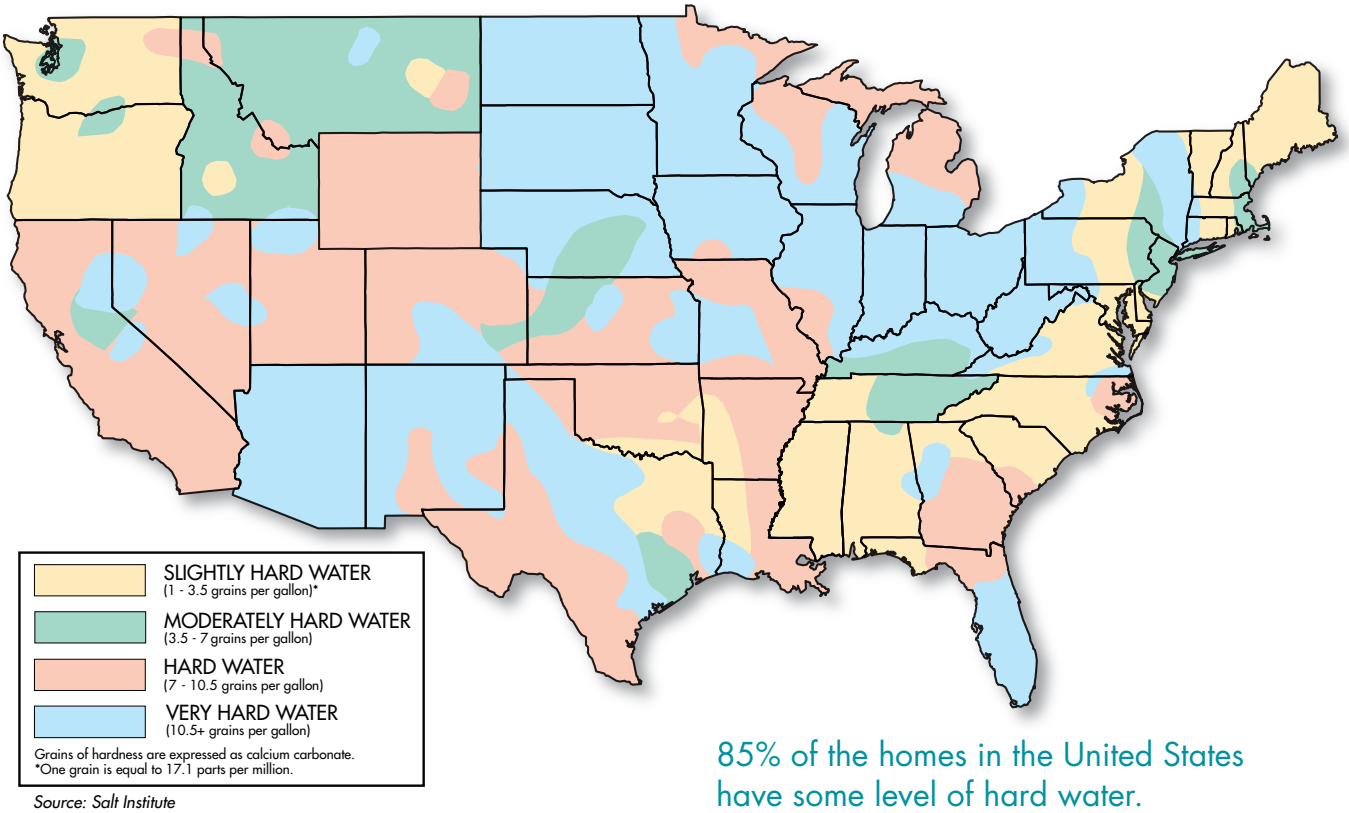
While not a health risk, the presence of calcium and magnesium makes it harder for soap and detergent to dissolve in water. And that can mean:

- newly washed clothes look dingy & feel scratchy
- washed clothes wear out up to 15% faster
- skin has a filmy residue after bathing
- extra shampoo is needed to get hair clean
- soap scum rings on bathroom fixtures
- extra detergent is needed to get dishes clean

If any of this is happening, a test for water hardness is highly recommended.

Hard water can also clog pipes and form water-impeding **scale deposits** in plumbing fixtures, hot water heaters and boilers. This can show up in the form of higher costs from increased energy and water usage, as well as additional maintenance charges. Hard water can also shorten equipment life including washing machines that can wear out up to 30% faster than normal.

WHERE ARE THE SOFTEST AND HARDEST WATERS IN THE U.S.?



Source: Salt Institute

85% of the homes in the United States have some level of hard water.

HOW DO YOU TEST FOR HARD WATER?

There are a variety of ways to test for hard water. One of the simplest and least expensive is a **water hardness test strip**. When tested this way, the **grains of hardness** per gallon can be measured, which in turn establishes the level of **hardness** in water. For example:

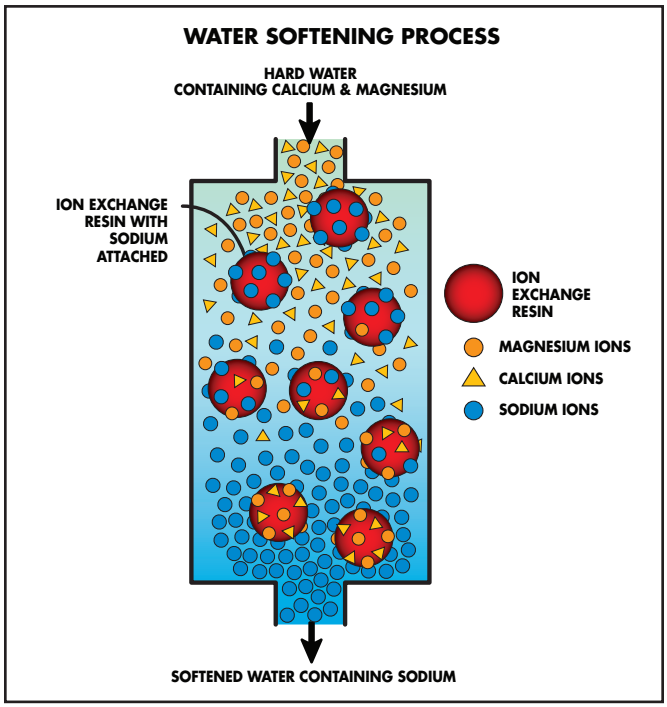
Slightly hard water:	1.0-3.5 grains/gal
Moderately hard water:	3.5-7.0 grains/gal
Hard water:	7.0-10.5 grains/gal
Very hard water:	10.5 & over grains/gal

WHAT IS THE BEST WAY TO SOFTEN HARD WATER?

Because dissolved calcium and magnesium are the causes of hard water, it is essential to treat water in a way that effectively removes these dissolved minerals from the water.

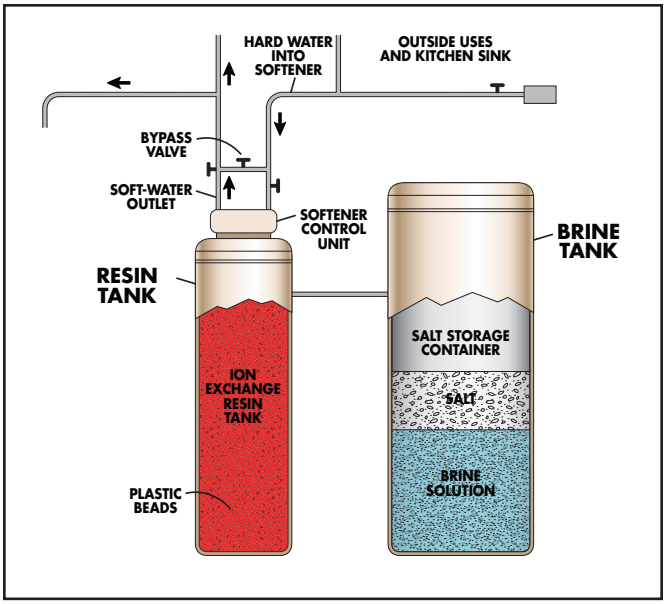
The best way to remove dissolved calcium and magnesium from your water is by using a water softener.

An alternative to a water softener is a type of **water purifier** called a **reverse osmosis** system. A reverse osmosis system uses a semipermeable membrane that acts as a **filter**, allowing water to pass through and trapping the calcium and magnesium, removing these minerals from your water. This alternate method is not recommended for whole house water softening as reverse osmosis can waste one gallon of water for every one gallon it softens.



HOW DOES A WATER SOFTENER WORK?

Plumbed into a home's water supply, a water softener is a mechanical appliance that includes a **resin tank** filled with a softening bed of **resin beads** and a **brine tank** that holds a salt solution. Water softeners are available in side-by-side and cabinet styles.

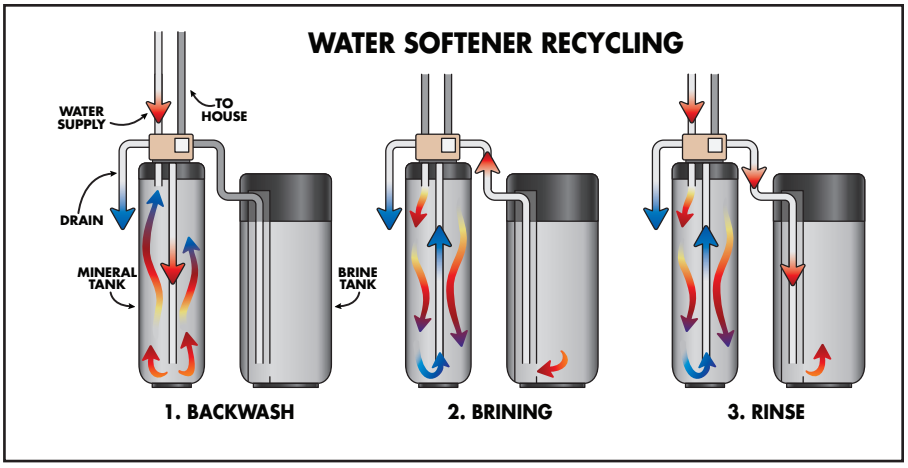


In a process known as an **ion (or cation) exchange**, the positively charged calcium and magnesium ions in the hard water pass through the resin bed and exchange places with positively charged sodium **ions** that are attached to the active sites on the beads. The result is that the water is now softened.

As the resins attract more and more calcium and magnesium minerals, the active sites decrease and their ability to soften the water is lessened. At this point, the softener needs to be regenerated. This means that the calcium and magnesium minerals need to be flushed from the resin tank and the beads' active sites need to be replenished with new sodium or potassium ions from the brine tank.

All this takes place in what is called a 3-phase **regenerating cycle:**

1. **Backwash**: The water flow is reversed to flush collected debris out of the resin tank.
2. **Brining**: The sodium or potassium solution from the brine tank displaces the calcium and magnesium from the resin beads' active sites, recharges the resin with sodium or potassium, and then flushes the calcium and magnesium down the drain.
3. **Rinse**: The resin tank is rinsed with fresh water and the brine tank is reloaded to begin the process again.



WHY IS IT IMPORTANT THAT A WATER SOFTENER REMOVES RADIUM FROM WATER?

Radium is a naturally-occurring radioactive element present in varying amounts in rocks and soil within the earth's crust. As **groundwater** comes in contact with these rocks and soil, it can pick up high amounts of radium.

Consumed in high doses, radium can cause lymphoma, bone cancer, and diseases that affect the formation of blood such as leukemia and asplastic anemia. The National Academy of Sciences has concluded that long-term exposure to elevated levels of radium in drinking water does indeed pose a "higher risk of bone cancer for the people exposed."

The U.S. Environmental Protection Agency estimates that long-term consumption of water containing five pCi/l radium will cause 44 added cancer deaths for every one million people exposed. The risk doubles to 88 per million at 10 pCi/l, triples to 132 at 15 pCi/l, etc.

An inexpensive way to remove up to 90% of radium from water is with the ion exchange process in a water softener.

WHY IS IT IMPORTANT THAT A WATER SOFTENER REMOVES BARIUM FROM WATER?

Barium is a lustrous metal that exists in nature in ores containing a mixture of elements.

In water, the more toxic soluble barium salts are likely to be converted to insoluble salts, which precipitate. Barium does not bind to most soils and may migrate to groundwater.

In the past, numerous industries regularly released barium into soil and water. Some examples of this included the discharge and disposal of drilling wastes, the smelting of copper, and the manufacture of motor vehicle parts and accessories.

At high levels in well water used for drinking, barium has the potential to cause various physical conditions. In the short term, barium can cause gastrointestinal disturbances and muscular weakness. In the long term, barium consumed can result in high blood pressure.

The ion exchange process found in water softeners is a very effective way of removing up to 99.5% of barium from drinking water.

WHAT ARE THE ADVANTAGES OF A WATER SOFTENER?

The advantages of using a water softener can be seen and felt in many positive ways:

- newly washed clothes look cleaner, feel softer, last longer
- softer skin and cleaner feeling hair
- no filmy residue after bathing
- less shampoo needed to get hair clean
- no soap scum rings on bathroom fixtures
- no film build-up on glasses & dishes
- less detergent needed to get dishes clean
- no form scale deposits in plumbing fixtures, hot water heaters & boilers
- decreased energy and water usage
- fewer maintenance charges and longer equipment life

WHAT ARE THE DIFFERENT TYPES AND STYLES OF WATER SOFTENERS?

There are four basic types of water softeners:

Semi-automatic: With this type, the operator must initiate only the regeneration cycle. Otherwise, all the other functions including all the steps required to return the system to service after regeneration are performed automatically by the unit.

Automatic: This is the most popular kind because all functions occur automatically, including regeneration. This phase is usually done during periods of low water usage and is triggered in one of three ways depending upon the unit:

Time-clock: Based on a time that the softener owner program, regeneration occurs on a fixed schedule.

Water meter: Once a fixed amount of water has gone through the softener, the regeneration process begins.

Sensor detector: The hardness of the water leaving the unit is monitored and the softener is signaled to regenerate as needed.

Demand Initiated Regeneration (DIR): Mostly used in commercial applications, these units handle all regeneration operations automatically as the demand for softened water dictates. The need for regeneration is determined by measuring gallons of water used or a change in electrical conductivity of the resin bed or by sensing a change in the hardness of the water. Because regeneration is done only when necessary, DIR units may require less salt and water. These units often have two softening tanks and a brink tank so that one tank can be recharging while the other is softening.

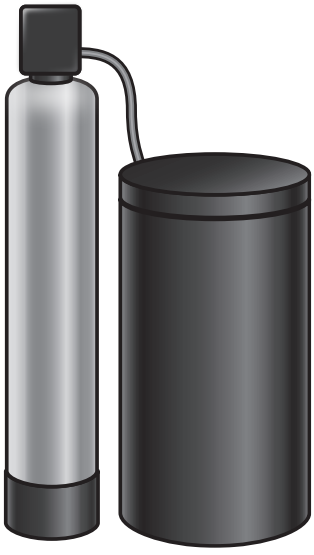
Off-Site Regeneration: With this rental type, the resin tank is exchanged in the home and then recharged at a central location.

Water softeners come in two different styles:

Single cabinet style with all the workings inside and the side-by-side version. Because the cabinet styles are usually bulky and hard to move around, manufacturers suggest using the highest purity salts with these. That way, the unit can be expected to perform longer at peak efficiency and require fewer cleanups.

Aside from type, style and price, another factor to consider when choosing a water softener is the hardness removal capacity of the unit. The smaller the unit's capacity, the more often it must be regenerated. A household's softening needs will depend on how much water is used daily and the hardness of the water.

Cabinet Style



Side-by-Side Style

To help choose a unit with the appropriate hardness removal capacity, a household's daily hardness removal need should be determined.

This simple formula should help:

Multiply the gallons of water a household uses daily by the hardness of the water.

Example:

350 gallons of water used daily
X 20 grains per gallon hardness
= 7,000 grains of hardness must be removed daily

For example: A typical 17,000 grain water softener would regenerate at 2/3 capacity or at 12,000 grains or every two days.

WHAT KINDS OF SALT PRODUCTS CAN BE USED WITH WATER SOFTENERS?

Water softener salts are made of either **sodium chloride** or **potassium chloride.** Besides size and shape, salts can differ in **solubility** (the ease at which they dissolve in water) and **purity** (the amount of impurities accumulated during the mining process).

FORMS OF SALT

Salt comes in several forms:

Blocks that can only be used in specially designed tanks. For maximum brine formation, blocks must always be submerged in water.

Cubes are about 3/8" thick and vary in width and length.

Pellets and Pellens are shaped like a cough drop and can vary in thickness.

Extra Coarse Crystals resemble over-sized grains of table salt.

Salts with Iron Fighting Additives help to fight rust and to keep a tank cleaner. Acting as a scrubber for the resin bed, these additives help limit the clogging of the resins, which helps make them stay more effective longer.

Salts with Resin-Cleaning Additives can protect the resin bed against deterioration caused by the accumulation of iron and other insolubles, as well as oil and fatty deposits plus other impurities found in local water supplies.

SODIUM CHLORIDE

There are three basic *types* of sodium chloride salts that can be used with water softeners:

Rock Salts are obtained by the traditional mining of underground salt deposits, rock salt is the most economical choice for water softeners. Rock salt usually contains much higher levels of impurities that eventually settle at the bottom of the brine tank. Because of this high level of **insoluble** matter, more time and energy must be devoted to cleaning out the brine tank.

Solar Salts are obtained mainly through evaporation of seawater or inland brine resources, solar salts are more pure and have considerably less insoluble matter than rock salt. Though most commonly sold in a crystal form, it is also available in compressed pellets or blocks.

Evaporated Salts are obtained from underground deposits with a solution-mining process, moisture is then evaporated using natural gas or coal. Evaporated salts are the purest and most water soluble of the three types. They are also the most expensive. On the other hand, they are the most convenient because they leave less sediment, which means less softener cleaning. They are available in compacted pellets, cubes and blocks.

POTASSIUM CHLORIDE

Potassium chloride and sodium chloride work equally well in water softeners and possess the very same water softening advantages. The main reason for choosing potassium chloride is that it does not add sodium chloride to softened water.

A secondary but still very important reason is that the added potassium in the softened water can be helpful in meeting the average daily requirement for potassium in the human diet. According to the FDA, the recommended daily intake of potassium is 3,500 mg. Because potassium is neither produced nor stored in the body, meeting this amount everyday can really be a challenge.

Why is potassium important for human health?

Potassium is an element that occurs naturally in the earth's crust. Present in certain fruits, vegetables and dairy products, it is an essential dietary mineral that aids in the normal health and functioning of our bodies including blood pressure regulation, heart function and carbohydrate metabolism. Not only does it help maintain the water and acid balance in blood and tissue cells, it assists in muscle building and transmits electrical signals between cells and nerves.

A good source for potassium is water that has been softened utilizing potassium chloride.

PURCHASE CONSIDERATIONS

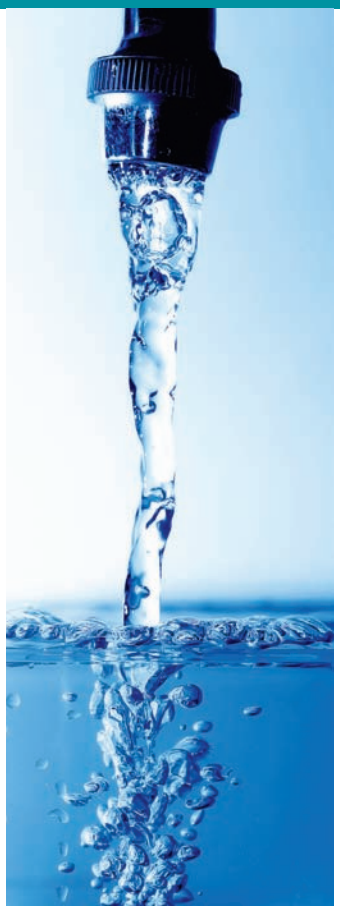
What should be considered when choosing a particular salt?

Some of the factors to be kept in mind when choosing a specific type of water softener salt include:

- requirements or recommendations by a particular water softener's manufacturer
- cost considerations relative to each salt's specifications
- cleanup frequency relative to a salt's level of purity and solubility
- sodium chloride or potassium chloride
- advantage of salts with additives

What health or environmental factors need to be considered?

Though the amount of sodium added to water during the softening process is related to the hardness of the water and is usually minimal, people on a low or no-salt diet may want to consult with their physician before choosing to install a water softener.



Three ways to limit sodium in the softening process include:

1. Soften only hot water.
2. For drinking and cooking purposes, bypass the water softener with a cold water line and separate unsoftened water faucet.
3. Use potassium chloride in the brine tank instead of sodium chloride. This way, potassium is exchanged with the calcium and magnesium, not sodium.

When using potassium chloride, the amount of potassium added is related to the hardness of the water and is usually minimal, however people who have kidney, liver or adrenal diseases should consult a physician because an increase in potassium could cause serious heart and health problems. Unless you have any of the aforementioned conditions it is almost impossible to ingest too much potassium.

Reclaimed water from showers, sinks, and other sources eventually ends up in municipal sewage systems, septic tanks, groundwater and/or surface waters. Because of this, it is important to consider what effect softened water might have on the environment. Both sodium chloride and potassium chloride brine discharge contains calcium and magnesium. These minerals are actually plant nutrients, which reduce damaging effects of reclaimed water.

Although potassium is a necessary plant nutrient, it is only recommended to use water softened with potassium chloride or sodium chloride every fourth time in your watering cycle.

Also, as some fish are sensitive to potassium chloride, consulting your veterinarian or local pet store is recommended before using water softened with potassium chloride or sodium chloride in your aquarium.

WATER SOFTENING GLOSSARY OF TERMS

BACKWASH: One of three steps involved in the water softening regeneration process, this is when the water flow is reversed to flush collected debris out of the resin tank. The other two steps are *brining* and *rinse*.

BARIUM: Barium is a lustrous metal that exists in nature in ores containing a mixture of elements. At high levels in drinking water, barium has the potential to cause gastrointestinal disturbances and muscular weakness in the short term and high blood pressure in the long-term.

BRIDGING: This is what happens when salt sticks together in the brine tank of a water softener, thereby limiting its contact with the water and diminishing the water softening process.

BRINE: A concentrated solution of salts (sodium chloride or potassium chloride) that help replaces calcium and magnesium ions during a water softener's ion exchange process.

BRINE TANK: One of two tanks that make up a water softener, this tank is filled with the salt solution. The other tank is filled with resin.

BRINING: This is the process in the water softener where the sodium or potassium solution from the brine tank displaces the calcium and magnesium from the resin beads. The resin is then recharged with sodium or potassium ions and the calcium and magnesium is flushed down the drain.

CALCIUM: One of two positively charged minerals that are the main causes of hard water. The other mineral is *magnesium*.

CATION (ION) EXCHANGE: The process by which positively charged calcium and magnesium ions in the hard water pass through the resin and exchange places with positively charged sodium or potassium ions that are attached to the beads. The result is that the water is now softened.

CYCLE: This includes all the steps involved in a water softener's ion exchange process.

DEIONIZATION: Using ion exchange resins in a water softener, this is the process by which ionized salts, including calcium and magnesium, are removed from water.

EVAPORATED SALTS: A type of salt used in water softeners that is obtained by solution-mining underground-bedded deposits of dissolving salt to form a brine whose moisture is then evaporated using natural gas or coal. Evaporated salts are the purest and most water soluble of the three types. They are also the most expensive. On the other hand, they are the most convenient because they leave less sediment, which means less softener cleaning. They are available in compacted pellets, sheeted salt or cubes, and blocks.

FILTER: A device that cleans water before it reaches a consumer's water softener or supply lines. It helps remove iron, silt, salt, odors, tastes and colors.

FILTRATION: With this process, water passes through a porous filter to remove solids.

FLOW RATE: Expressed in gallons per minute per cubic foot of resin, this is the amount of solution that goes through a bed of resin within a certain time.

GRAINS OF HARDNESS: This is the measurement used in expressing the hardness of water relative to the amount of magnesium and calcium that is present. The more grains of hardness in the water, the harder the water. One grain equals 17.1 parts per million.

GROUND WATER: All water found in natural reservoirs below the earth's surface (aquifers).

HARDNESS: A condition of water that contains amounts of dissolved calcium and magnesium.

HARD WATER: Water that contains more dissolved minerals than ordinary water. The most common of these minerals, which results naturally from exposure to rocks and sediment, are *calcium* and *magnesium*. Because these are the minerals that cause hard water, the more calcium and magnesium in the water, the harder the water.

INSOLUBLE: The amount of a substance that cannot dissolve in water.

ION: Atoms in a solution that have a positive or negative electrical charge because of the gain or loss of an electron.

ION (OR CATION) EXCHANGE: The process by which the positively charged calcium and magnesium ions in the hard water pass through the resin and exchange places with positively charged sodium or potassium ions that are attached to the beads. The result is that the water is now softened.

MAGNESIUM: A naturally-occurring metallic metal that along with calcium is responsible for the hardness in water.

MINERAL: An element or chemical compound that is normally crystalline and that has been formed as a result of geological processes.

MUSHING: This is what happens when salt in a water softener collapses to table salt-sized crystals and bonds together in the brine tank into a thick mass, thereby limiting the production of soft water.

OPERATING PRESSURE: This is the range of pressure (30-100 per square inch) at which a water conditioning appliance functions properly.

OSMOSIS: The tendency of water to pass through a semi-permeable membrane into a solution where the solvent concentration is higher, thus equalizing the concentrations of materials on either side of the membrane.

PARTICULATE: A minute separate particle such as with a granular substance.

PH (POTENTIAL OF HYDROGEN): This is the level of acidity or alkalinity in water.

POTASSIUM CHLORIDE/POTASSIUM: An alternative to sodium chloride for use in water softeners, potassium is an element that occurs naturally in the earth's crust.

PPM (PARTS PER MILLION): This measurement is a way of stating the level of a particular element in water.

PURITY: The amount of impurities in a water softening salt that is accumulated during the mining process.

RADIUM: This is a naturally-occurring radioactive element present in varying amounts in rocks and soil within the earth's crust. As groundwater comes in contact with these rocks and soil, it can pick up high amounts of radium. Consumed in high doses, radium can cause bone cancer.

RAW WATER: This is water in its natural state before it has been treated to make it acceptable for drinking.

REGENERATING CYCLE: As the resins attract more and more calcium and magnesium minerals, their ability to soften the water is lessened. At this point, the softener needs to be regenerated. This means that the calcium and magnesium minerals need to be flushed from the resin tank and the beads need to be replenished with new sodium or potassium ions from the brine tank. All this takes place in what is called a 3-phase regenerating cycle that includes: *backwash, brining* and *rinse*.

RESIN BEADS (BED): Located in the resin tank of a water softener, this softening bed of resin beads is the place where positively charged calcium and magnesium ions in the hard water pass and exchange places with positively charged sodium or potassium ions that are attached to the beads. The result of this process, known as an ion (or cation) exchange, is that the water is now softened.

RESIN TANK: The part of a water softener that is filled with a softening bed of resin beads.

REVERSE OSMOSIS: This is a process for the treatment of water that incorporates a membrane filter to eliminate mineral particles.

RINSE: Part of the regenerating cycle, this is when the resin tank is rinsed with fresh water and the brine tank is reloaded to begin the process again.

ROCK SALTS: Obtained by the traditional mining of underground salt deposits, rock salt is the most economical choice for water softeners. Rock salt is mixed with a lot of impurities that eventually settle at the bottom of the brine tank. Because of this and because rock salt has a high water-insoluble level, more time and energy must be devoted to cleaning out the brine tank.

SCALE DEPOSITS: A result of hard water, this is the accumulation of calcium and magnesium minerals water can clog pipes and impede water in plumbing fixtures, hot water heaters and boilers.

SODIUM CHLORIDE/SODIUM: An alternative to potassium chloride for use in water softeners, sodium is an inorganic compound of sodium and chlorine, a salt in which ionic bonds hold the two components in the familiar white crystals known as salt.

SOFTENED WATER: This is the result of hard water that has been softened by the removal of calcium and magnesium minerals.

SOLAR SALTS: Obtained mainly through evaporation of seawater or inland brine resources, solar salts are more pure and water soluble than rock salt. Though most commonly sold in a crystal form, it is also available in compressed pellets or blocks.

SOLUBILITY: The amount of a substance (water softener salt) that can be dissolved in water.

SOLVENT: A substance, such as water, that dissolves another to form a solution.

SOURCE WATER: This is water that has not yet been filtered or cleaned in any way.

SURFACE WATER: Water that is above ground (rivers, lakes, reservoirs) that is pumped and treated.

TOTAL HARDNESS: The total amount of components in water responsible for its hardness.

TREATMENT: The process necessary to reduce or eliminate particular contaminants in drinking water.

WATER HARDNESS TEST STRIP: A coated paper strip that quickly and simply measures the hardness or the grains of hardness per gallon of water.

WATER PURIFIER: This is a filtering process where water passes through a filter bed that traps calcium and magnesium particles. This process removes only particles and cannot remove dissolved calcium and magnesium. Therefore, a water purifier cannot soften water.

WATER SOFTENER: Plumbed into a home's water supply, a water softener is a mechanical appliance that includes a resin tank filled with a softening bed of resin beads and a brine tank that holds a salt solution. In a process known as an ion (or cation) exchange, the positively charged calcium and magnesium ions in the hard water pass through the resin bed and exchange places with positively charged sodium or potassium ions that are attached to the beads. The result is that the water is now softened.