PRIVATE DRINKING WATER IN CONNECTICUT

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Publication No. 10: Ion Exchange Treatment of Private Drinking Water Systems

Cation (+) Exchange Units

Effective Against: positively charged ions, inorganic minerals, such as iron and manganese ions, and hard water minerals (calcium and magnesium).
Not Effective Against: negatively charged ions such as nitrate, organic compounds, and concentrations of ferric iron (solid, colored form of iron).

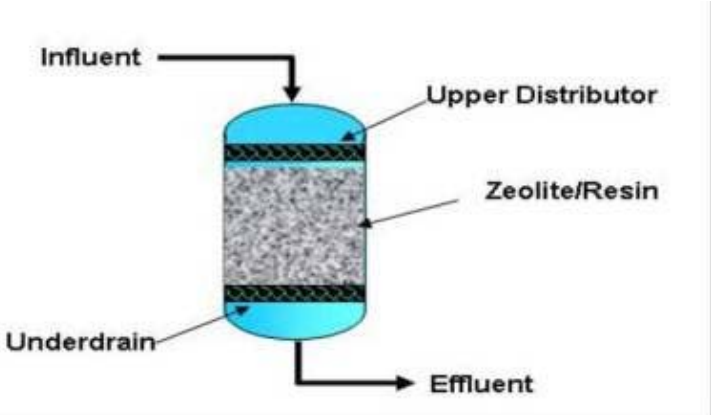
Anion (-) Exchange Units

Effective Against: negatively charged ions such as nitrates, bicarbonate, sulfate, selenium, and some compounds of arsenic.
Not Effective Against: positively charged ions such as iron, manganese, calcium or magnesium.

How Cation Exchange Units Work

Untreated water passes through a tank containing high capacity ion exchange resin beads saturated with sodium or potassium covering both their exterior and interior surfaces. As water passes through the bed of ion exchange, the contaminant ions exchange places with the resin beads while the sodium or potassium on the resin are released into the water.

Eventually, the beads become saturated with the contaminant they are removing and no replacement ions remain. When this occurs, the sodium or potassium ions must be regenerated or recharged by flushing the ion exchange resin with a brine solution. The frequency of regeneration depends on the amount of the contaminant in the water, the amount of water used in the home, the size of the unit, and the capacity of resins to remove the cations.



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Cation exchange devices are commonly used in other parts of the country as water softeners. However, calcium and magnesium (the two ions associated with hard water) typically are found in high concentrations in Connecticut water supplies in a few geographical areas, primarily Northwestern Connecticut.


Resin Sample

How Anion Exchange Units Work

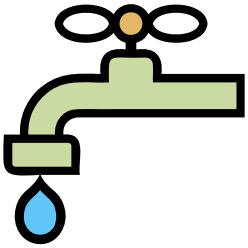
The anion exchange unit is similar to the cation exchange device. The difference is that the resin beads are saturated with negatively charged ions that replace the contaminants. Chloride and hydroxide ions are the most commonly used in these treatment systems. The most common application for anion exchange units is the removal of nitrate, arsenic and bicarbonate.

Types of Units

Once a water test indicates that an ion exchange unit is necessary, unit selection depends on how much treated water you need. You may choose between manual, semi-automatic, or fully automatic units. The difference is how much you must be involved in regenerating the exhausted resins. In a manual system, the owner generally must determine when to regenerate the resin, as opposed to a fully automatic unit available with digital controls and many programmable options. Before purchasing a system, verify that the treatment system you are purchasing has been tested and certified by a third part to ensure manufacturer's claims. See the section on **Product Certification** at the end of this fact sheet.

To operate properly, ion exchange equipment requires the incoming water to be of a minimum flow rate and pressure. Check these minimum requirements against the capacity of your existing water supply system.

Ion exchange units are usually rated according to the maximum flow rate of water they can accommodate, their total softening capacity, and the gallons of treated water produced between regenerations. Many factors affect the selection of an ion exchange unit, including:



- Concentration of the brine solution used for regeneration
- Presence of other minerals (such as sodium or sulfate) in the raw water
- Presence of impurities (such as suspended particles) in the raw water.
- Presence of oxidized iron (rust appearance) and/or manganese (dark spots).

Maintenance

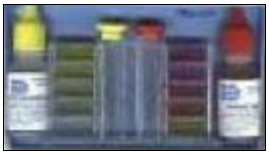
Regardless of the quality of the equipment purchased, it will not perform satisfactorily unless maintained in accordance with the manufacturer's recommendations for maintenance, cleaning, and part replacement. Keep a logbook to record equipment maintenance and repairs.

Maintenance is largely confined to restocking the positively or negatively charged ion supply for the brine solution. All units require the mixing of a brine solution for the recharging or regenerating process. The frequency depends on whether the unit is a one or two tank system, the size of the brine storage compartment, the degree to which the unit is automated, and how much treated water is consumed.

With manual and semi-automatic models, you will have to actually start the regeneration cycle. Some companies that sell ion exchange equipment may offer regular service on their units for a monthly fee. This service relieves the consumer of most of the responsibility for maintaining the unit.

Exchange resins wear out. Check with the manufacturer to determine the life of the resin bed and the service frequency. If the resin bed is not regenerated on a regular basis with a good backwash and at proper intervals, it may become contaminated with slime or impurities from the raw water and become unusable.

This will definitely occur if the raw water contains any iron/ manganese bacteria. If this happens, the resin must be replaced with new material. The effectiveness of this system may also require that raw water be pre-treated to adjust pH levels and filter sediments or other impurities before entering the ion exchange system.



Some companies may offer delivery of portable exchange units that are replaced at periodic intervals. Sealed canisters with newly regenerated resin are delivered to your home on a regular basis. The exhausted unit is taken back to the company's regeneration facility to be refurbished. As a quality control measure, it would be advisable to check the new unit for hardness using a swimming pool test kit. The newly regenerated unit should be producing water with zero hardness.

Other Considerations

Ensure the system you choose is installed and operated according to the manufacturer's instructions. After installation, retest both the raw water (prior to treatment) and the treated water at a state certified laboratory to ensure it is working properly and removing the contaminants. You should continue to test the quality of both the raw and treated water annually or more frequently (quarterly or semi-annually) if high levels of contaminants are present in the raw water. Frequent testing will also help you determine how well your treatment system is working and whether maintenance or replacement of components may be necessary.

Added Sodium at Tap

A cation exchange unit that uses sodium as its exchange ion will add sodium to the treated water. For every 100 ppm of hardness, approximately 46 ppm of sodium is exchanged. This is normally a relatively small fraction of the sodium intake from other dietary sources and is probably not a problem for healthy people. People on restricted salt diets, however, should consult their physician before using water from an ion exchange unit using sodium. If the added sodium presents a problem, a cation exchange unit that uses potassium instead of sodium is another option. You can install an additional treatment unit, such as reverse osmosis or distillation, to remove sodium from the drinking water.

Wastewater Generated

You should consider the effect an ion exchange unit might have on a septic system. It is common practice to install ion exchange units so that water from the regeneration cycle (see Maintenance Section) is piped to the septic system. This technically is not allowed in Connecticut. You should check with your local health authorities; they may suggest regeneration off site or a holding tank. Typically each regeneration cycle requires 50 gallons of water, an amount similar to conventional automatic washing machines.
The frequency of regeneration, and thus, of disposing 50 additional gallons of water to the septic system, depends on how much treated water you use. You should make sure that your septic system could handle an additional load from the treatment system.

Questions to Ask Before You Buy

Before purchasing a water treatment device, have your water tested at a state certified laboratory to determine the contaminants present. This will help you determine if ion exchange is an effective treatment method for your situation. See Publication #19 *Questions to Ask When Purchasing Home Water Treatment Equipment* for more information.

Consumers should inquire about the following before purchasing an ion exchange unit:

- Which type of unit do I need - cation or anion?
- Has the treatment system been tested and certified by a third party to ensure that it meets manufacturer's claims? (e.g. National Sanitation Foundation- NSF)

- What flow rate and pressure of incoming water does the unit require?
- What size brine tank should I get?
- How often will the brine solution need to be mixed?
- Is the unit manual, semi-automatic, or fully automatic?
- How often will I need to regenerate the resin bed?
- How may gallons of treated water can the unit produce between regenerations?
- Are there any special installation requirements that may add to the equipment cost, for instance changes to your household plumbing?
- How long does the resin last based on the amount of water used in the house (gallons per day).
- What are the requirements for backwashing, separate holding tank, etc?

Note: The CT Department of Public Health cautions potential buyers to make sure that a softener is needed; furthermore, recommending homeowners limit softening to their cold water system serving the hot water system. This reduces the size of equipment and frequency of regeneration. Also, homeowners can select units that exchange potassium instead of sodium if concerned about sodium.

Product Certification

NSF International is a non-profit organization that sets performance standards for water treatment devices. Because companies can make unsubstantiated statements regarding product effectiveness, the consumer must evaluate test results of the device to determine if claims are realistic. Products that have been tested or evaluated by NSF and meet their minimum requirements are entitled to display the NSF listing mark on the products or in advertising literature for products. Manufacturers and models that meet NSF's standard are included in a listing published twice a year. For more information contact NSF at 800-NSF-MARK or http://www.nsf.org/consumer/drinking_water/

For more information please click on the following links:
EPA Office of Groundwater and Drinking Water
http://www.epa.gov/ogwdw/
EPA New England
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Adapted from *Healthy Drinking Waters for Rhode Islanders*, University of Rhode Island Cooperative Extension, *April 2003*.