WQRF | Water Quality Research Foundation

SOFTENERS AND SEPTIC PERFORMANCE

Well operated softeners will not harm – and could even aid – septic systems.

Water Treatment Industry Toolkit

Does water softener discharge disrupt septic system performance?

Water softeners and septic systems are often found on the same property and, in the majority of these cases, no problems are indicated.Yet, there have been sporadic, mostly anecdotal reports of issues related to the combined use of these kinds of equipment at some sites. Experts in both fields are working together to better understand the interactions involved between water softeners and onsite wastewater systems.The recently completed study at Virginia Tech addresses this issue specifically.

How water softeners work

What we think of as "hardness" is basically calcium and magnesium in water, which is removed by softener resin.The resin needs to be regenerated regularly to effectively remove hardness, and this is completed by running a sodium chloride solution through the resin bed. The result is a waste brine solution (or "regenerant") that contains the removed calcium and magnesium hardness, as well as some excess sodium. The salt concentration of the waste is typically diluted sixfold by rinsing steps conducted during regeneration, but then it is further diluted to a total dilution of 160- to 400-fold with other household liquid waste. However, since the waste from the regeneration process alone can contain a fairly high salt concentration, its disposal into onsite wastewater treatment systems has been a topic of debate and the focus of this study.

It is sometimes thought water softeners are used mostly for aesthetics (i.e. better soap lather, removal of staining iron and waterborne odors, fewer spots on dishware and in showers, etc.).While these benefits are pleasing, they are not the main reason many people – especially in rural areas – use water softeners. Softeners are often the enabling technology that keeps houses running effectively and economically by preventing damaging scale buildup in the plumbing system. In areas with especially hard water (> 10 grains per gallon), softeners are a necessity for anyone who doesn't want to continuously replace pipes, fixtures, water heaters, and appliances. Comprehensive independent studies funded by the Water Quality Research Foundation (WQRF), and completed recently by independent researchers, have also shown many other practical advantages: Saving energy and money, reducing the use of harmful detergents, and keeping our landfills a little less full. More details can be found in the WQA Softener Benefits Toolkit or online at https://www.wqrf.org/uploads/8/3/5/5/83551838/researchstudy_benefitsofsoftenedwater_execsummary.pdf

Softeners: Timed or demand based?

Essentially, there are two ways a softener decides when it's time to regenerate, or to run the sodium solution over its resin bed.

In the past, most softeners sold were "time clock" models. Based on water hardness levels and water usage calculations, a timer determines when the resin is likely saturated with hardness ions and regeneration is most likely needed.Today, the most common type of water softener sold is the "demand-initiated regeneration" (DIR) unit. These units keep actual track of the water usage and trigger regeneration based on various factors, including the amount of water used and/or the electrical conductivity of the resin, or, in some cases, by monitoring the hardness of the effluent. These units are very efficiently operated in both the amount of salt and water used.

Septic Systems

Septic systems work on basic principles. Wastewater from a house is piped into a tank where, over time, solids settle and scum floats to the top.The settled solids are anaerobically digested, that is, broken down through a bacterial process that takes place amid the lack of oxygen. Any liquid component that results will eventually flow in a relatively clear condition into a drain field. The soil in the drain field then removes and inactivates the remaining impurities through natural processes.

Wastes that contain large concentrations of excess sodium can hurt the settling of solids, producing a lower quality effluent, and can negatively affect soil drainage potential. This is where the issue of softener and septic system combined use becomes critical.

Research Support

In 2012, the Water Quality Research Foundation commissioned Virginia Polytechnic Institute and State University to conduct independent and scientific testing on this issue. The result is an official report, "Changes in Septic Tank Effluent Due toWater Softener Use."

Nearly $100,000 was invested for this 18-month study, which included many site visits and the support of numerous trained experts from the Water Quality Association (WQA), the National Onsite Wastewater Recycling Association (NOWRA), the State Onsite Regulators Alliance (SORA), and NSF International.

To obtain the most accurate results possible, two different approaches were taken. One study, in a controlled laboratory setting, examined a range of typical softener/septic scenarios.Then to look at real-world conditions in everyday circumstances, case studies were conducted in the field.The authors also looked at the results of previous studies and tests.

After rigorously analyzing data from column and case study experiments, researchers found that, while the effect of softeners on septic systems will depend on source water quality and usage, certain general conclusions can be made.

According to the authors of the study: "The data indicate that the use of efficiently operated water softeners improves septic tank performance, while the use of very inefficient home softeners may have a negative effect on solids discharged to the drain field. The level of impact will depend on the level of hardness in the water, whether the regeneration waste is discharged to the septic tank, and the amount of excess sodium present in regeneration wastes."

Previous experimentation has shown that the presence of the right amount of calcium and magnesium, which are put into the waste stream along with sodium levels by softeners, can help the settling process in septic tanks. Additionally, earlier data shows that soil structure in the drain field can be positively affected by the calcium and magnesium ions in water softener effluent in certain quantities.

The authors found conversely that diversion of regeneration wastes, or the addition of regeneration wastes that contain concentrations of excess sodium, may be detrimental to solids settling and, thus, result in a lower quality because the solids content in the effluent is higher. This result was found when the studies mimicked the operation of diverted wastes or a softener "in an inefficient manner in relation to the excessive use of salt for the removal of hardness." In other words, the negative consequences took place when more sodium was used than necessary for softening or when the calcium and magnesium were not reintroduced into the septic system through regeneration.

These results are particularly revealing because they suggest well operated softeners at their highly rated efficiencies of 3000 to 4000 grains of hardness per pound of salt used will not harm – and could even aid – septic systems. As it happens, properly set efficiency rated DIR units (currently, the most commonly installed device type) fit the need of most rural households, providing softened water inside the house using less sodium chloride and water for recharging the unit, and leadingto an efficiently operated septic tank and discharge field. A fill-in-the-blank spreadsheet can be located on the WQA Website to aid in assessing ion ratios in septic tanks under various hardness levels and desirable high efficiency salt settings.

Thus: **Septic systems and water softeners: Effective Performance Together**

Implications for policymaking

Instead of relying on conjecture and assumptions, this major independent study was initiated in 2012 to bring out the facts on this issue.The conclusion is that when operated properly and efficiently, water softeners may actually help septic systems work better. A contrary implication of this also holds: When a softening device is set very inefficiently or regeneration wastes are diverted, it appears there could be negative consequences for a connected septic system.

Armed with these results, policymakers and those in associated industries can lay out sensible approaches to educate buyers and users of the need for efficient water softening as much as possible and encourage efficient devices. This means getting the word out through dealers, manufacturers, public education and other means. The conclusions of this study may also offer helpful guidance as rules and regulations are drafted and revised in states and communities, particularly concerning housing and plumbing related guidelines.

The Water Quality Association, a not-for-profit organization that seeks to uphold high standards in the water treatment industry, has committed to education programs to help disseminate sound practices for those with softeners and septic systems. The association provides information through its professional training and certification programs and other venues.WQA also operates the Gold Seal Certification Program to test and certify products, which helps consumers find efficient systems that fit their needs.

In some states, specialty licenses are required to install and maintain certain water treatment devices. Through this licensing, professionals can be educated on how to better inform consumers and users. When plumbing and housing codes are being revised, the information from this study might also help provide guidance.

Guidance from WQA and NOWRA to maintain a septic system receiving softener discharge:

1. All onsite wastewater systems require a degree of user vigilance and periodic maintenance to ensure proper functioning. Seek guidance on this from state or local regulatory agencies, operation and maintenance manuals of treatment components, or through a qualified local service provider.

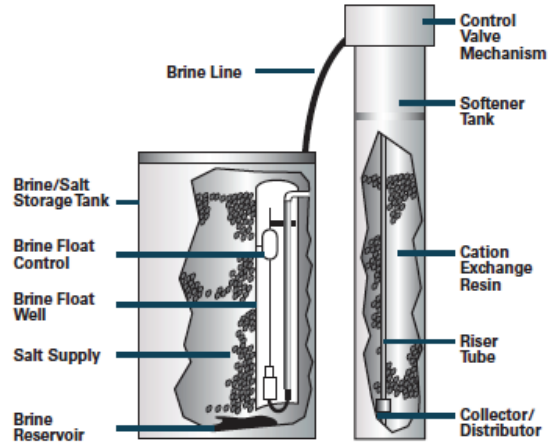

Figure 1. Typical residential water softener with automatic control valve. (McGowan, 2000)

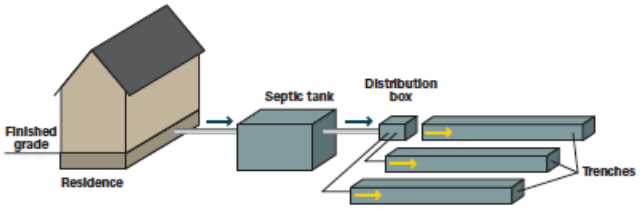

Figure 2. Typical conventional septic system configuration. Many variations are possible. (CIDWT 2009)

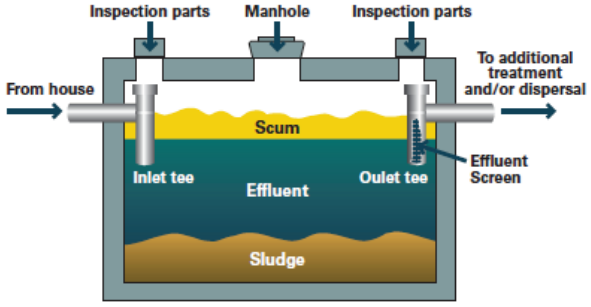

Figure 3. Typical one compartment septic tank illustrating solids separation and development of clear zone. The outlet tee (on right) is designed to draw clarified effluent from the clear zone, through an effluent screen, and then out of the tank and convey it to the next component (NFSC 2000).

2. Maintain your water softener system on a regular basis, follow the manufacturer's operating instructions, and consult or retain a qualified water treatment specialist to assure most efficient softener operation.
3. Avoid the use of excessive bleaches & detergents, strong disinfectants, "every-flush" toilet disinfection chemicals, and caustic drain cleaners.
4. Be sure to inspect your home for possible sources of excess water consumption such as leaking toilet flappers and valves, which can over time, overload the capabilities of a septic system.
5. Consider using equipment determined to be "High Efficiency" or Demand Initiated Regeneration (DIR), when selecting a new water softener, and make sure that the salt setting corresponds to higher efficiency ratings.