Water Softener Backwash Brine Stresses Household Septic Tanks and Treatment Systems

in My opinion...

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It is a fact that water softener brine regeneration discharges change the consistency and chemistry of the wastewater stream in ways that pose a problem for onsite treatment systems and the dispersal field. Studies have shown that water softener brine regeneration wastes not only harm the flora and fauna in the wastewater treatment system, they can also cause the septic tank itself to discharge greater concentrations of solids, grease, and oil into the dispersal field.

Since the purpose of the septic tank is to separate the solids and the fats, oils, and grease (FOG) from the liquid, discharging mostly dissolved organic matter and nutrients, the discharge of solids and FOG into the drainfield will cause the soils to plug resulting in an expensive drainfield repair. The concern is not the softened water nor whether or not sodium salts affect soil infiltrative capacity or long-term acceptance rates (LTARS). The concern is the high concentration of chloride salt in the backwash brine from softener regeneration. Regenerate brine is recognized and typically classified as a "salt-laden water, free of contaminant" and, thus, does not need to be discharged into biological wastewater streams.

Salt Stratification Inhibits Tank Performance

Research performed at the National Sanitation Foundation (NSF) used complete-mix aerobic treatment units, where the water softener backwash brine was introduced to a system that is completely mixed. Septic tanks were not part of the NSF study, and it would be misleading and scientifically inappropriate to directly compare any complete-mix aerobic process to a passive anaerobic process. Studies with septic tanks, which are designed to be quiescent by nature, have shown that the high concentration of salt introduced by slugs of backwash brine cause salt stratification in the tank, which inhibits the ability of solids and FOG to stratify.

The result is that the salt water dives to the bottom of the tank occupying space that is designed for the settling of heavier solids. In addition, the sludge in a septic tank is mostly liquid with a density very near that of the clear zone. The heavier salt water can actually lift the sludge from the bottom of the tank, displacing it and

washing it into the downstream components such as an ATU, media filter, or the soil dispersal field. As a result of its density, the salt-laden brine competes with the sludge to occupy space at the bottom of the tank, effectively reducing sludge storage volume. This could increase sludge pump out frequency or allow the sludge to be carried out into the soil dispersal area.

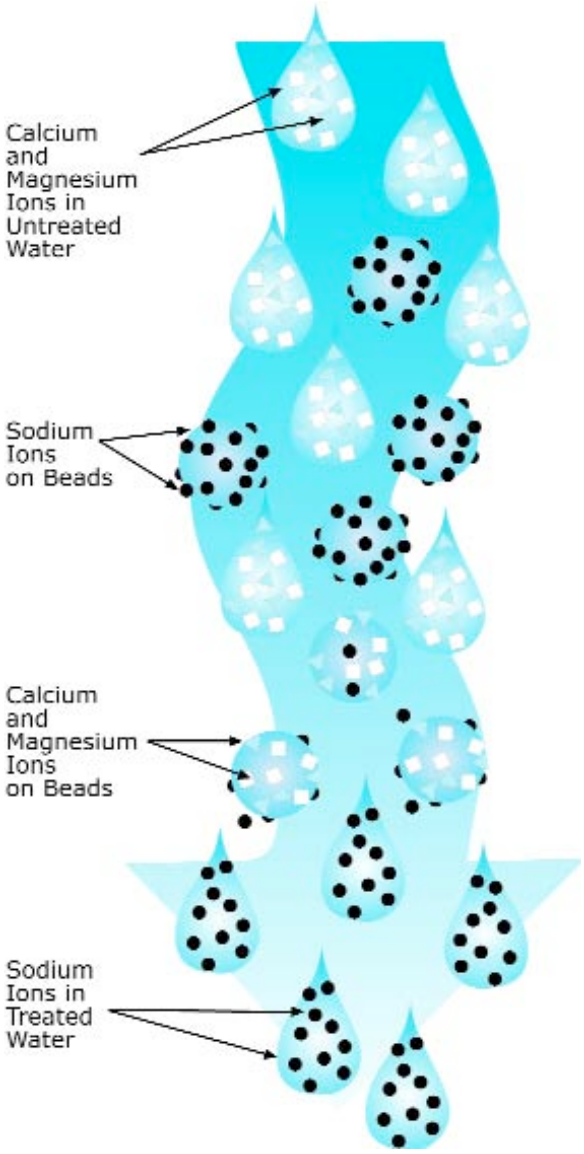
In field observations of septic tanks having water softener brine discharged into the tank, the tanks have not developed distinct layers of sludge, scum, and a clear zone. These tanks were approximately four years old, and were expected to have a normal 3- to 4-inch thick sludge layer.

A study in Australia notes that "A loss of hydraulic conductivity results from the use of sodic wastewater on various soil profiles." Nearly all ion exchange water softeners use sodium chloride for regeneration. The high concentration of sodium enters the wastewater stream when the water softener is backwashed. The sodium enters the wastewater stream as a slug to the septic tank two to three times per week.

In addition, field observations of side-by-side dispersal systems in a shared mound have shown that the trenches receiving the effluent with water softener brine discharges formed a thick, gelatinous slime layer that clogs the infiltrative surface, while the trenches receiving no salt water discharge remained open with a normal microbial clogging layer.

A study conducted at the University of Wisconsin introduced the backwash brine only to the soil dispersal component, not to the septic tank. The report suggests that additional research is needed to evaluate the effects of backwash brine on septic tank flora and fauna. The report is also inconclusive as to whether or not water softener backwash brine is harmful to septic systems. Additionally, these studies were performed nearly three decades ago when the required levels of treatment were not as restrictive as they are today.

The NSF study about water softener effects only compared one system receiving water-softener brine to a control system. The tests were performed to NSF Standard, 40 Class II requirements during 1978. These standards required that BOD_5 and TS_S must not exceed 60 milligrams per liter (mg/L) and 100 mg/L respectively for more than 10 percent of the test period. Current requirements for most states are for NSF Standard, 40 Class I requirements of 25 mg/L BOD_5 and 30 mg/L TSS. Regulations require onsite treatment processes to accomplish not only higher organic removals, but also very restrictive nutrient removals. In these applications, water softener brine can be extremely detrimental.



Sodium and Chloride Inhibit Operation

Sodium concentrations greater than 3,500 mg/L have been reported to inhibit anaerobic digestion. It's common to see municipal systems ban the discharge of high concentrations of salt into large treatment plants. Wastewater design texts and manuals require treatment processes to be sized accordingly, relative to influent salinity concentrations. "The higher the concentration, the greater the size" is not typically taken into consideration in small onsite applications.

Chloride concentrations greater than 180 mg/L have an inhibitory effect upon nitrifying microorganisms (U.S. Environmental Protection Agency Publicly Owned Treatment Works manual on toxicants and inhibitory thresholds). Chloride concentration in regenerate can reach into the 10,000 mg/L range, with sodium in the 6,000 mg/L range. A field study of 18 onsite wastewater treatment systems in Virginia clearly showed that nitrogen removal was inhibited in systems receiving water softener backwash brine.

The systems receiving backwash brine from water softeners had average chloride concentrations of 1,207 mg/L in the septic tank effluent with one system having a concentration of 10,900 mg/L.

Manufacturers Void Warranties

Most of the reputable manufacturers of wastewater treatment systems have clauses in their warranties voiding the warranties if water softener backwash brine is discharged to the treatment system. There is a serious risk involved in discharging water softener backwash brine to advanced treatment systems. The risk is in the form of voiding the warranty, not meeting required compliance levels, tripling O&M needs/costs, and diminishing the long-term system performance and life.

Some regulatory authorities classify the brine as salt-laden water, free of contaminants to be dispersed directly to a sump or infiltration chamber. In most cases, regeneration brine began as well water (groundwater), and it is still considered groundwater with a heavy addition of sodium chloride (table salt).

Other Discharge Alternatives Exist

It is not necessary to discharge the regenerate to the wastewater stream. It's done purely to cut costs. Homeowners are often told that it will cost "thousands of dollars" to re-route backwash brine away from the septic tank because it will involve the disruption and destruction of concrete footings and floors.

In Virginia, five water softener backwash discharges were routed out of the wastewater system for less than $100 per home. With simple planning at the beginning of the plumbing from the home, a second small pipe from the backwash could bypass the septic tank and the water softener backwash brine could be discharged away from the treatment system. If the soil scientist is comfortable with the salt water discharging to the soil, the pipe could lead around the septic tank and treatment system to the distribution box or discharge basin where the salt water could be diluted in the soil along with the remainder of the treated wastewater stream. The second pipe for water softeners could be included as a requirement in on-site regulations. The expense of a second pipe is minimal, and installing it along with the house sewer would reduce the cost compared to a retrofit.

Simple, inexpensive options are available to homeowners and regulators to prevent septic tank and treatment system failure and to keep the system warranty in effect.

Homeowners should have appropriate information to make informed decisions regarding their homes and the long-term effects one process/product may have on another. If they believe the risk is negligible, and are willing to discharge the backwash brine into their wastewater systems at the risk of voiding their systems' warranty and increasing operating and other associated costs, they certainly have that choice.

In closing, as homeowners we all love our water to be soft. However, we all love it when our water and wastewater systems function and coexist efficiently, cost effectively, and cause us little concern. We also know that avoiding a minor installation expense at the risk of elevating service needs or premature pumpouts, repairs, rehabilitation, field replacement, performance/compliance costs, etc., is not a gamble worth taking. This is especially true when we know we can have our soft water without contaminating the chemistry of our wastewater processes.

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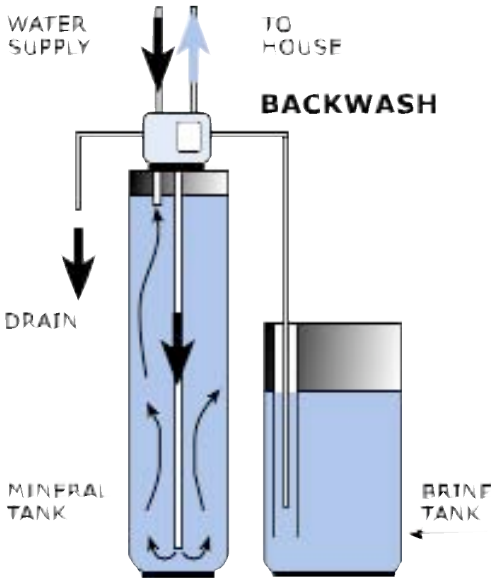

The backwash phase reverses the water's flow and flushes any accumulated dirt particles out of the tank and down the drain. Next, in the regeneration or recharge phase, the sodium-rich brine solution flows from the brine tank into and through the mineral tank. The brine washes the calcium and magnesium off the beads. In the final phase, the mineral tank is flushed of the excess brine, which now also holds the calcium and magnesium, and the solution is disposed of down the drain.