RESEARCH HIGHLIGHT

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Impact of Water Softeners on Septic Tanks—Field Evaluation Study

INTRODUCTION

When water softener is used to remove "hardness" (dissolved magnesium and calcium) from household water, it produces a salty "backwash" in the household's wastewater system. This field study determined whether this backwash affects the performance of septic tanks.

HOW A WATER SOFTENER WORKS

Water softeners remove dissolved magnesium and calcium through ion exchange. First, resin beads supersaturated with sodium "pick up" the calcium and magnesium and replace them with sodium. Next, a sodium chloride brine is "backwashed" across the beads, picking up the calcium and magnesium and replacing them once again with sodium. Finally, this backwash solution, which now contains sodium, chloride, calcium and magnesium, flows into the septic tank and eventually into the septic system's leaching bed.

POSSIBLE EFFECTS OF BACKWASH ON TANK PERFORMANCE

The main goal was to determine the effect of water softener backwash on the septic tank's capability to process waste. Septic tanks rely on anaerobic and facultative bacteria to digest solids as they settle out of the wastewater.

Existing studies have conflicting conclusions as to whether water softener backwash affects the settling of the waste or the action of the bacteria. While sodium inhibits anaerobic bacteria, it does so only at relatively high concentrations. Some studies suggest that magnesium and calcium, which are both present in the backwash, can counteract sodium's inhibitory effect on bacterial digestion.

Another possible impact, which was not examined in this study, is the effect of water softener backwash on septic tank's leaching bed permeability.

METHODOLOGY

The study examined 75 home septic tanks—27 with water softener backwash and 48 without it. Surveys completed by the homeowners showed that the two groups of tanks were similar in size, material and condition.

A "sludge judge"—a plastic tube with a valve at one end—measured the depth of the sludge and scum layers in the tanks. For each tank, samples were taken from the sludge in the first compartment and from the effluent at the outlet T.

The sludge samples were tested in the laboratory for levels of sodium and chloride and for indicators of the extent of bacterial digestion. Samples of effluent from the two groups of tanks were analyzed to evaluate the effectiveness of the tank in removing contaminants. Results from the two groups were compared and analyzed to determine whether the differences found were statistically significant.

RESULTS

Tank performance

The analysis showed that tanks receiving water softener backwash contained significantly higher levels of both sodium (Na) and chloride (Cl^-) than those without water softener backwash. However, tanks receiving backwash did not differ significantly in indicators of bacterial digestion, or in the composition of the effluent produced.

Bacterial digestion

Sludge samples were compared based on three bacterial digestion indicators:

1. VSS (volatile suspended solids), a bacteria biomass measure
2. TC (total coliform), a facultative bacteria measure
3. Sludge and scum accumulation rate (solids accumulation per person per year since the last pump-out).

None of the three indicators differed significantly between tanks receiving water softener backwash and those that do not.

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Composition of effluent

The composition of the effluent was analyzed to evaluate the effectiveness of the tank in removing contaminants from the wastewater.

The following indicators of tank performance were measured:

- COD (chemical oxygen demand)
- $CBOD_5$ (five-day carbonaceous biochemical oxygen demand)
- TSS (total suspended solids)
- HPC (heterotrophic plate count)
- *E. coli*

None of these indicators of tank performance differed significantly between tanks receiving water softener backwash and those that do not.

PERFORMANCE OF LEACHING BEDS

Although the performance of the leaching beds was not studied directly, sodium absorption ratios (SAR) in the effluent of the two groups of tanks were compared.

Sodium is known to cause clay to swell, reducing the permeability of the soil. However, this effect is counteracted by magnesium and calcium. The amount of sodium relative to the amount of magnesium and calcium can be calculated as a sodium absorption ratio (SAR). Previous studies have found that soils with a clay content of 15 per cent swell and become less permeable when the sodium absorption ratio exceeds 10.

In this study, effluent from tanks receiving water softener backwash showed significantly higher sodium absorption ratios than tanks that do not receive backwash. However, none of the tanks that produced effluent with an SAR of over 10 (13 out of 57 studied) showed signs of "hydraulic failure," that is incapacity of the leaching bed to drain properly.

For leaching beds that did show signs of failure (12 out of the 75 studied), the clay content of the soil and the age of the system appeared to be the primary factors.

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HOMEOWNERS IMPLICATIONS AND AREAS FOR FURTHER STUDY

Based on this field study, it appears that water softener backwash discharged to a septic tank does not affect the tank's capability of effectively treating wastewater.

Further research is needed to determine the effect of water softener backwash on the performance of septic tank leaching beds and on alternative treatment technologies.

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