

Alternative to Ion-Exchange Softeners for Domestic & Commercial Applications

Many potential factors to consider:

- Health
- Taste
- Water Use
- Energy Use
- Scaling of Hot Water Heater
- Scaling of sinks, toilets, dishes, etc.

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will focus primarily on scaling
since this can be scientifically quantified



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Alternative to Domestic & Commercial Water Softeners

Alternative Technologies needed:

- Most water softeners are based on cation exchange technology and use salt (NaCl) as the regeneration chemical. Great strides have been made to create a more efficient conventional softener (use less salt per gallon of water processed) but none have arrived at the perfect utility value of 6,000 grains recovered capacity per pound of salt (NaCl). There are those that use potassium chloride (KCl) in place of NaCl and call it saltless; however, *KCl is a salt*. It's just not common or table salt (the name given specifically to NaCl a long, long, long time ago).

Are there really alternatives to salt-based water softeners? → Yes, there are.



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Alternative to Domestic & Commercial Water Softeners

Alternative Technologies needed:

- There is a tremendous push today to achieve softened water without the use of salt. The primary driver for this is the need to maintain low TDS in wastewater so it can be recycled or reprocessed for groundwater injection (without the need to reduce its TDS with additional expensive equipment). This issue has brought about several laws restricting the use of salt-regenerated water softeners.



Is there an alternative to the salt-regenerated water softener?

YES

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Filtersorb SP3

Filtersorb SP3 is a:

- scale-inducing technology, which works by encouraging formation of scale *before* a water heater in order to prevent the formation of scale *in* the water heater. It is based on template assisted crystallization (TAC) technology, which catalyzes the formation of sub-micron crystals that remain in the water as colloidially suspended particles and do not stick to heated surfaces.



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Scale Prevention Technology

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Green and Sustainable

- a) Scale inducing Technologies
- b) Scale preventing Technologies
- c) Template Assisted Crystallization (TAC)

➔ **Filtersorb SP3 has ➔ a, b & c**

Media is alternative

- ✓ to Water Softeners and IX Technology

Media can be used in

- ✓ Pressure Vessels
- ✓ POU Cartridges
- ✓ Operates in upflow direction
- ✓ Very cost effective
- ✓ Highly flexible



Scale Prevention Technology

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Scale Inducing Technologies

- These technologies work by inducing scale to form before a hot water heater thereby reducing the scale forming potential of the water.
- Template assisted Crystallization – catalyzes the formation of sub - micron crystals that remain in the water as colloidal matter.

Scale Preventing Technologies

- These technologies modify the water content to prevent scale formation.



Scale Prevention Technology

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Template Assisted Crystallization

Technology has many different Applications – relatively new to water treatment

- A catalytic reaction is carried out on a template – usually a honeycomb polystyrene structure
- Can be used to make well ordered micrometric and nanometric structures



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- ✓ NSF Certified
- ✓ Uses Polymeric Beads with nucleation sites to convert dissolved hardness into microscopic crystals
- ✓ Once crystals grow to the template size, the crystals are released and remain in the water without forming scale
- ✓ Operates as a fluidized bed to maximize surface area and effectiveness
- ✓ Commercially systems available for a variety of flow rates.



Quantifying Scale Formation

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- DVGW – German Association of Gas and Water Boards is responsible for certifying technologies for safety, hygiene and performance capabilities.
- DVGW – W512 is the test used to determine effectiveness of water conditioning devices installed to prevent or reduce scaling in drinking water heating systems and secondary installations.
- The W512 testing protocol is what we are **basing** our experimental methodology on.
- Operate a system for twenty days and quantify scale formed in a water heater.



Testing Methodology

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- Protocol **based** on DVGW W512 test to assess control of scale formation
- Pump 130 L of water through an electronically heated 10-L reservoir for 20 days
- After test is complete, determine the quantity of scale formed on the heating element and the reservoir



DVGW W512 Protocol

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- Requires a temperature of 80°C. Domestic water heaters operate between 40-60°C. It would be more realistic to operate the tests at 60°C.
- Requires an unrealistically low watt density. We used a watt density typical of an electric water heater.



Assessment of Scale Formation

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- ✓ The quantity of calcium and magnesium in any scale formed is quantified by dissolution in acid and subsequent analysis
- ✓ Scale on the Heating Coil and the Container Walls is quantified in terms of the number of moles of Ca and Mg ions
- ✓ An effectiveness factor is calculate by comparing the results with a treatment device with untreated water



Effectiveness Factor (EF)

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$$EF = \frac{(Ca + Mg)M \text{ untreated} - (Ca + Mg)M \text{ treated}}{(Ca + Mg)M \text{ untreated}}$$

The DVGW certifies a device with an EF greater than 0.989

For this study the EF will be used as a relative measure without applying any pass fail criteria.



Summary of Technologies

FILTERSORB SP3 – Scale Inducing

New to water industry and rapidly developing technology

No Power or Backwash required

Life of Media – recommended change 3-5 Years

Best Performance also in seawater

