Water softening system or antiscalant dosing in RO / NF systems?

As reverse osmosis technology has evolved, the pretreatment methods have evolved with it. One of the major improvements has been the enhancement of scale inhibition chemistries.

With the increase in use of membrane filtration processes, issues of scale formation resulting in membrane fouling have also been on the rise; severely impacting the performance of the filtration systems; especially in Nanofiltration NF and Reverse Osmosis RO membranes.

With reverse osmosis and nanofiltration systems, it is always best to prevent the scaling of your membranes. When RO/NF membranes scale up, the flow rate drops and the pump can overload. There are two ways to prevent scaling of your reverse osmosis system.

1. Water softener
2. Antiscalant system

While both methods are effective as pretreatment before a membrane system, the decision comes down to the size of the system. For smaller systems with a feed rate of less than 5mch, it can be difficult to inject as little as 3-5 ppm of antiscalant into the feed stream.

As systems become larger, one uses both more salt and more antiscalant. However, the equipment cost remains roughly the same for antiscalant injection and increases with larger softeners. Generally, antiscalant chemicals are less costly than salt. Generally speaking, sanitary sewer and septic systems don't appreciate the sodium chloride that softeners contribute, as it may negatively impact the biological treatments that are often employed. In addition, another key concern is the constituents to be controlled. If hardness-related scale is not the only issue (e.g. silica, low-level of dissolved metals), then of course antiscalant/antifoulant can offer broader or more targeted control. In addition, softeners require maintenance and upkeep to ensure they don't harbor biological growth.

SupraChem

Technical Bulletins

What is Water Softener ?

Water Softener :

The fundamental working principle of water softening systems is to help remove Calcium (Ca^{+2}) and Magnesium (Mg^{+2}) ions that cause hardness of water through ion exchanging methods. It is a process of removal whereby Sodium (Na^{+}) ions present in the cationic resin exchange places with the calcium and magnesium ions in the water. After this process, the saturated resin must be regenerated with a time or flow controlled regeneration procedure. After the resin has become saturated with the unwanted ions (Resin has a greater affinity for these unwanted ions such as calcium, magnesium and other cations), it is regenerated by washing it with a solution of the desired ion, which is NaCl in this case.

What is RO Antiscalant ?

ANTISCALANTS

Product Effectively Against

Products	Water Type	Silica	$CaCO_3$	$BrSO_4$	$SrSO_4$	CaF_2	$CaSO_4$	$Mg(OH)_2$	Iron	Manganese / Aluminum	$Ca(PO_4)_2$	Silt / Clay	Organic / Bio
SupraChem 6400	SW, BW	O	OOO	OO	OO	O	OO	OOO	OO	●	●	OO	●
SupraChem 6402	SW, BW	O	OOO	OOO	OOO	OO	O	OOO	OO	●	●	OOO	●
SupraChem 6403	SW, BW Waste Water	OOO	OOO	●	●	OOO	O	●	O	●	OOO	OOO	OOO
SupraChem 6404	SW, BW	O	OOO	OO	OO	OO	OO	●	O	●	●	OOO	●
SupraChem 6405	BW Waste Water	OOO	OOO	OOO	OOO	OOO	OOO	●	OOO	OOO	●	OOO	OOO
SupraChem 6406	SW, BW	●	OOO	OOO	OOO	O	OOO	●	O	O	O	●	●
SupraChem 6407	SW, BW	●	OO	O	O	●	O	●	●	●	●	O	●

O **Poor** OO **Good** OOO **Excellent** ● **Unsuitable**

Antiscalant / Antifoulant Dosing Systems :

Antiscalant chemicals are used to prevent the scaling & fouling of the RO membranes. Scale may consist of mineral fouling such as calcium sulfate, calcium carbonate, barium sulfate, silica, calcium fluoride, and strontium sulfate. The Antiscalant dosing should be done before reaching the RO membranes to break up sulfate precipitates, calcium carbonate, and other mineral fouling.

Antiscalant chemical is used to process very poor quality feed water at very high rates of recovery. When used properly, Antiscalant extends the time between membrane cleanings from a few weeks to years in some cases. Without Antiscalant, membrane systems would not be as successful serving the water treatment industry.

Advantage :

1. Reduces water hardness to below 1 grain per liters
2. Chemicals are not required
3. It can remove traces of iron and manganese
4. Better choice for smaller systems

Advantage :

1. No salt required
2. It is effective against silica SiO_2, iron, manganese, carbonates, sulfates and others
3. Requires less footprint
4. Extends RO or NF membranes life
5. Works with up to 150 grains of hardness
6. Less operating costs than water softeners

Disadvantage :

1. High capital cost
2. Cause water in lost in regeneration
3. Sanitary sewer and septic systems don't appreciate the sodium chloride
4. Requires large volumes of water for backwash and regeneration
5. Incremental cost of pumping (electrical costs) due to pressure loss
6. Heavy bags of salt (NaCl)
7. High labor and operating costs
8. Not recommended when the water TDS is higher than 2500ppm

Disadvantage :

1. Accurate dilution is critical
2. Accurate injection rate is critical
3. Requires chemical storage
4. Requires handling chemicals

Conclusion:

Scale control has evolved over the years from the use of acid injection to the use of antiscalants. Although there can be considerable savings when antiscalants are used over water softening plants, care must be taken in the selection of an appropriate antiscalant which can reduce the risk of scaling without affecting the overall efficiency of the plant.