

RO Membrane Cleaning: Chemicals and Best Practices

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Based on the Hydranautics Technical Service Bulletin – TSB107.10, PWT Cleaning recommendations and GE Water technical paper on RO feedwater.

The following are the generic chemicals that are used in RO cleaning:

1. **Citric acid** solution at 2% is useful in removing inorganic scale, metal oxides/hydroxides, and inorganic-based colloidal material. Rybar recommends using ammonia for adjusting the pH of the Citric acid solutions.
2. **Sodium Tripolyphosphate (STPP)** at 2% and 0.8% **Na-EDTA** which is useful in the removal of Ca-Sulfate scale and organic foulants of natural origin. STPP acts as a detergent and sequestrant.
3. 2% **STPP** with 0.25% **Sodium-Do-Decyl-Benzene-Sulfonate (Na-DDBS)** is used for the removal of heavier levels of organic foulants.
4. 0.5% by w of **HCl** useful for the removing of inorganic scale and metal oxides/hydroxides.
5. **NaOH** 0.1% w and **Na-DoDecyl Sulfate (SDS)** 0.03% w useful for the removal of biofilm, fungi, mold, slime
6. **NaOH** 0.1%w useful for the removal of polymerized Silica.

An efficient RO pre-treatment system would circumvent cleaning altogether and extend the life of the RO membranes up to 12 years. RO fouling problems can be very costly in terms of downtime and capital replacement costs. This is why GE Water recommends “*RO Feedwater: Treat It Right*”.

Rules of Thumb/Quality control:

1. Don't start with acid cleaning unless you are 100% sure there is no organic fouling.
2. Beware of the chemical compatibility of the pre-treatment chemicals and the anti-scalant and the hardness in the water
3. Beware of Fe and Al colloids
4. Beware of scale and silica concentrations at the brine side. Use the membrane program and a water analysis to estimate potential foulant thresholds or calculate based on rejection rates and solubility data*.
5. Do your SDI test to make sure that no particulates are entering the membranes.
6. If you can dissect a membrane (do an autopsy) and analyze the foulant this is the ideal scenario. Here are some tips:

"In the examination of foulants by the naked eye or with a magnifying glass, crystals have **well defined shapes**."

"Colloidal fouling: The foulants appear typically as colorless to yellow or brown **jelly** during autopsy."

Metin recommended testing the cleaning chemicals on the foulant.

RO Tips on Correct Cleaning Procedures:

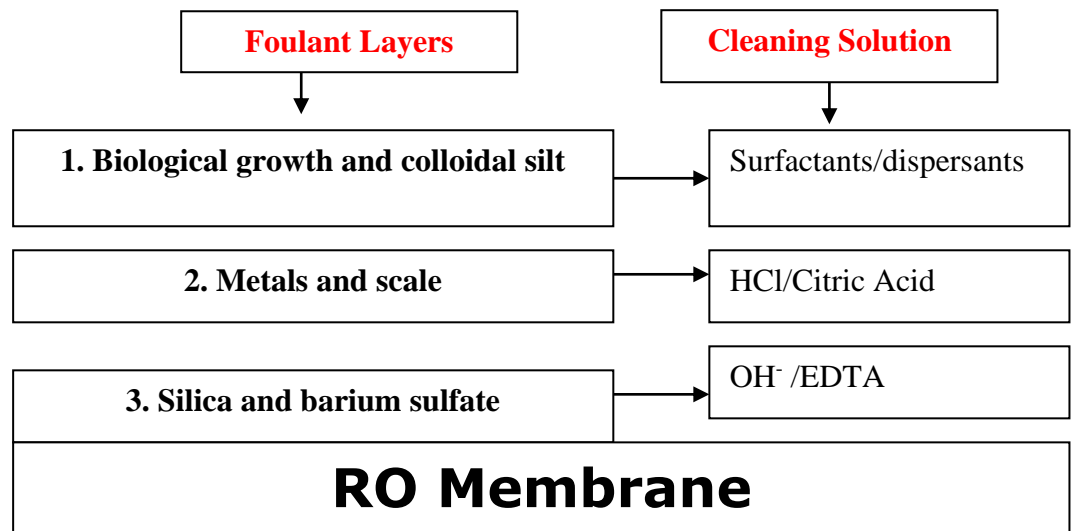
From PWT_Cleaning_Reverse Osmosis (RO) Chemicals for Water Treatment.htm

1. When planning a membrane cleaning, it is important to consider **the order** in which the required cleaners should be used. In general, remove biological growth and colloidal silt first (using surfactants). A second cleaning (acid) removes the metals and scale from the membrane. Layers, such as silica and barium sulfate which tend to exist at the lower level of the stratum (closest to or directly on the membrane), may be removed in a final procedure (EDTA).
2. During the cleaner recirculation and rinsing procedures, **pressures should be reduced** so permeation is avoided. By reducing pressures, the membrane foulants are no longer being forced toward the membrane by the water flowing through it. Instead, foulants may move away from the membrane surface, into solution and out of the membrane element.
3. The Order of Cleaning

(from <http://www.pwtinc.com/>)

When possible, conduct a foulant analysis to determine which foulants exist, what cleaners should be used and in which order cleaners should be applied. Foulant layers differ from one RO to the next, depending on feedwater characteristics and the hydration level of the foulants (absorbed water associated with the chemical form of the foulant).

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*** Solubility Limits of Feedwater Salts in ppm at 30 °C:**

| | |
|-----------------------------------|------|
| Calcium Carbonate (at pH 10)..... | 65 |
| Calcium Sulfate..... | 2090 |
| Magnesium Sulfate (at pH 10)..... | 9 |
| Strontium Sulfate..... | 114 |
| Barium Carbonate (at pH 10) | 24 |
| Barium Sulfate..... | 2 |
| Silica (at pH 8) | 120 |

This data is from the GE paper “*RO Feedwater: Treat it Right*”