FILMTEC™ Membranes

Cleaning Iron Fouling from FILMTEC FT30 Elements

The following cleaning procedure is designed specifically for a system that is fouled with iron. Consult the general cleaning instructions for information that is common to all types of cleaning such as suggested equipment, pH and temperature limits, and recommended flow rates.

Safety Precautions

1. When using any chemical indicated here in subsequent sections, follow accepted safety practices. Consult the chemical manufacturer for detailed information about safety, handling and disposal.
2. When preparing cleaning solutions, ensure that all chemicals are dissolved and well mixed before circulating the solutions through the elements.
3. It is recommended the elements be flushed with good-quality chlorine-free water (20°C minimum temperature) after cleaning. Permeate water is recommended; but a dechlorinated potable supply or prefiltered feedwater may be used, provided that there are no corrosion problems in the piping system. Care should be taken to operate initially at reduced flow and pressure to flush the bulk of the cleaning solution from the elements before resuming normal operating pressures and flows. Despite this precaution, cleaning chemicals will be present on the permeate side following cleaning. Therefore, permeate must be diverted to drain for at least 10 minutes or until the water is clear when starting up after cleaning.
4. During recirculation of cleaning solutions, the temperatures must not exceed 50°C at pH 2-10, 35°C at pH 1-11, and 30°C at pH 1-12.
5. For elements greater than six inches in diameter, the flow direction during cleaning must be the same as during normal operation to prevent element telescoping, because the vessel thrust ring is installed only on the reject end of the vessel. This is also recommended for smaller elements.

Cleaning Procedure

There are seven steps in cleaning elements with iron fouling.

1. Make up the cleaning solution listed from Table 1.

Table 1. Iron fouling cleaning solutions

Cleaning solutions	Solution
Preferred	1.0% (wt) $Na_2S_2O_4$ pH 5, 30°C maximum
Alternative	2.0% (wt) citric acid
Preferred	0.5% H_3PO_4
Alternative	1.0% NH_2SO_4H

1. (wt) denotes weight percent of active ingredient.
2. Cleaning chemical symbols in order used: $Na_2S_2O_4$ is sodium hydrosulfite.

Cleaning Procedure (cont.)

2. Low-flow pumping. Pump mixed, preheated cleaning solution to the vessel at conditions of low flow rate (about half of that shown in Table 2) and low pressure to displace the process water. Use only enough pressure to compensate for the pressure drop from feed to concentrate. The pressure should be low enough that essentially no permeate is produced. A low pressure minimizes redeposition of dirt on the membrane. Dump the concentrate, as necessary, to prevent dilution of the cleaning solution.

Table 2. Recommended feed flow rate per pressure vessel during high flow rate recirculation

Feed pressure[1]		Element diameter	Feed flow rate per pressure vessel	
(psig)	(bar)	(inches)	(gpm)	(m^3/hr)
20 - 60	1.5 - 4.0	2.5	3 - 5	0.7 - 1.2
20 - 60	1.5 - 4.0	4[2]	8 - 10	1.8 - 2.3
20 - 60	1.5 - 4.0	6	16 - 20	3.6 - 4.5
20 - 60	1.5 - 4.0	8	30 - 40	6.8 - 9.1
20 - 60	1.5 - 4.0	8[3]	35 - 45	8.0 - 10.2

[1] Dependent on number of elements in pressure vessel.
[2] 4-inch full-fit elements should be cleaned at 12 - 14 gpm (2.7 - 3.2 m^3/hr).
[3] For full-fit elements, 400 and 440 sq. ft. area elements.

3. Recirculate. After the process water is displaced, cleaning solution will be present in the concentrate stream that can be recycled to the cleaning solution tank. Recycle the cleaning solution for 15 minutes or until there is no visible color change. If at anytime during the circulation process there is a color change, dispose of the solution and prepare a new solution as described in step 2.
4. Soak. Turn the pump off and allow the elements to soak. Soak the elements for 1-15 hours to remove the iron from the surface of the membrane (soaking overnight will give best results). Soak times are essential for the sodium hydrosulfite to be effective. To maintain temperature during an extended soak period, use a slow recirculation rate (about 10 percent of that shown in Table 2). Soak time will vary depending on the severity of the fouling. For lightly fouled systems, a soak time of 1-2 hours is sufficient.
5. High-flow pumping. Feed the cleaning solution at the rates shown in Table 2 for 45 minutes. The high flow rate flushes out the iron removed from the membrane surface by the cleaning. If the elements are heavily fouled, using a flow rate that is 50 percent higher than shown in Table 2 may aid cleaning. At higher flow rates, excessive pressure drop may be a problem. The maximum recommended pressure drops are 15 psi per element or 50 psi per multielement vessel, whichever value is more limiting. If there is a color change, dispose of the solution and prepare a new solution as described in step 2 and repeat the process from step 3.
6. Flush out. Prefiltered raw water can be used for flushing out the cleaning solution, unless there will be corrosion problems (e.g., stagnant seawater will corrode stainless steel piping). The system should be flushed for one hour.
7. The system should be restarted. Elements and the system need to stabilize before taking any data. The stabilization period will vary depending on the severity of the fouling. To regain optimum performance, it may take several cleaning and soak cycles.

Additional Information

The sodium hydrosulfite has a very pungent odor, so the room must be well ventilated. Follow all safety regulations and procedures.

Contact time is key to successful cleaning. The solution will sometimes change many different colors. Black, brown, yellow are all very normal for this type of cleaning. Anytime the solution changes color, it should be disposed of and a new solution prepared. The length of time and the number of soaking periods will depend on the severity of the fouling.

Citric acid was originally used as a cleaner for cellulose acetate membranes and is not as effective with thin film composite chemistry. Further, it has a disadvantage of being a nutrient source for systems, which have biological fouling. It is, however, easier to handle than sodium hydrosulfite and is included as an alternative cleaner for that reason.

FILMTEC™ Membranes
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