

Cleaning Procedure for Dairy-5K Ultrafiltration Membranes

This bulletin provides general cleaning instructions for Dairy 5K-UF Membranes used for applications such as fractionating, purifying, and dewatering milk and cheese whey as well as other non-dairy applications. The Dairy 5K membrane is a hydrophilic polyethersulfone membrane.

Please note that preventable chemical damage to the Dairy 5K represents the primary root cause for field failures; therefore it is essential that proper precautions are taken for optimal membrane life. Care should be taken to verify and conduct necessary calibration on metering pumps, temperature, and pH measuring equipment on a regular basis. Dosage rates should be carefully calculated. Care should be taken when mixing chemicals, especially when chlorine is utilized, as excessive chlorine over time is a common root cause for chemical degradation.

The UF system is traditionally cleaned daily, after the shift. Water flux tests are often run immediately following the cleaning in place (CIP), to verify the effectiveness of the cleaning process. Prolonged operation of a fouled membrane will shorten its useful life and make effective cleaning more difficult.

1. Shut down the UF unit to be cleaned. Be sure to follow all safety procedures for system shutdown.
2. Flush the UF membranes with softened potable water. Flush for at least 10 minutes at normal operating flow to dislodge large foulants from the system.
3. Prepare the cleaning solutions. The cleaning solutions must be prepared with softened potable water, or alternatively treated water that is free of sparingly soluble salts. Water should be prefiltered since debris may cause mechanical damage to the membrane surface. Iron and other transition metals, which pass through unfiltered water or may exist in dissolved state, may act as a catalyst to oxidation in the presence of free chlorine.
4. Warm the cleaning solution to 104 - 122°F. **DO NOT EXCEED 122°F!** Cleaning with warm water is much more effective than cleaning with cold water. Take care to monitor cleaning temperatures and do not allow the temperatures to drift above 122°F.
5. Chlorine levels should be conservatively chosen given the amount of fouling being addressed. Chlorine levels should not exceed 200 ppm for a membrane that is fouled with organics. Care should be taken to dose the chlorine when the buffered cleaning solution is above the pH level of 10.5. If chlorine is added before pH's have been adjusted above pH 10.5, there can be extreme damage to the membrane surface. Even a 100 ppm chlorine exposure to a UF membrane at

pH's below 9 can be damaging. This is a common mistake. Chemical dosing equipment set up for chemical addition is helpful so that operators do not introduce chemicals too quickly, which cause chemical damage to the feed end of a system. Short periods of over-concentrations of chlorine are more damaging to membranes than over exposing the membrane over time to lower dosages of chlorine.

Organics tend to consume chlorine quickly in the system, which may make finding a stable chlorine level challenging. Though enough chlorine may be added to give a level of 200 ppm to a solution, it is possible to measure less than 100ppm with a test kit. The actual membrane surface will only have minimal exposure. Using an alkaline & chlorine step at a lower chlorine level can remove organics, thereby making the primary alkaline and chlorine step (at higher concentration) more effective, and easier to achieve. This can provide a stable chlorine level without risking operator errors which lead to over-concentrating chlorine with consequential damage.

6. Circulate the cleaning solutions through the system for 30 – 60 minutes at a fairly high flow rate, since high flow has a scouring effect, which assists in loosening foulants from the surface of the membrane. Normal operating flow rates (40 to 80 gpm/module or pressure vessel) should be used during the cleaning operation. It is typical to use various acid or alkaline washes and other proprietary enzymatic cleaners in Dairy industry applications. A compatibility study should be conducted prior to large scale usage of the chemical.
7. Flush the cleaning solution and rinse the UF membrane with softened potable water until no traces of cleaning solution remain.

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