Cleaning Procedure for Ultrafiltration Membranes used for E-Coat Paint Applications

This bulletin provides general cleaning instructions for 2000 type membrane modules which have been used in electrocoat paint applications. The 2000 type membrane is a hydrophilic polyolefin which has no surface charge.

The membrane elements should be cleaned when the permeate flux decreases to 70% of its design rate, or to an unacceptably low level. Prolonged operation of a fouled membrane will shorten its useful life and make effective cleaning more difficult.

To clean the UF system:

1. Shut down the UF unit:
   a. Observe and record permeate flux.
   b. Open bypass valve.
   c. Close feed inlet and outlet valves.
   d. Stop paint pump.

2. Purge (Paint flush):
   a. Using DI water, displace the paint in the UF unit with at least 2 to 3 volumes of UF permeate or clean city water.
   b. Rinse the UF modules with clean water for 15 minutes.

3. Prepare cleaning solutions:
   a. Add cleaning chemicals to cleaning tank according to the formulations in the attached table.
   b. Warm the cleaning solution to 90 to 100°F.
   c. Use UF permeate or clean city water for preparation of cleaning solution.
4. **Cleaning:**
   a. Circulate cleaning solutions for 2 hours.
   b. Maintain feed pressure during cleaning between 30 - 40 psi.
   c. Return (outlet) pressure should be between 5 - 10 psi.

5. **Soaking:**
   a. Allow the cleaning solution to soak for 12 to 72 hours.
   b. Recirculate the cleaning solution for 30 minutes every 4 hours during the soak period, if possible.
   c. Recirculate the cleaning solution for 30 minutes at the end of the soak cycle.

6. **Rinsing:**
   a. Stop the cleaning pump and drain the cleaning solution.
   b. Drain the rinse water from the UF unit.
   c. Repeat the rinse cycle 2 or more times until the rinse water loses its soapy feel.

7. **Restart the paint:**
   a. Start the paint pump.
   b. Open the paint feed inlet and outlet valves.
   c. Close the bypass valve. Adjust the valves to achieve an inlet pressure of between 30 to 60 psi, and an outlet pressure of 10 - 20 psi.
   d. Observe and record the permeate flux.
Cleaning Formulations for Cationic ED Paint Removal from the NTU-2020-M7S Ultrafiltration Tubes

<table>
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<tr>
<th>Name</th>
<th>Components</th>
<th>Supplier</th>
<th>Purpose</th>
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</table>
| CR-1 | - 10% Ethylene Glycol Monobutyl Ether (EB)  
- 5% Lactic Acid  
- 2.5% AWR-5441  
- 82.5% DI Water or Permeate | - Ashland Chemical  
- Monsanto  
- PPG | General cleaning to remove paint (resin/pigment) fouling on membrane surface |
| CR-2 | - 10% Ethylene Glycol Monobutyl Ether (EB)  
- 5% Lactic Acid  
- 5% AWR-5441  
- 80% DI Water or Permeate | - Ashland Chemical  
- Monsanto  
- PPG | For more resistant fouling |
| CR-3 | - 1% Ethylene Glycol Monobutyl Ether (EB)  
- 2% Ethylene Glycol Monoethyl Ether Acetate (EE)  
- 3% Lactic Acid  
- 0.25% Triton X-100  
- 93.75% DI Water or Permeate | - Ashland Chemical  
- Ashland Chemical  
- Monsanto  
- Rohm & Haas | General cleaning to remove paint fouling & some inorganic salt deposition on membrane surface (except ZnPO₄) |
| CR-4 | - 2% Acetic Acid (pH not less than 2 solution) | - Various suppliers | Removing PbCO₃ inorganic fouling |
| CR-5 | - 5% Acetic Acid  
- 5% Ethylene Glycol Monobutyl Ether (EB)  
- 0.25% Triton X-100  
- 89.75% DI Water or Permeate | - Various suppliers  
- Ashland Chemical  
- Rohm & Haas | Removing PbCO₃ inorganic fouling |

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