

# Advantages of Ultrafiltration as a Pretreatment to Reverse Osmosis

Ultrafiltration (UF) is becoming more popular for pretreatment to reverse osmosis systems for its ability to remove fine particulates and colloidal silica, which can foul RO membranes. UF membranes typically have pore sizes under 0.1 micron and as small as 0.001 micron, so in addition to particulates, they are often used for removing bacteria and viruses in high purity polishing or drinking water applications as well. UF in industrial purified water systems is a crossflow separation process, similar to reverse osmosis except the membrane is designed to remove discrete particles and high molecular weight organics, but allows ionic species to permeate the membrane.

UF membranes come in tubular, spiral wound and hollow fiber designs, and are generally constructed from polypropylene, polyethersulfone (PES), and polyvinylidene fluoride (PVDF). UF membranes are typically rated for a molecular weight cutoff, rather than a micron removal rating. With the variety of UF configurations and materials, it's important to match the membrane to the application, and in some cases more than one type of membrane may be appropriate. It is also important when designing a system to select a membrane material that is compatible with the chemicals that will be used for cleaning and sanitizing the system.

For pretreatment to reverse osmosis, a hollow fiber element is most commonly used, as these membranes exhibit good physical strength, are less prone to breakage, and can be cleaned both chemically as well as scoured with air. In pretreatment applications, conventional filtration is normally used upstream to remove relatively large suspended particles, to permit the membrane to do the job of removing finer particles and organic molecules. These modules

are typically mounted vertically, so the UF skids themselves are fairly compact; however, the system also requires auxiliary equipment for backflushing and cleaning, so the complete system can take up some floor space. It should be noted that in many of these pretreatment applications, similar results can be achieved using the proper coagulant aid at the proper dosing rate with conventional filtration; so if capital is limited (or even if it isn't), this approach warrants serious evaluation.

For polishing applications, where there is not as much particulate loading, a spiral configuration may be the most appropriate choice. In high purity water systems, UF is increasingly used instead of the conventional 0.2 or 0.1 micron polishing cartridge filters. When a UF membrane is used in lieu of a cartridge type final filter, particle removal efficiency is improved, plus the UF membranes can be sanitized rather than having to be replaced if bacterial growth is experienced.

Yet another opportunity to use this technology is in the growing demand for water reuse and recovery. UF is effective for removing emulsions and many of the organic compounds found in industrial wastewaters. In general, these applications require a pilot study to determine the most appropriate membrane for the application and to generate data for design of the full-scale system.

For further information or for assistance in evaluating a potential application, contact your Process Solutions, Inc. sales representative!