America's Authority in Membrane Treatment

AMTA

American Membrane Technology Association

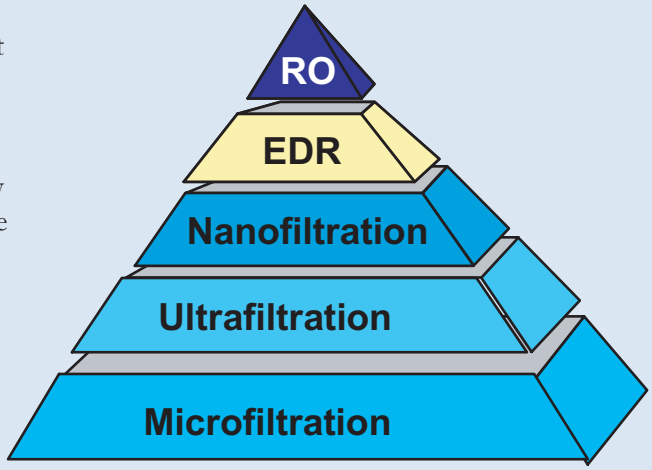
Improving America's Waters Through Membrane Treatment and Desalting

Membrane Separation Process

Water utilities across the world are turning to advanced treatment to meet more stringent drinking water regulations.

Membrane systems, available in variety of separation capabilities have become the technology of choice for these regulations. From the removal of turbidity, precursors and disinfectant tolerant micro-organisms relating to both groundwater and surface water supplies, as well as tapping into new water supplies, such as brackish and seawater.

Low pressure membrane filtration, such as microfiltration (MF) and ultrafiltration (UF), have emerged as viable options for addressing the current and future drinking water regulations. Full-scale facilities have demonstrated the efficient performance of both MF and UF as feasible treatment alternatives to conventional granular media processes. Both MF and UF have been shown to exceed the removal efficiencies identified in the Surface Water Treatment Rule and related rules, such as *Cryptosporidium oocyst*, *Giardia cyst*, and turbidity. MF and UF membrane systems generally use hollow fibers that can be operated in the outside-in or inside-out direction of flow. Pressure (5 to 35 psi) or vacuum (-3 to -12 psi for outside-in membranes only) can be used as the driving force across the membrane. Typical flux (rate of finished water permeate per unit membrane surface area) at 20 degrees C for MF and UF ranges between 50 and 100 gallons per square foot per day (gfd).



In desalination, salt water on one side of a semi-permeable Reverse Osmosis membrane is subjected to high pressure. This causes fresh water to diffuse through the membrane and leaves behind a more concentrated solution than the source supply, containing the majority of the dissolved minerals and other contaminants. Because the feed water must pass through very narrow passages, fine particulates or suspended solids must be removed during an initial treatment phase (pretreatment). Brackish water RO plants typically recover 60 to 85 percent of the source water, with 100-300 psi applied pressures. Seawater RO recovery rates range from 40 to 60 percent, with pressures ranging from 500-1000 psi.

A "loose" version of RO called Nanofiltration (NF) typically operates at 85 to 95 percent recovery, with lower pressures. It is typically used for organic, color and contaminant removal, as well as for softening.

Electrodialysis Reversal (EDR) is an electrochemical process in which membranes that allow selective passage of either positively or negatively charged ions can accomplish the desalting. Because most dissolved salts are ionic (either positively or negatively charged), the ions are attracted to electrodes with an opposite electric charge and are washed away in the reversal mode of operation. It is a process typically used for brackish water and contaminant removal applications. Recovery rates for EDR range from 75 to 95 percent of the source water.

This material has been prepared as an educational tool by the American Membrane Technology Association (AMTA). It is designed for dissemination to the public to further the understanding of the contribution that membrane water treatment technologies can make toward improving the quality of water supplies in the US and throughout the world.

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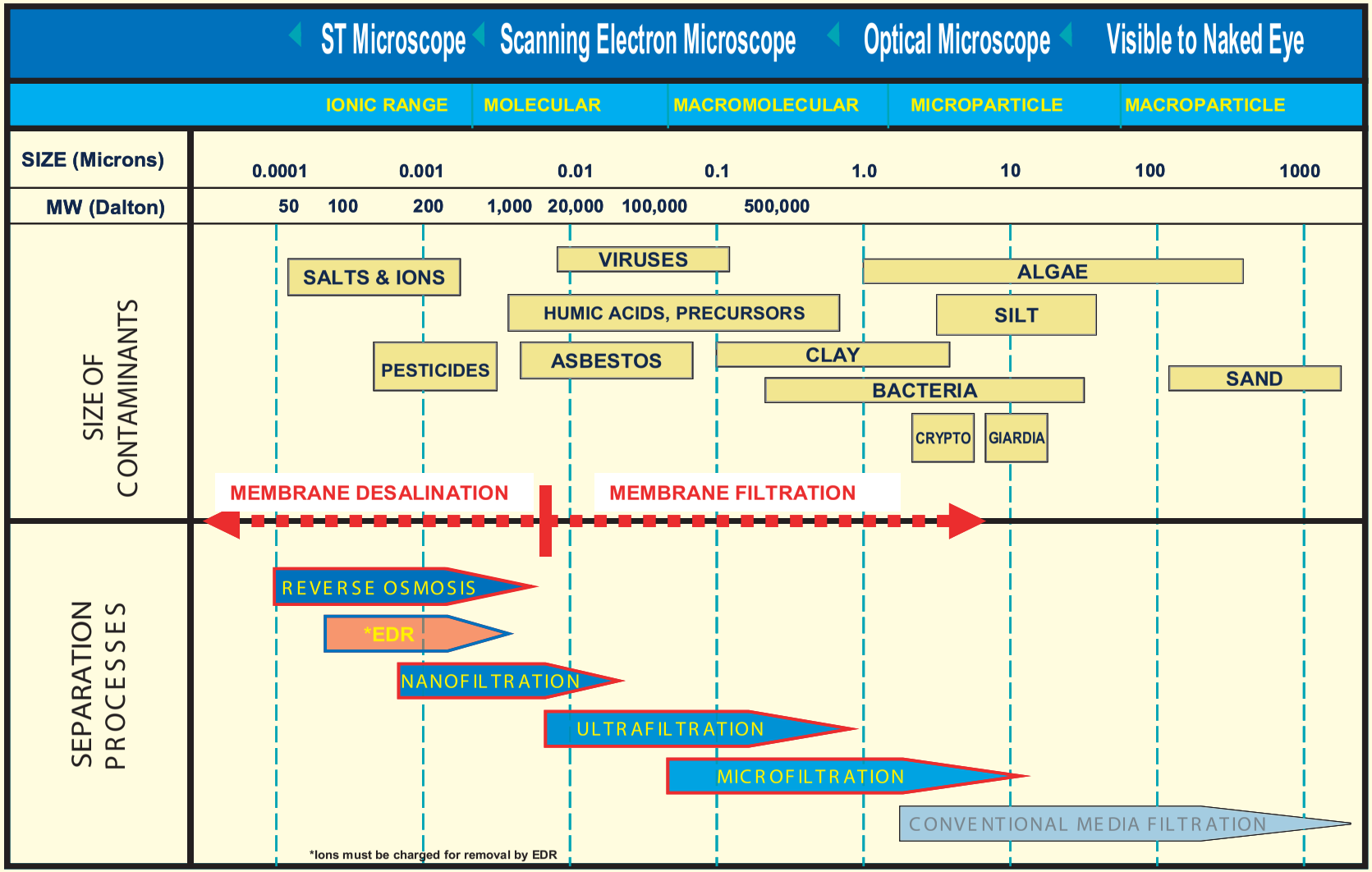
Membrane Separation Processes Relative to Contaminant Size



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