San Diego County Water Authority
Our Region's Trusted Water Leader

Submerged Membrane Water Treatment

Improving INFRASTRUCTURE

What is membrane water treatment?

In the membrane treatment process, untreated water is drawn through very fine pores in membrane fibers. The pores are just large enough for water molecules to pass through, but small enough to leave behind contaminants and particles, such as dirt, dust, bacteria, cryptosporidium, giardia, and others. Membrane treatment systems are in common use today around the world.

Submerged membrane treatment employs slender strands of membrane fiber to separate water from contaminants.

Does membrane treatment eliminate bacteria and viruses?

Membrane pores are smaller than all but the very smallest microbial contaminants, so they screen out the vast majority of bacteria and viruses. Any microbial contaminants that do pass through are eliminated during primary or secondary disinfection.

What type of membrane process does the Twin Oaks Valley plant use?

The Twin Oaks Valley Water Treatment Plant uses a submerged membrane process, also known as ultrafiltration, to remove contaminants. Submerged membranes are hollow strands of membrane material immersed in a tank of untreated water. A pump creates a vacuum that pulls water molecules into the hollow core of the strands, separating purified water from contaminants. The membrane fibers replace conventional chemical coagulants, sedimentation, and sand filtration.

What is conventional water treatment?

The most common or "conventional" water treatment process in the U.S. uses chemical coagulants that cause contaminants to stick together. The water is then stirred so these clumps bump into each other to form larger clumps. The largest clumps are allowed to settle by gravity as sediment, and the smaller clumps are removed by a media filter.

How is the Twin Oaks Valley plant different from conventional treatment?

1) Membrane treatment achieves a higher removal rate than conventional treatment because membranes remove all particles that cannot fit through the pores. While conventional treatment is effective, it does not reach as high a degree of contaminant removal as membrane treatment.

Membrane Treatment at Twin Oaks Valley	Comparable Conventional Treatment
Fine Screening	
Submerged Membrane Filtration	Flocculation and Sedimentation
Ozonation with Peroxide	Ozonation with Peroxide
Biological Filtration (Granulated Activated Carbon)	Biological Filtration (Sand/Anthracite or GAC)
Chemical Mix Chamber and Chlorine Contactor	Chlorine Contactor
Clearwell	Clearwell

Similar for both treatment processes

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2) The membranes at Twin Oaks Valley form a physical barrier that performs consistently in separating water molecules from contaminants. In conventional treatment, success depends on proper management of chemicals. If the chemicals are not added in the right amount, treatment is less effective.

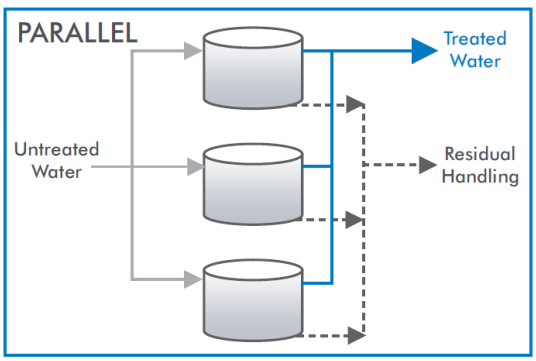
3) The membrane system at Twin Oaks does not use chemical coagulants, so it produces up to 80 percent less treatment byproducts, or residual solids. Fewer chemical deliveries to the plant and less frequent removal of residual solids means fewer trucks on the road and reduced disposals in landfills.

How are they similar?

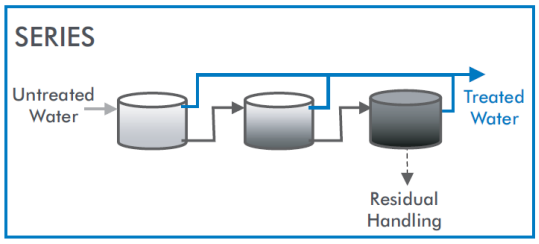
After the membrane filtration step at the Twin Oaks Valley plant, the additional treatment processes are similar to many conventional treatment plants. Ozonation and advanced oxidation provide disinfection and taste and odor control, followed by deep-bed granular activated carbon filtration, which provides an additional barrier to contaminants and taste and odor control. The final step is secondary disinfection, which protects the water during delivery from the plant to the consumer. Treated water is stored briefly in a covered clearwell reservoir before distribution to users.

Are there different ways to design submerged membrane treatment?

Yes. The Twin Oaks Valley plant is a parallel system in which untreated water makes a single pass through one membrane tank. When membranes become blocked with contaminants, they are taken out of service for cleaning. Backup membranes keep the plant running at full capacity during this process.



The other design is a series system in which residual contaminants remaining in a membrane tank are transferred to the next tank to extract the maximum amount of treated water possible. The concentration of contaminants is increased in each subsequent tank. If problems arise in treating the higher concentration of contaminants,the productivity of the entire series of tanks is affected.



What is membrane fouling?

This occurs when too many contaminants adhere to the membrane, clogging the pores and restricting the flow of water. Regular backwashing and clean-in-place cycles help prevent this buildup.

Are submerged membranes different from reverse osmosis?

Yes. In reverse osmosis for seawater desalinationor consumer water purifiers, layers of membrane sheets are rolled up and enclosed in a pressurized tube. Compared to submerged membrane systems, reverse osmosis requires significantly more power to pressurize the tube to a point that allows for the separation of water molecules from salt and other dissolved solids.

Can a large submerged membrane plant be as reliable as a smaller one?

Yes. The Twin Oaks Valley Water Treatment Plant produces up to 100-million gallons of treated water per day, making it one of the world's largest submerged membrane plant. But because the membrane tanks are configured in parallel, they are equivalent to 14 separate plants sitting side by side, each producing approximately 7 million gallons of treated water per day.

For more information, go to **sdcwa.org/water-quality.** ■

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