Company News

FO plant completes 1-year of operation

Since Modern Water burst upon the desal scene with a June 2007 initial public offering that raised £30 million ($48 million), it has guarded its technology offering closely. Known as 'manipulated osmosis desalination' (MOD), the process was developed by Professor Adel Sharif, a chemical engineering professor at the University of Surrey, and is described as "a two-stage process that combines forward osmosis (FO) with reverse osmosis (RO)."

Although it continues to maintain secrecy around the draw solution chemistry and FO membrane, Modern Water invited *WDR* to visit two of its operating installations in the Sultanate of Oman last week: a potable seawater desalination installation in Al Khaluf, 400km (250 mi) south of Muscat, and an industrial cooling tower installation in Sohar, 175km (110 mi) north of Muscat.

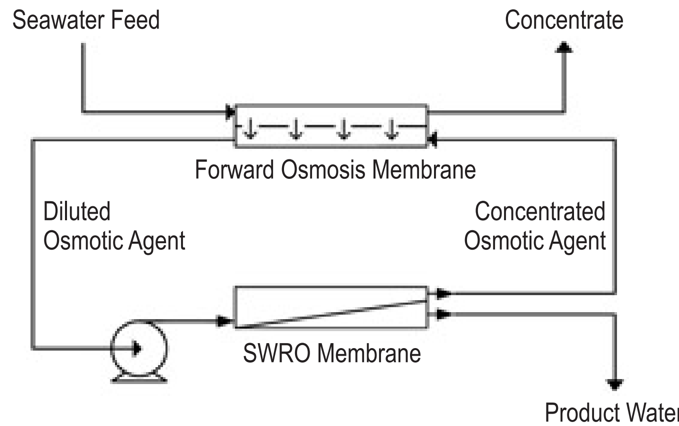
At the Khaluf site, Modern Water's 100 m^3/d (26,420 GPD) containerized unit operates alongside a conventional SWRO system owned by Oman's Public Authority for Electricity and Water (PAEW). The plants serve a local fishing community and provide the only public water supply for 70km (44 miles). Blue tanker trucks, or bowsers, are filled with product water at the plant's filling station before distributing the water to area residents.

It is hard to imagine a more difficult location in which to install a membrane desalination system. In addition to its remote location, the site's intake consists of a weighted HDPE pipeline that extends out 350 meters (1,250 ft) from shore. During low tide, 80 percent of the pipe is exposed, lying on a mudflat, with the end of the pipe submerged in less than 1m (3 ft) of seawater.

In addition to the intake, the SWRO and MOD share an existing dual media filtration system that often produces a filtrate SDI that is so poor it is immeasurable.

In a subsequent meeting, PAEW chairman Mohammed al Mahrouqi told *WDR* that one of the reasons the remote site was chosen was because of its hard-to-treat seawater. "We knew that this was difficult seawater to treat, but it is important that we provide a safe, reliable water supply for the local residents. We thought that this would be a good test for Modern Water and its technology; if it is successful at Khaluf, it should work almost anywhere," he said.

Modern Water's two-stage MOD process employs FO, operating at a 35 percent recovery, to dilute the draw solution before it is desalinated by high-pressure membranes to produce potable water with a 120 mg/L TDS. During desalination, the proprietary osmotic agent in the FO draw solution is concentrated, or regenerated, enabling its recirculation and reuse.



Seawater Manipulated Osmosis Desalination

The most obvious operational advantage of the MOD arrangement is that the diluted feed reduces desalination energy requirements by more than 20 percent. In addition, the chlorine-tolerant, fouling resistant FO membranes produce a virtually particulate-free feedwater for the high-pressure RO membranes. A periodic, chemical-free osmotic flush maintains a low differential pressure, although after a full year of operation in the brine-staged arrangement employed at Khaluf, there was no apparent differential pressure increase on the second set of FO membranes.

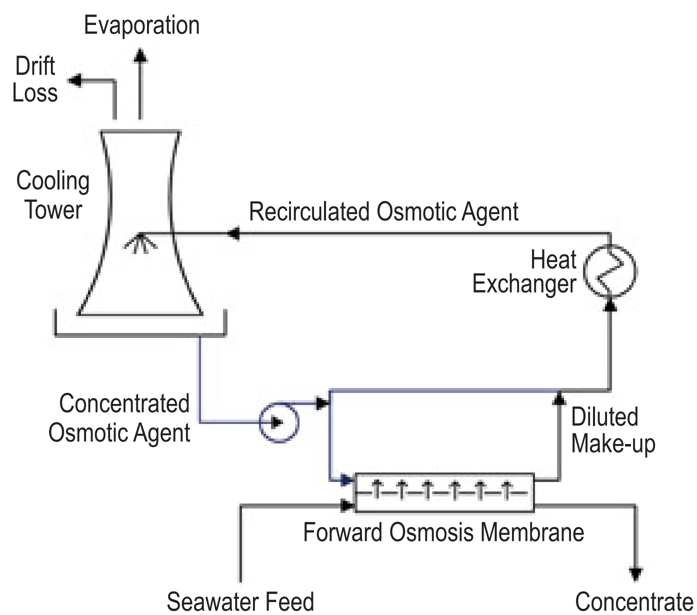
While the company expected to clean the FO membranes less frequently than the existing SWRO operating in parallel with its MOD system, they did not expect that they would not have to clean them at all, especially considering the poor quality of feedwater.

"To eliminate the temptation, we made a conscious decision to keep all cleaning chemicals away from the site. The unit has now been in operation for one year without a chemical cleaning. This is particularly impressive when considering that we can operate the high-pressure portion of our system with three RO elements at 50 percent conversion," said Modern Water's technical director, Peter Nicoll. "Meanwhile, the membranes on the existing SWRO system are cleaned up to two times per month and have just been replaced for a second time in the past year."

Nicoll considers the movement away from once-through cooling to evaporative cooling systems to be another opportunity for Modern Water. "The cost of water is one of the biggest expenses associated with evaporative cooling.

In some places, regulations prevent new cooling towers and district cooling systems from using potable water for makeup and many people are concerned about using tertiary water for cooling water makeup," he said.

Using its FO system, the company replaces the cooling tower recirculation water with a draw solution that contains an osmotic agent, and uses seawater as the feed solution. Not only are the FO membranes inherently less prone to fouling, the low, 2-bar (29 psi) operating pressure uses up to 50 percent less energy than SWRO and the high-quality product water replaces water lost by evaporation, conserving potable water for other uses.



Cooling Tower with Manipulated Osmosis Make-up

To prove its potential, the company installed a 150 L/h (40 GPH) demonstration system at a petrochemical plant site in Oman's Sohar Port. Using a dual media filter followed by a 5-micron cartridge filter, the system continues to produce high-quality desalinated seawater with no increase in differential pressure across the membrane.

Modern Water chairman Neil McDougall told *WDR* that he has been extremely pleased with the performance of both projects, noting, "They have proven that the MOD process becomes more cost-effective as the source water becomes more challenging, both in terms of total dissolved solids and fouling potential. We're at a point where we have begun offering MOD systems in competitively-bid situations where alternative technologies are acceptable."

WDR's C_{DR} rating for this technology is 8.9.

What is District Cooling?

A district cooling system (DCS) produces and distributes chilled water from a central source to multiple buildings through a network of insulated, underground pipes for use in air conditioning. The use of a central cooling plant eliminates the need for separate systems in individual buildings.

A DCS consists of three primary components: the central plant, the distribution network and the consumer system. The central plant may include the cooling equipment, power generation and thermal storage. The distribution or piping network is often the most expensive portion of the DCS, and the consumer system usually consists of air handling units and chilled water piping in the individual buildings.

A central plant eliminates the need for individual cooling towers, reducing the risk of legionnaires' disease arising from poor maintenance. A DCS usually reduces the fresh water consumption that results from multiple or poorly maintained cooling towers that make these systems more attractive with rising potable water costs.