Part of an industrial wastewater treatment system for reuse using PolyCera membranes. Photo by PolyCera

ceramic membranes at a lower cost. Using PolyCera in more than 60 of its mobile wastewater treatment systems, the company has recycled more than 189 million liters (50 million gallons) of water, representing almost 1 million truck miles taken off the road.

Treatment of blowdown water for reuse

Blowdown water from power plant cooling towers can present very challenging geochemistry, with super-saturated concentrations of minerals that must be removed before reapplying the water for cooling. A pilot-scale evaluation system for a power plant (Figure 1), consisting of chemical softening followed by PolyCera Hydro UF, was implemented to prove the ability to treat waters with varying qualities and make the filtrate suitable for reuse. The pilot test proved the ability of PolyCera Hydro UF membranes to remove precipitated silica, hardness, and other suspended solids, thus, providing a very high quality, consistent feed to the high-recovery RO unit targeting total dissolved solids removal.

Throughout the evaluation period, the system consistently produced a high quality of filtrate with average turbidity and scaling ions removal efficiencies of 96.4 percent and 82 percent, respectively. All of the key performance indicators were met or exceeded during the evaluation with an attractive return on investment for the owner allowing discussions to commence on scale-up and plant expansion.

Food and beverage process separation

In February 2019, PolyCera's Hydro MF/UF line of membranes received approval from the US Food and Drug Administration (FDA) for use in food processing applications. These applications include dairy processing, fat and casein removal, whey concentration, and lactose isolation. They have also been certified to NSF/ANSI 61, which covers all products with drinking water contact from source to tap. These approvals open up significant opportunities in the food and beverage process separations as well as drinking water purification, offering more robust and durable membranes for such applications.

The impact of drivers ranging from water scarcity to increasingly stringent environmental regulations portends continued growth in industrial wastewater treatment and reuse. PolyCera's advancements in organic metal membrane technology overcome traditional barriers to use of membranes in industrial applications; hence, there is a new, low-cost option to apply membranes to recover difficult to treat industrial effluents and challenging process separations.

Author's Note

Anna Jawor is director of applications engineering at PolyCera, Inc, based in Los Angeles, California, United States (www.polyceramembranes.com). She can be reached at anna.jawor@polyceramembranes.com.

Reuse system reduces water and chemical use in Phoenix

Since November 2018, Atlantis Technologies' radial deionization (RDI™) system installed in global biopharmaceutical firm Celgene's flagship facility in Phoenix, Arizona, United States (US), has been reusing up to 87,000 liters (23,000 gallons) per day of wastewater from various streams for reuse in the facility's cooling towers.

The new wastewater reuse system supports the company's global strategic initiatives of reducing water usage at its plants. Celgene projects annual cost savings of at least US$28,400 and up to $50,000, including reduced chemical use in towers.

"One of Celgene's corporate sustainability goals is to reduce total water withdrawals by 10 percent by 2020, so the installation of this system helps meet our environmental stewardship efforts," says Anthony J. Benenati, manager of aseptic manufacturing support at Celgene. "We chose to start in Phoenix where the clean water supply is so limited and water stewardship is a critical community issue. We plan to expand the current system to reuse excess reclaimed water for other water needs around this facility and others within the company," he adds.

The 12-cylinder, vertically mounted RDI system reduces the salinity of the feed water to the cooling tower, reducing chemical usage by as much as 50 percent. Developed by Atlantis Technologies, radial deionization is an improved and patented form of capacitive deionization.

With the Atlantis RDI system, water is passed between two oppositely charged supercapacitors that remove salt. Once full, the capacitor polarity is switched, and a low-volume, high-concentration brine is produced. Cylinders and the system can be placed in parallel to increase volume or in series to process high salinity water. The system can also partially desalinate water, known as TDS shaving, further improving economics for applications such as cooling towers and waste discharge.

Singapore pilot plant could recover precious metals, reduce liquid waste 90 percent

Under a new research partnership and licensing agreement, Separation Technologies Applied Research and Translation (START) Centre, a national-level facility to develop and commercialize innovative separation and filtration technologies in Singapore; and Memsift Innovations Pte Ltd, a local water technology firm specializing in zero-liquid discharge water treatment systems, will jointly build a wastewater treatment facility that could potentially reduce the amount of liquid waste by more than 90 percent.

The pilot facility will be located at a semiconductor company in Singapore and can also recover precious metals from the treated water that can then be sold and reused.

The START Centre is supported by the Singapore Economic Development Board (EDB) and Nanyang Technological University Singapore (NTU Singapore). It is part of NTUitive, the innovation and enterprise company of NTU Singapore.

The pilot plant uses a novel water treatment system that leverages a new type of hollow-fiber membrane invented by Professor Neal Chung at the National University of Singapore, which has been assigned to and scaled up for industrial application by the START Centre.

Unlike the typical hollow-fiber membrane, which resembles noodles with a hollow core like a straw, the new tri-bore hollow-fiber membrane invented by Professor Chung has three hollow cores, allowing for a water flow rate that is approximately 30 per cent higher. The pilot facility will treat up to 5,000 liters per day for the semiconductor firm.

This pilot plant is expected to help the firm save up to 1.6 million liters of water a year (two-thirds of an Olympic-sized swimming pool), resulting in a savings of US$250,000 in disposal cost. It will filter more than 90 percent of wastewater into clean water and concentrate the metal waste into a liquid that can then be sold to other companies.