EXECUTIVE INSIGHT ON INNOVATION

INDUSTRY INNOVATIONS TO SOLVE WATER RECYCLING AND REUSE

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Water scarcity and degradation of water resources combined with increasingly more stringent environmental regulations are threatening the license to operate of industries worldwide. In many regions, decades of uncontrolled industrial development have resulted in pollution of conventional surface water and depletion of underground water resources. With population growth and hyper-urbanization, industries find themselves competing with people for potable water and are relying more and more on impaired water resources to sustain increasing industrial output. In particular, industrial operators are turning to unconventional sources like treated wastewater effluent from local municipalities as well as implementing tighter water management and reuse policies recycling water within plant operations. Economics often favor reuse and recycling over desalination and are subject to less permitting obstacles.

Two primary sources of water supply can be considered to solve industry's needs. In plant water recovery and the use of adjacent municipal wastewater supplies. With many industries the recovery of plant water can be challenging due to the aggressive nature of particulate material and suspended solids. The development of new ceramic membrane filtration technology enables these waste streams, once problematic to treat, to be recovered reliably and economically.

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At Nanostone Water we have applied our ceramic filtration technology to address these challenges at a major semiconductor manufacturing facility in East China. This facility, focused on advanced large-scale integration assembly and testing, needed to expand and upgrade its wastewater management system's capacity to meet new environmental regulations. The factory was treating several different wastewater streams and had experienced irreversible fouling and fiber breakage from abrasive solids, which damaged the polymeric membranes. Excessive downtime caused the reuse system's treatment capacity to drop 30-40% below the plant's water requirements increasing demand for freshwater. After a successful pilot, the factory installed the CM-151 membrane systems which operates at a flux of 124 l/m^2.h with a limited footprint and a combined recovery rate greater than 95%. By investing in the new systems, the factory achieved reliable, stable operations with high quality permeate, reduced its dependence on freshwater, and lowered its disposal costs.

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Another successful application to meet the new Zero-Liquid Discharge (ZLD) regulations governing wastewater treatment, the Xiaojihan Coal Mine, a member of the China Huadian Group, had to expand the capacity of its wastewater management system. The mine faced several issues with its existing wastewater treatment process, a submerged polymeric ultrafiltration membrane system: fouling had become a frequent issue, and the need to perform Clean-In-Place (CIP) had increased to multiple times a week. That, combined with frequent fiber breakage in the PUF membrane and subsequent failure of their downstream reverse osmosis (RO) membrane, resulted in a treatment capacity that was below the plant requirements.

If we consider treatment of municipal derived wastewater microfiltration (MF), ultrafiltration (UF), and reverse osmosis (RO) are the most common membrane technologies to recycle wastewater streams and provide the quality of water necessary for industrial processes such as boiler feed and ultra pure water supplies. Where implemented to treat municipal wastewater, treatment of organic and biological active waste is necessary. Most polymeric MF/UF systems can provide the high-quality treated water required to operate the RO system safely, provided that a sufficient pre-treatment system is installed and operated properly. However, in a growing number of cases, systems are exhibit permeability loss and premature failure, due to higher concentration of organic matter, larger populations of microorganisms as well as other particulates. Downstream RO performance is impacted, resulting in increasing chemical cleaning frequency and replacement frequency.

In these cases, ceramic ultrafiltration membranes have proven to several certain advantages over polymeric membranes, including less complex pretreatment requirements, an ability to handle a wider range of incoming feed water quality parameters, higher flux, better recoverability, as well as more robust and reliable operation. In fact, in some applications, ceramic ultrafiltration membranes have shown to be capable of treating industrial wastewater directly, without a clarifier for example, while delivering a stable permeate quality to the downstream RO.

Ceramic membrane filtration is creating possibilities to solve our water challenges by enabling the treatment and recovery of industrial and municipal waste streams. As we see greater innovation, increasing scale of manufacturing we can expect ceramic membrane filtration to be more widely adopted as a key strategy to recover valuable water.

About the Authors

Carlo Patteri joined Nanostone in 2019 as Business Leader Industrial Water with the responsibility to set up and implement the sales strategy for industrial segments and grow the industrial water and wastewater business worldwide. He was previously Business Development Director for Veolia Water Technologies in South East Asia and Regional Manager APAC for Sofinter Group with over eighteen years experience in water/ wastewater treatment and industrial steam generation. Education background: Master's degree in Environmental Engineering and M.B.A.

Jonathan Pressdee joined Nanostone Water in 2020, with the responsibility of business development globally. He spent 30 years in water treatment industry, primarily in consulting and technology leadership roles. Jonathan has a wealth of knowledge of UF, electrodialysis, EDI, IX, advanced oxidation, and deep application expertise of seawater desalination, municipal drinking water, reuse and industrial process water wastewater.

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