PVDF Use in Water & Wastewater Treatment

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Clean water is fundamental need for humans yet according to the United Nations, a third of the world's population is water-stressed.[i] While United Nations 2030 Sustainable Development Goal 6 (SDG 6) envisions universal access to clean water and sanitation[ii], global water scarcity is increasing. This is being driven by continued population growth, agricultural intensification and industrialisation, increased urbanization, and climate change. Water treatment, wastewater treatment and reuse, desalination, and stringent water quality standards are essential to address our global water shortages. This combined with growing urbanization have led to an increased reliance on membrane-based water treatment technologies, such as micro-filtration (MF) and ultrafiltration (UF).

The ability of MF and UF to remove harmful pathogens more effectively and reliably than conventional clarification and sand filtration is why these technologies have become ubiquitous in water treatment. Furthermore, growing urbanization has led to a rapid expansion of these significantly more compact and reliable treatment technologies.

For example, in the city of Adelaide (Australia) catastrophic water shortages have led to the city relying on UF and desalination to supply up to 50% of the towns water supply[iii]. In Singapore where population growth, urbanization, and water scarcity is an acute issue, UF is used for supplying over 30% of the countries water through desalination, and a further 30% of the countries water through reclamation and recycling[iv].

In the last 20 years, MF/UF has become ubiquitous in drinking water production, process water production, wastewater treatment, and reclamation all over the world[v]. The Global Water Intelligence (GWI) estimated that MF/UF would be responsible for producing 14000 million litres per day (MLD) of clean water in 2018, with approximately 3000 MLD for drinking water[vi]. In addition, they estimate that Membrane Bioreactors – which are almost exclusively utilize PVDF MF/UF - are also responsible for treating approximately 20000 MLD of sewage [vii].

Of the materials used for MF and UF, over 77% are prepared from polyvinylidene fluoride (PVDF)[viii]. Further, in recent years almost all MF or UF membranes used for secondary effluent treatment have been observed to be PVDF based[ix]. The

drinking water and wastewater treatment industry has largely standardized on the use of PVDF, as no other materials meets the balance of technical, economic, health or environmental requirements. Hence, PVDF is synonymous with providing safe water supplies and addressing global water scarcity.

All filtration products used in contact with drinking water must pass stringent national and state regulations or standards that are regulated in every country of use.

The impact of prohibiting the use of PVDF in MF/UF and MBR socially would be significant. a transition away from PVDF would require decades; in the order of 50 years. Water treatment plants are typically built with a planned 30 year life. The economic and social impact of prohibiting the use of PVDF in water treatment is challenging to estimate.

Bark et al provided an economic assessment of the value of water and wastewater treatment at approximately USD $3 million per gigalitre of water (Bark, et al., 2011). With approximately 10780 MLD of MF/UF capacity, and 20000 MLD of MBR capacity by PVDF membranes an initial assessment of the impact of prohibiting the use of PVDF globally would place this at USD $92 million per day. In Europe alone, which accounts for approximately 28% of MF/UF installed capacity (Global Water Intelligence, 2014), the cost of prohibiting PVDF could be estimated at approximately USD$ 25.9 million per day.

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[i] https://www.unwater.org/water-facts/scarcity/
[ii] https://sdgs.un.org/goals
[iii] https://en.wikipedia.org/wiki/Adelaide_Desalination_Plant
[iv] Water supply and sanitation in Singapore - Wikipedia
[v] AWWA, 2016. Microfiltration and Ultrafiltration. s.l.:American Water Works Association.
[vi] Global Water Intelligence, 2014. Low Pressure: HIgh Expectations, s.l.: Global Water Intelligence.
[vii] Judd, S., 2019. *MBR Global Capacity.* Available at: https://www.thembrsite.com/largest-mbr-plants/membrane-bioreactor-global-capacity/
[viii] Pearce, G., 2019. Microfiltration and Ultrafiltration Market Report, s.l.: Membrane Consultncy.
[ix] The MBR Site | The material question – choosing MBR membrane materials