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Editorial

Overview of Membrane Fouling

Kate Wilson*

Editorial Office, Journal of Membrane Science and Technology, Spain

EDITORIAL NOTE

The requirement to reduce fouling drives a lot of innovation in membrane and process design. Membrane fouling reduces permeability, increases energy consumption, and changes the permeate. Quality shortens membrane life and enhances the cost of water production in general. Fouling-induced decreases in membrane permeability lead to decreased flux in experimental studies conducted at constant pressure. In full-scale water recycling facilities, however, as membrane permeability decreases, the applied transmembrane pressure is often increased (at an additional energy cost) to achieve the plant's goal water production rate. Because of the low salinity and high organic content of the source waters, as well as the normally high recovery of the process, fouling in wastewater reuse varies from fouling in other kinds of desalination. Fouling is discussed in terms of its types, methods, and effects. Fouling issues unique to wastewater effluents with high organic and biological content and low salinity are described, and fouling mitigation strategies are reviewed. This section compiles the findings of earlier membrane fouling investigations as well as newer research. Fouling is classified as scaling (crystallisation of dissolved inorganic salts), cake formation by colloids and organic macro-molecules, or biofilm formation in a review of RO membrane fouling in wastewater reuse. Cake formation is further divided into particulate fouling and organic fouling in a broader discussion of RO (Reverse Osmosis) membrane fouling. The majority of source water contains foulants of various forms. Organic and silica fouling, for example, coexist on RO membranes processing effluent. Different forms of fouling can also help each other: biofouling, for example, has been demonstrated to improve scaling by increasing the concentration polarisation of sparingly soluble salts. Membrane compaction and chlorine degradation are also occasionally considered types of fouling. Because of its reversibility, concentration polarisation of rejected dissolved material is not normally considered fouling, but the consequent rise in transmembrane osmotic pressure difference must be taken into account when building RO plants. The mechanisms of fouling induced membrane performance deterioration have already been discussed. Pore blockage, cake formation with accompanying hydraulic resistance and cake-enhanced osmotic pressure biofilm-enhanced osmotic pressure membrane compaction, and membrane deterioration owing to oil and chlorine exposure are only a few examples. Although fouling reduces membrane permeability (water flux per unit of applied pressure), the impact of fouling on solute rejection might be beneficial or harmful. In a study of the effects of fouling with tertiary effluent and model organic and colloidal foulants on salt and N-nitrosamine rejection for RO and NF (Nanofiltration) membranes, some scientist discovered that fouling enhanced salt and N-nitrosamine rejection for most foulants. During biofouling of NF membranes with Membrane Bioreactor (MBR) permeate, on the other hand, rejection of both organic matter and inorganic salts decreased (only marginally) throughout a 10-day period during which the flux reduced to one-third of its original value After fouling with micro-filtered secondary effluent, assessed the change in in solute rejection of NF and RO membranes. Fouling enhanced the rejection of hydrophobic neutrals and ionic organic solutes, while the rejection of hydrophilic neutral primidone reduced.

Correspondence to: Kate Wilson, Editorial Office, Journal of Membrane Science and Technology, Spain, Email: membranescitechnol@journalres.com

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