



## The membrane fouling simulator: development, application, and early-warning of biofouling in RO treatment

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### ABSTRACT

The growing demand for fresh water has resulted in increasing use of reverse osmosis (RO) membrane systems for seawater desalination. A major operational problem of RO membrane filtration systems is biofouling – biomass growth causing an unacceptable membrane performance decline. Biofouling reduces the produced water quantity and quality and increases costs. The need for fouling remediation is mainly derived from destructive trial-and-error research with practical membrane modules. Therefore, a clear need existed for the development of a small-sized membrane fouling simulator (MFS) for systematic, low-cost studies. Since the introduction of the MFS in 2006, many articles have appeared which are evaluated in this review. The review describes (i) the location of biofouling in full-scale installations, (ii) development of MFS, (iii) characterization, reproducibility and representativeness of fouling development in the MFS, (iv) applications such as assessing the impact of anti-scalant or biocide dosage, phosphate limitation, feed spacer geometry and linear flow velocity and (v) early warning for biofouling. MFS studies have increased the understanding of biofouling and enabled improved practical membrane performance such as selection of dosed chemicals and feed spacer design. Future MFS studies are anticipated to enable the development of advanced biofouling control strategies.

*Keywords:* Seawater desalination; Reverse osmosis membrane; Biofouling; Membrane fouling simulator; Early warning

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