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Three steps to control biofouling in reverse osmosis systems

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ABSTRACT

Exposure to water containing micro-organisms causes biofouling on reverse osmosis (RO) membranes as they adhere, multiply and produce extracellular polymeric substances (ESP) which form biofilm on the surface of the membrane. As micro-organisms are present in virtually every water system, biofouling is one the most commonly encountered fouling types in large and small scale RO installations treating surface, waste- or seawater. Biofouling control is significantly improved when multiple methods are combined in an integrated approach and prevention methods employed in the RO stage itself are applied. In this study the impact of new membrane chemistry, feed spacer thickness and the use of non-oxidative biocide upon to the rate of biofouling in RO systems was investigated using a pilot-scale experiment involving small membrane elements subject to a high-fouling feed and autopsy-based analysis of membrane foulant loading and composition. The results were as follows: (1) The benefit of using the newest development in the family of fouling resistant (FR) membranes, DOW FILMTEC™ BW30XFR, was validated with side-by-side operation where lower rate of flux loss was observed when compared to the current industry standard membrane, BW30. (2) Thicker feed spacers provided reduced pressure drop and reduced rate of pressure drop increase during episodes of fouling. Overall organic foulant loading and bacterial counts were found to be reduced on membrane used in combination with thicker spacers. (3) The clear benefit of DBNPA dosing was observed with both shock and continuous dosing regimes. The benefit was most visible in the evolution of Δp as the treated elements operated at significantly lower Δp. Autopsy based results verified significantly lower organic fouling loading on the biocide treated element. These results point to the value of the studied factors – membrane chemistry, feed spacer configuration, and biocide dosing – for use with high-fouling feeds. The suggested route is to combine the components for use as an integrated strategy to solve biofouling. Combining a FR membrane with a thick feed spacer is preferred whenever a high potential for biofouling is seen. The use of targeted biocides in the pretreatment section will further result in improved fouling prevention and ensure long-term trouble free operation, maximizing the membrane lifetime and minimizing the operational expenses of the treatment system.

Keywords: Biofouling; Membrane and feed spacer modification; DBNPA

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