Monitoring and controlling biofouling in an integrated membrane system

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\textbf{ABSTRACT}

An integrated membrane system, producing high-quality industrial water from canal water, suffered severely from membrane biofouling. The full-scale plant (comprising: coagulation, moving bed filtration, ultrafiltration and reverse osmosis) has a capacity of 1750 m\textsuperscript{3}/d. It is equipped with three reverse osmosis units and is located in Klazienaveen, the Netherlands. Fouling of the reverse osmosis membranes manifested as a frequent and rapid increase in pressure drop across the feed-brine channel of the first stage. Frequent chemical cleaning (CIP; cleaning in place) was therefore needed to prevent damage to the membranes. To reduce the cleaning frequency, a research project was conducted with the following objectives: controlling biofouling by dosing peracetic acid (PAA) and DBNPA and evaluating a newly developed in-line biofouling monitor, which monitors biofouling in an early stage. This in-line monitor continuously measures the increase in pressure drop across the feed-concentrate channel of the first element of the first stage in a unit. The in-line biofouling monitor demonstrated that the increase in head loss occurred almost exclusively in the first element and could be accurately measured. Biofouling was controlled by intermittently dosing PAA and DBNPA to two different units. The third unit was used as reference. The results of these efforts were: Intermittent dosing of PAA and DBNPA successfully controlled biofouling. It led to a reduction in the cleaning frequency from 12 times per year (and almost weekly in the summer) to once every three to four months; No increase in salt passage was observed, which could be attributed to the use of PAA or DBNPA.

\textbf{Keywords:} Biofouling; In-line biofouling monitor; Biofouling control; Peracetic acid; DBNPA; Reverse osmosis; Operational experience

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