

A pilot-scale comparison of granular media filtration and low-pressure membrane filtration for seawater pretreatment

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ABSTRACT

This paper summarizes the results of a long-term comparative pilot-scale study on seawater pretreatment for reverse osmosis (RO) desalination. A conventional granular media filtration pretreatment (CPP) and a low-pressure membrane filtration pretreatment (MPP) were operated side-by-side at a site located on the Mediterranean Sea. This study showed that the SDIs after microfiltration were lower than the ones obtained after coagulation + granular filtration: average SDI_{15} was 3.5 at CPP outlet and 2.5 at MPP outlet. However, MFIs values after maturation of the CPP filter were nearly the same as in the MPP permeate. Microorganism removal in terms of bacteria and picophytoplankton was highly better at the MPP outlet (1.8 log vs. 0.6 log for bacteria removal, 4 log vs. 0.8 log for plankton removal). On the other hand, removal of dissolved organic matter was significantly lower for the MPP as compared to the CPP. During this study, a higher fouling potential of the MPP outlet water was demonstrated through the monitoring of RO units fed by the two pretreatment processes. Indeed, while the longitudinal pressure drop was almost stable to 0.1 bar for the two RO membrane units, the normalized permeate flow decreased by 15% for the RO unit fed by CPP outlet water versus more than 30% for the RO membrane fed by MPP outlet water. According to these results, despite that MPP provided lower SDI values than CPP, the fact that it did not retain dissolved organic matter led to a higher extent of organic fouling on the RO membrane fed with the microfiltration pretreatment.

Keywords: SWRO desalination; Seawater characterization; Modified Fouling Index; Granular pretreatment; Membrane pretreatment

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