



## Amorphous aluminosilicate scaling characterization in a reverse osmosis membrane

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### ABSTRACT

This paper describes the results of experiments performed in a high-recovery system to elucidate the silica scaling phenomenon and characterize the scaling. In this research, cation exchange pretreatment is used to reduce  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ , and  $\text{Mg}^{2+}$  levels to prevent scaling during subsequent nanofiltration (NF) and reverse osmosis (RO) filtration, in which RO is fed with NF concentrate. In a pilot plant, a series of experiments were carried out at a total (NF + RO) recovery of 91, 94, 96 and 98% with locally available tap water as feed water. Autopsy studies were performed with the RO membranes after each experiment. The fouling layer was studied using SEM-EDX, ATR-FTIR and fouling extraction to determine the structure and the composition of the fouling deposits. A thin dense fouling layer was observed, which covered approximately half of the membrane surface, after operating for 20 days at 91 and 94% recovery. At 96 and 98% recovery, the fouling layer was thicker and completely covered the membrane surface. The scaling layer was mainly composed of Si, Al, Fe and O. The amount of Si increased with increasing recovery. To work at these high recoveries for an extended period, further measures need to be taken to prevent silica scaling.

*Keywords:* Concentrate; Membrane fouling; Silica scaling; Colloidal fouling; Concentration polarization

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