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Using tertiary-treated municipal wastewater as makeup water by reverse osmosis membrane

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ABSTRACT

The objective of this research was to study the possibility of using reclaimed municipal wastewater in cooling tower by treating the water using reverse osmosis (RO) membrane. In this study, RO membrane was operated at initial flow rate of 6.3 m^3/d, whereas the initial transmembrane pressure (TMP) was at 116 psi. During the operating period, permeate flux slightly decreased to 4.8 m^3/day with the increase of TMP up to 127 psi and membrane fouling resistance of 3.34E + 12 m^{-1}. Major membrane fouling mechanism was complete blocking followed by standard blocking and cake layer formation. Average permeate characteristics were 36.3 μS/cm of conductivity, 42.3 mg/L of TDS, 4.4 mg/L of hardness, 22.7 mg/L as $CaCO_3$ of alkalinity, 0.002 mg/L of iron, 0.05 mg/L as $CaCO_3$, 1.5 mg/L of chloride, 2.1 mg/L of silica, and there was no phosphate passing through RO membrane. Percent rejections compared to UF treated wastewater were in the range of 90.2–99.9% except for silica where rejection was only 85.1%. Scaling and corrosion index was studied in terms of Langelier saturation index (LSI) and Ryznar stability index (RSI). Without RO membrane, LSI value was −0.59 and RSI value was 8.5. With RO membrane, LSI value was −5.0 and RSI value was 17.0. From calculation of cycles of blowdown, it was found that when using the membrane, the cycles increased from 2.3 to 44 cycles. This, then, resulted in reduction of makeup water from 379.0 to 221.2 m^3/d, a decrease by 41.6%. Payback period of installation and operation of RO membrane system was 14 months.

Keywords: Makeup water; Reverse osmosis membrane; Tertiary-treated municipal wastewater

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