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The effects of feed water temperature and dissolved gases on permeate flow rate and permeate conductivity in a pilot scale reverse osmosis desalination unit

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ABSTRACT

Feed water temperature is an important parameter in determining the optimum conditions for an efficient seawater reverse osmosis (SWRO) process. Increased feed water temperatures are known to increase the permeate flux rate in commercial SWRO systems. There are several factors which link feed water temperature to the operational efficiency of the fundamental membrane desalination process. In this study we have obtained precise data on these effects using two different types of RO membranes in a small scale pilot unit with feeds of seawater, brackish water and pure water. The mechanisms involved have been examined in this work. Pre-heating the feed water to enhance RO efficiency may lead to greater cavitation within the RO membrane. Vapour cavities formed by cavitation have the potential to hinder permeate flow by blocking sections of the polymer matrix in the skin layer of the membrane. In earlier work, it was identified that the presence of dissolved atmospheric gases in seawater leads to a potential for cavitation within the porous membranes used in high pressure RO processes. It was also established that the almost complete removal of these dissolved gases prevented this cavitation. The effects of de-gassing on the permeate rate in a small scale pilot SWRO system was reported recently. This work has been extended here to include more hydrophobic membranes, which are more likely to produce cavitation. In addition, there is new evidence to support the view that de-gassing the feed water can remove/reduce vapour cavities in the membrane for improved flow, which is maintained even when the feed water is re-gassed.

Keywords: Desalination; Degassing; Temperature effects

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