

Study of ultrasonically enhanced chemical cleaning of SWRO membranes at pilot plant scale

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ABSTRACT

Fouling accumulated on reverse osmosis (RO) membranes during operation is one of the main problems affecting seawater desalination processes. This phenomenon causes a deterioration of the permselective properties of the membranes, which turns into a loss of performance of the process and costs increase. Conventionally, recovery of the process performance in desalination plants is carried out periodically by means of physical and chemical cleaning stages. However, conventional cleaning does not manage to recover completely the membrane properties and eventually can damage the membrane materials. New membrane cleaning techniques have been developed in order to improve this recovery. Ultrasound (US) radiation, which has shown to be an interesting technique during filtration since it avoids fouling deposition and allows to lengthen the period between cleaning stages, is proposed as an alternative technique to remove membrane fouling. This work investigates the effect of the combination of chemical cleaning methods and US application to clean a RO membrane from a desalination plant. The experiments performed were able to determine the best operating conditions to carry out the US cleaning protocol. Sodium hydroxide 2% w/v and sodium dodecyl sulphate 4% w/v solutions at 25°C were used, as they showed the highest recovery of the membrane properties in the chemical cleaning tests. Results showed that cleaning by US had a positive effect on the membrane selectivity (increase by 15.2%), and a low significant effect on its permeability. The utilization of the chemical cleaning combined with US improved the permeate flux considerably, without modifying salt rejection index in a significant way. Among the two cleaning solutions tested, the best results in terms of permeability and selectivity of the cleaned membrane, were those obtained by the US procedure using NaOH 2% w/v cleaning solution at 25°C.

Keywords: RO; Ultrasound enhanced; Chemical cleaning

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