

## Experimental and economical evaluation of a membrane crystallizer plant

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### ABSTRACT

Nowadays water scarcity is being recognized as a present and future threat to human activities throughout the world. Therefore, a definite trend to develop alternative water resources for a sustainable development can be observed. Since much of this precious limited supply is either locked in polar ice or it found in a limited number of lakes and rivers throughout the world, the largest potential source of alternative water is represented by salt water (97% of available water) and requires desalination. Today, the most commonly used desalination technology is reverse osmosis (RO) due to its low energy consumption and high recovery factor ( $\approx 40\text{--}50\%$ ) with respect to thermal processes (usually characterized by a recovery factor of about  $10\text{--}20\%$ ). This means less highly-concentrated brine to be discharged which can affect aquifers and marine environment and which can also result in financial penalties if toxicity standards are not met. In this work, the possibility of using membrane crystallizer (MCR) on nanofiltration (NF) brine streams for the quasi-total recovery of the desalted water combined to solid salts production has been investigated. Special focus has been placed on the stability and control of the process by avoiding crystal deposition inside the membrane module and/or on the membrane surface. The results achieved through the experimental tests showed, apart an initial transitory stage, an almost constant trend of the trans-membrane flux. This encouraging outcome was due to the optimization of the process parameters and to the improvement of an existing MCR lab-plant.

*Keywords:* Water stress; Desalination; Membrane contactor technology; Economical evaluation

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