CCD series no. 18: record low energy in closed-circuit desalination of Ocean seawater with nanoH₂O elements without ERD

Zviel Gal, Avi Efraty*

Desalitech Ltd, P.O. Box 132, Har Adar 90836, Israel, email: avi@desalitech.com (A. Efraty)

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Abstract

Experimental trials of seawater desalination under closed-circuit desalination conditions are described with a unit comprising four modules, each of four Qfx-SW-400-ES nanoH₂O elements, with seawater feed in the cited (parentheses) ranges of salinity (33,801–37,197 ppm), flux (9.2–13.4 lmh), recovery (42–53%), and temperature (15.0–18.4°C). The normalized results of this study revealed specific energies in the range of 1.453–1.775 kWh/m³ and permeates in the range of 379–682 ppm. The lowest energy trial in the series of 1.453 kWh/m³ with permeates of 682 ppm is observed with feed of 35,329 ppm at flux of 9.2 lmh flux and 47% recovery, and this energy is the lowest ever recorded for Ocean seawater desalination. The highest energy trial in the series of 1.775 kWh/m³ with permeates of 548 ppm is observed with feed of 33,913 ppm at flux of 12.3 lmh and 53% recovery. In comparison with SWC6 elements in the same unit, the experimental data with the Qfx-SW-400-ES nanoH₂O elements reveals 8–12% lower energy consumption and permeates of 2–3-fold higher TDS.

Keywords: Reverse osmosis; Desalination; RO; SWRO; Closed-circuit desalination; CCD; Low energy; High recovery; Ocean seawater desalination

*Corresponding author.

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