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Reverse Electrodialysis with saline waters and concentrated brines: a laboratory investigation towards technology scale-up

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Abstract

The use of concentrated brines and brackish water as feed solutions in reverse electrodialysis represents a valuable alternative to the use of river/sea water, allowing the enhancement of power output through the increase of driving force and reduction of internal stack resistance. Apart from a number of theoretical works, very few experimental investigations have been performed so far to explore this possibility.

In the present work, two RED units of different size were tested using artificial saline solutions. The effects of feed concentration, temperature and flowrate on process performance parameters were analysed, adopting two different sets of membranes. These experiments allowed to identify the most favourable conditions for maximising the power output within the presently investigated range, i.e. 0.1 M NaCl as diluate and 5 M NaCl as concentrate at 40°C. Under these conditions a power density equal to 12 W/m²_{cell_pair} was reached, among the highest so far reported in the literature. Increasing the unit size a slight reduction in power density was observed. These results indicate new directions for a successful scale-up and development of the Reverse Electrodialysis technology.

Keywords: salinity gradient power, RED, seawater, brackish water, brine

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