

## Numerical simulation on a dynamic mixing process in ducts of a rotary pressure exchanger for SWRO

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### ABSTRACT

A rotary pressure exchanger (RPE) is an energy-recovery equipment based on the positive displacement principle. Since there is no tangible separator in the duct of the rotor, the mixing occurs between the high and low salinity fluids and during the mass and energy transportation. The movement of the mixing zone in the duct works as a liquid piston. The formation and movement of the mixing zone are key factors on the performance of RPE. In this paper, 3.5% NaCl and 1.8% NaCl solutions are selected as the reference fluids. The dynamic mixing process model is set up. The mixing formation, its movement and concentration distribution in the duct are simulated based on the experimental data. The simulation shows that the mixing zone moves reciprocally in the duct and its moving distance remains almost unchanged. After the observation was analyzed, the conclusion for the mixing zone keeping constant moving distance is that the liquid flow rate and the rotor speed substantially cancel each other. This important characteristic of the mixing zone will guarantee the purity of seawater. Although the volumetric efficiency is not very satisfying, the simulation gives theoretical support and future innovation for a rotary pressure exchanger.

*Keywords:* Rotary pressure exchanger; Mixing; Numerical simulation; Positive displacement; SWRO

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