Desalination and Water Treatment
www.deswater.com
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doi: 10/5004/dwt.2012.3009

Taylor & Francis
Taylor & Francis Group

42 (2012) 269–273
April

3D numerical simulation on mixing process in ducts of rotary pressure exchanger

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Received 2 June 2011; Accepted 16 October 2011

ABSTRACT

Since there is no physical barrier between the brine and seawater streams in the rotor ducts of rotary Pressure Exchanger (RPE), the degree of mixing between these streams has become an important criterion of the performance of RPE. In this paper, a 3D numerical simulation mode of a whole RPE is presented, followed by an illustration and discussion of the computational results to analyze the relationship between the rotation speed, flow rate and fluid mixing. It is demonstrated that under certain conditions, a stable liquid plug can be formed in RPE channels. It is clearly seen that movement of a liquid piston separates the fresh water and brine to prevent from over-mixing with each other. Moreover, the mixing in RPE was controlled by the operating conditions. It was found that the volume mixing ratio rises with increase of flow rate and decrease of rotation speed.

Keywords: Numerical simulation; Mixing; Rotary pressure exchanger; Liquid piston; SWRO; 3D numerical simulation; Volumetric efficiency

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2011 Qingdao International Desalination Conference Symposium on Desalination and Water Treatment Global Platform for Water Solutions, June 20–23, 2011 Qingdao, China