CFD Simulation of the Effects of Extended angle on the Mixing Performances of Rotary Pressure Exchanger

H. Bie¹, Y. Jia¹, W. An*, C. Li¹

¹Ocean University of China, China

Abstract

By directly contacting with the high and low pressure fluids, rotary pressure exchanger(RPE) can efficiently recover the high pressure energy of the concentrated salt water and achieve pressure energy transfer, as well as reduce the operation cost of reverse osmosis desalination. Therefore, controlling the radial mixing caused by the direct contact between different fluids is a critical technology for the RPE development to reduce the energy consumption. In this paper, RPE models were built based on the background of reverse osmosis seawater (SWRO) desalination system. On the basis of RPE extended angle concept, the mixing performances of the turbulence model were firstly simulated by CFD software. Then, the structure and operation parameters were changed to analyse the flow field information and reveal the unsteady flow mechanism in RPE. And the flow characteristics of unsteady flow field and the development of high and low pressure fluid mixing properties in the rotor duct were investigated. The simulation results showed that when the extended angle was ±30°, smaller volume mixing rate can be obtained compared with no extended angle. The study results can provide a basis for the design and optimization of RPE, and also establish a theoretical guidance for controlling the hydraulic driven rotary device.