Abstract

The aim of this work is to enhance the permeation flux and rejection during thereverse osmosis (RO) filtration process of simulated seawater, using gas-liquidtwo-phase flow to reduce the concentration polarization layer by injecting air. Theeffect of various operating conditions (feed concentration, flow rate, temperature,operating pressure, and gas flow rate) on RO performance was evaluated and optimized. The central composite design (CCD) technique was used to find the optimaloperating conditions. The objective function (Response) was the flux of permeate and salt rejection. The coefficients of the proposed model were found, and the significant and nonsignificant parameters for the proposed model were checked by the F-test method. In order to ensure a good model the test for significance of theregression model (F-test) was performed by applying the analysis of variance(ANOVA). It was found that the flux and the rejection of NaCl solution throughout the RO are dependent on the operating conditions in the following sequence: concentration>pressure>temperature>flow rate. In addition, the results showed that theexperimental data have good agreement with the values predicted by the response model for permeation flux and salt rejection. The results showed a positive effectof constant gas-liquid two-phase flow on permeate flux and salt rejection. At lowliquid flow rates, better improvement was achieved with a horizontally installedmembrane. Using the gas-liquid two-phase flow technique with an injection factorof 0.878, slug flow pattern, superficial air velocity of 1.5923m=s, and superficial liquid velocity of 0.221m=s, the permeate flux increased from 3.406 to 5.676kg=m2.h and salt rejection increased from 85%to 91%