Modeling of waste brine nanofiltration process using artificial neural network and adaptive neuro-fuzzy inference system

Fakhreddin Salehi\textsuperscript{a,*}, Seyed M.A. Razavi\textsuperscript{b}

\textsuperscript{a}Faculty of Food Science and Technology, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran, Tel./Fax: +98 1732426432; email: FS1446@yahoo.com
\textsuperscript{b}Department of Food Science and Technology, Ferdowsi University of Mashhad, Khorasan, P.O. Box 91775-1163, Iran, Tel./Fax: +98 518805763; email: S.Razavi@um.ac.ir

Received 13 October 2014; Accepted 12 June 2015

\textbf{ABSTRACT}

In this study, artificial neural network (ANN) and adaptive neuro-fuzzy inference system (ANFIS) models were used to predict the average permeate fluxes and sodium chloride rejection of waste brine nanofiltration process. The ANFIS and ANN models were fed with three inputs: feed concentration (40, 60, 80, and 100 g/l), pressure (1.0, 1.25, 1.5, 1.75, and 2.0 MPa), and temperature (30, 40, and 50°C). Both models were trained with 30% of total experimental data. Thirty percent of the experimental data were used to test the prediction ability of ANFIS and ANN models. Independent permeate flux and NaCl rejection predictions were calculated for the remaining of total data (40%). The results revealed that ANN predictions agreed well with variety of experimental data. It was found that ANN with 1 hidden layer comprising 8 neurons gives the best fitting quality, which made it possible to predict flux and rejection with acceptable correlation coefficients ($r = 0.90$ and $r = 0.87$, respectively). A hybrid method (the combination of least squares and back propagation algorithms) was used as the training method of the ANFIS. The overall agreement between ANFIS predictions and experimental data was excellent for both permeate flux and salt rejection ($r = 0.96$ and $r = 0.94$, respectively).

\textit{Keywords:} Membrane; Effluent; Fuzzy inference system; Neural network; Simulation; Sodium chloride

\*Corresponding author.

1944-3994/1944-3986 © 2015 Balaban Desalination Publications. All rights reserved.