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Dynamic modeling of flux and total hydraulic resistance in nanofiltration treatment of regeneration waste brine using artificial neural networks

Fakhreddin Salehi, Seyed M.A. Razavi*

Department of Food Science and Technology, Ferdowsi University of Mashhad, Khorasan, P.O. Box 91775-1163, Mashhad, Iran
Tel. +98 511 8795620; Fax: +98 511 8787430; email: s.razavi@um.ac.ir

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ABSTRACT

Artificial neural networks (ANNs) were used to predict dynamically the permeate flux and total hydraulic resistance through the crossflow nanofiltration (NF) of waste brine. The ANN was fed with three inputs: transmembrane pressure (TMP), temperature and time. It was found that ANN with 1 hidden layer comprising nine neurons gives the best fitting with the experimental data, which made it possible to predict flux and total hydraulic resistance with high correlation coefficients (0.96 and 0.98, respectively). The effect of TMP and temperature on the recovery of useable brine from waste brine was also investigated by using polyamide tubular NF membrane. High reduction in salt and water consumption was achieved in this study. In addition, experimental results showed that the flux was increased significantly with increase in pressure and temperature ($p < 0.01$), whereas fouling and NaCl rejection increased considerably as the pressure and temperature increased, respectively. With an increase in TMP and temperature, it was observed that total hydraulic resistance, gel layer resistance and concentration polarization resistance were increased. Pressure was the most sensitive factor for prediction of both flux and total hydraulic resistance.

Keywords: Membrane; Simulation; Wastewater treatment; Hydraulic resistances

*Corresponding author.