

Development and comparison of non-parameter regression methods for prediction of cell voltage and current efficiency in a lab scale chlor-alkali membrane cell

N. Shojaikaveh, S.N. Ashrafizadeh*

Research Lab for Advanced Separation Processes, Department of Chemical Engineering, Iran University of Science and Technology, Narmak, Tehran 1684613114, Iran

Tel. +98 21 77240496; Fax +98 21 77240495; email: ashrafi@iust.ac.ir

Received 30 June 2009; Accepted 26 August 2009

ABSTRACT

This article presents the development and comparison of non-parameter regression methods such as artificial neural network (ANN), genetic algorithm optimization (GA) and support vector machine (SVM) models for the prediction of cell voltage and caustic current efficiency (CCE) vs. different operating parameters in a lab scale chlor-alkali membrane cell. In order to validate the model predictions, the effects of various operating parameters on the cell voltage and CCE of the membrane cell were experimentally investigated. Each of six process parameters including anolyte pH (2–5), operating temperature (25–90°C), electrolyte velocity (1.3–5.9 cm/s), brine concentration (200–300 g/L), current density (1–4 kA/m²), and run time (up to 150 min) were thoroughly studied. The new models yielded the accurate prediction of experimental data with the lowest standard deviation error (SD). It was found that the developed models are not only capable to predict the voltage and CCE but also to reflect the impacts of process parameters on the same functions. According to the obtained results, SVM model is suitable for the prediction of CCE with an average deviation of 1.53% while GA and ANN models are more accurate than SVM model for predicting the voltage with an AD of 1.21% and 1.27%, respectively.

Keywords: Chlor-alkali; Membrane cell; Electrolysis; Artificial neural network; Genetic algorithm; Support vector machine

* Corresponding author.