A statistical experimental design for the separation of zinc from aqueous solutions containing sodium chloride and n-butanol by micellar-enhanced ultrafiltration

Sz. Kertész, J. Landaburu-Aguirre, V. García, E. Pongrácz, C. Hodúr, R. L. Keiski

School of Environmental Sciences, University of Szeged, H-6720 Szeged, Dugonics tér 13, Hungary
Department of Process and Environmental Engineering, University of Oulu, Mass and Heat Transfer Process Laboratory, FI-90014 University of Oulu, P.O. Box 4300, Finland
Thule Institute, Centre of Northern Environmental Technology, FI-90014 University of Oulu, P.O. Box 7300, Finland
Department of Mechanical and Process Engineering, University of Szeged, H-6725 Szeged, Moszkvai krt 5-7, Hungary
e-mail: hodur@mk.u-szeged.hu

Received 15 September 2008; Accepted 18 August 2009

Abstract

This paper reports the removal of zinc from aqueous solutions containing n-butanol and sodium chloride by micellar-enhanced ultrafiltration using the anionic surfactant sodium dodecyl sulfate. Statistical experimental design was used to analyze the effect of initial concentration of zinc ions, n-butanol, sodium dodecyl sulfate and sodium chloride, transmembrane pressure and membrane nominal molecular weight limit on the process performance for screening purposes. The linear models developed for the estimation of the effects of the process parameters were excellent. Pressure and nominal molecular weight limit, and feed concentration of sodium dodecyl sulfate and sodium chloride were the main factors affecting the absolute permeate flux and rejection coefficient towards zinc removal, respectively. Zinc was successfully removed obtaining rejection coefficients up to 99% in the most favorable experimental conditions. On the contrary, no rejection of n-butanol was observed.

Keywords: Micellar-enhanced ultrafiltration; Screening fractional factorial design; Zinc; n-butanol; Electrolyte

* Corresponding author.