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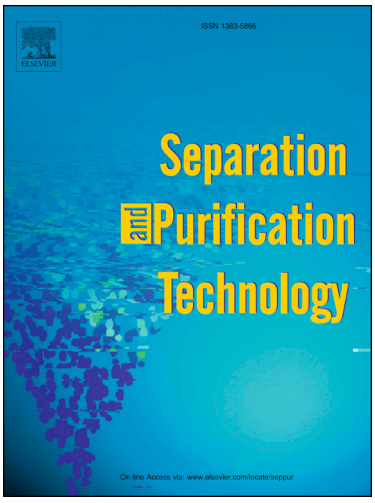

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Experimental simulation of continuous nanofiltration processes by means of a single module in batch mode

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Abstract

This work proposes a method of simulating the performance of continuous nanofiltration processes by means of experimental runs performed on a laboratory set-up equipped with a spiral-wound module working in batch recirculation mode. It describes how to implement the proper changes in feed concentration and operating conditions in a batch recirculated system in order to obtain similar conditions to those of a continuous one. The analogy between the concentration process in the continuous and in the batch recirculation system is discussed and the difference in ion concentration of the cumulative permeate between the two systems is estimated numerically.

The procedure was applied in a case study to estimate the performance of a continuous process intended to remove nitrate from brackish water using a high rejection nanofiltration membrane (Dow-Filmtec NF90). The sequence of concentration steps performed in the batch-recirculated set-up yielded an estimation of the ion concentration profiles throughout the continuous system. A mathematical analysis of the results showed that the nitrate concentration in the permeate experimentally obtained in the batch system is 4.5% higher than that expected in the continuous system.

The experimental method described here can be used to design membrane system applications for which the target ions are not accurately predicted by models or are not included in commercial software.

Keywords: nanofiltration; batch mode; continuous process; process design; NF90

1. Introduction

In recent years, the nanofiltration (NF) membrane process has been shown to be a feasible solution for different water treatments including groundwater, surface water and wastewater reclamation [1-4]. NF membranes are efficient at removing divalent salts and small organic matter at low operating pressures. In addition to this general purpose, NF has increasingly been used in many new interesting environmental applications such as the removal of arsenic and persistent organic pollutants, as well as in a membrane-integrated hybrid treatment systems for desalination [5-8].

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