Evolution of electrolyte mixtures rejection behaviour using nanofiltration membranes under spiral wound and flat-sheet configurations

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ABSTRACT

Nanofiltration (NF) membranes can be used in different configurations. The aim of this work was to determine the reliability of the data obtained using flat-sheet (FS) laboratory-scale configuration when NF membranes are implemented at industrial scale level using spiral wound (SW) configuration. Ion rejections in salt mixtures with the two configurations types were analysed, modelled, evaluated and compared. In both cases of the study, the operation was carried out in cross-flow mode and with recirculation of permeate and concentrate streams into the feed tank. Different feed synthetic salt solutions were used based on a dominant and a trace salt. In both cases, the operating temperature was kept constant (21.5 ± 2.5°C), and the trans-membrane pressure range varied from the osmotic pressure to 20 bar. The same NF membrane was used for both configurations: NF270 (Dow Chemical). The solution–diffusion–electromigration–film model was employed to describe the experimental results. Comparing both membrane configurations, the trans-membrane flux obtained with the FS configuration was higher than that observed with the SW configuration under the same operating conditions. In general, it is proved that ion rejection curves for both membrane configurations were fairly similar. Moreover, the membrane permeances with respect to each ion in both configurations were quantitatively similar.

Keywords: Nanofiltration; Flat-sheet membrane; Spiral wound membrane; Ion rejection; Salt mixtures

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