Desalination and Water Treatment
www.deswater.com
doi: 10.1080/19443994.2014.890550

54 (2015) 890–899
April

Taylor & Francis
Taylor & Francis Group

Rejection and adsorption behaviour of phytoestrogens by nanofiltration and reverse osmosis membranes

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Received 26 November 2013; Accepted 25 January 2014

ABSTRACT

This study investigated the rejection and adsorption behaviour of two phytoestrogens, genistein and formononetin, by a NF270 nanofiltration (NF) membrane and an ESPA2 reverse osmosis (RO) membrane. Filtration experiments were conducted using a cross-flow membrane system at three different feed solution pH values of 4, 7 and 11. Mass balance calculations indicated that adsorption of both phytoestrogens to the membranes occurred under all pH conditions. The rejection efficiency of the phytoestrogens by the ESPA2 membrane was considerably higher than for the NF270 membrane under all conditions. For the NF270 membrane, at pH 4 and 7, the rejection of phytoestrogens decreased dramatically over the first 4 h of operation and was relatively stable during the later stages of filtration, suggesting that size exclusion, adsorption and convection were the main rejection mechanisms for these compounds. By contrast, at pH 11, there was only a slight reduction in the rejection of these compounds with time and that electrostatic repulsion became the overriding rejection mechanism. Conversely, the phytoestrogen rejection by the ESPA2 membrane was relatively stable at all pH conditions, which could be attributed to size exclusion being the dominating rejection mechanism.

Keywords: Phytoestrogens; Nanofiltration; Reverse osmosis; Adsorption; Rejection mechanisms

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Presented at the 6th International Conference on the "Challenges in Environmental Science and Engineering" (CESE-2013), 29 October–2 November 2013, Daegu, Korea