Desalination and Water Treatment
www.deswater.com

39(2012)123–136
February

doi: 10/5004/dwt.2012.2965

Taylor & Francis
Taylor & Francis Group

Recent developments and future challenges of forward osmosis for desalination: a review

Jian-Jun Qin*, Winson Chee Loong Lay, Kiran Arun Kekre

Technology and Water Quality Office, Public Utilities Board, Singapore 82 Toh Guan Road East, #C4-03, Singapore 608575
Tel. +65 63262914; Fax: +65 63262929; email: Qin_Jianjun@pub.gov.sg

Received 15 May 2011; Accepted 9 August 2011

ABSTRACT

This article focuses on the recent developments of forward osmosis (FO) for desalination and the challenges it faced. Issues discussed include membrane, configuration, draw solution, integration with post-treatment, and energy and economic evaluation. In spite of the potential advantages of FO, there exist a number of technical barriers that impede FO's application for water desalination. Further membrane development is needed to give high water flux, low reverse solute flux and material stability over the operating pH range. It is currently not economically viable to use NaCl as the draw solute for municipal scale FO desalination in view of the solute loss through the membrane. Progress in post-treatment is also needed, because FO cannot stand as a single process, but has to be integrated with a post treatment to regenerate draw solution and produce desalinated water that meets the required standards. A FO–RO process is technically feasible, but economically unviable due to energy consideration. In order for FO to compete with the existing RO desalination technology, breakthrough is necessary in the three key areas of membrane development, selection of appropriate draw solution, and integration with a suitable post-treatment, and these need to be addressed based on a total system approach.

Keywords: Forward osmosis; Desalination; Draw solution; Post-treatment; Energy consumption; Product quality

*Corresponding author.