Salt recovery from brine generated by large-scale seawater desalination plants

Ghada Al Bazedi\textsuperscript{a}, Reem S. Ettouney\textsuperscript{b}, Shadia R. Tewfik\textsuperscript{a,\ast}, Mohamed H. Sorour\textsuperscript{a}, Mahmoud A. El-Rifai\textsuperscript{b}

\textsuperscript{a}Department of Chemical Engineering and Pilot Plant, National Research Center, Cairo, El-Tahrir St., Dokki, Giza, Egypt
Tel. +2 02 33389935; Fax: +2 02 33370931; email: shadiatewfik@yahoo.com
\textsuperscript{b}Chemical Engineering Department, Cairo University, Cairo, Egypt

Received 21 August 2012; Accepted 7 May 2013

ABSTRACT

Water shortages in the Middle East and North Africa (MENA) region countries mandate the installation of large-scale desalination plants. Concentrate management requires properly operated cost-effective technologies to reduce the environmental impacts arising from brine discharge. Significant improvement in economics may be obtained by the recovery of chemicals from brines. This study addresses the management of modular brine streams generated from large-scale reverse osmosis desalination plants with microfiltration and nanofiltration (NF) as pretreatment stages. Appropriate salt recovery schemes have been identified and analyzed from the performance and environmental points of view. The economics of salt recovery schemes from NF and reverse osmosis (RO) brine based on evaporation ponds, brine evaporator and membrane crystallizer (MCr) are analyzed and compared. Phased application of the salt recovery program is considered. The results indicate that using NF as pretreatment and adopting salt recovery schemes provide higher water recovery in addition to producing valuable products. The adoption of MCr has high prospects for application in salt recovery from desalination brine. Increasing the capacities of salt recovery systems offers both technical and economic merits.

Keywords: Salt recovery; Brine; Desalination; Membrane crystallizer; Evaporator; Techno-economics