Desalination and Water Treatment
www.deswater.com
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doi: 10.5004/dwt.2009.762

9 (2009) 131–135
September

Change of energy consumption through the adjustment of feed flow rate in RO membrane process

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Received 15 September 2008; Accepted 4 June 2009

ABSTRACT

The reverse osmosis (RO) process requires a large amount of energy for pressurizing feed flow, most of which is wasted through the brine stream. To recover the brine energy and deliver it to the feed, several methods using energy recovery devices (ERDs) have recently been used. However, the way to achieve efficient RO membrane process without ERD is also required in small RO desalination systems. In this work, the change of energy consumption upon the alteration of recovery ratio through the adjustment of feed flow rate was demonstrated. A variable frequency drive (VFD) was used to regulate feed flow rate. Permeate flux, recovery ratio, and salt rejection which are the key performance parameters of reverse osmosis were compared at the different feed flow rates, operating pressures, and feed temperatures. In addition, the power consumed in both high pressure (HP) pump and booster pump was measured and the specific energy consumption was compared. The control of feed flow rate reduced the specific energy consumption by 20%. Thus the adjustment of feed flow rate was effective to some extent in energy saving at a light cost of permeate volume and product water quality.

Keywords: Energy consumption; Feed flow rate; Specific energy; Reverse osmosis

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Presented at the Conference on Membranes in Drinking and Industrial Water Production, 20–24 October 2008, Toulouse, France.