

Water hammer simulation in spiral wound reverse osmosis membranes

S.A. Avlonitis*, D.A. Avlonitis, A. Baldoukas, K. Kralis, A. Metaxa

Laboratory of Quality Control, Operations Management and Process Engineering, Technological Institute (T.E.I.) of Chalkidas, 34400 Psaxna EVIA, Greece

Tel. +30 22280 99650; Fax +30 22280 99649; email: savlon@teihal.gr

Received 2 April 2009; Accepted 25 November 2009

ABSTRACT

The purpose of this work is the development of a mathematical model for the formation and the propagation velocity of water hammer in spiral wound reverse osmosis (RO) membranes. Unexpected shutdowns of the RO plants and failure of the check valves can cause water hammer formation and its propagation as a pressure wave inside the membrane envelope resulting in membrane destruction. The model is based on energy and mass balances at flow conditions inside the membrane envelope. The mathematical analysis results in explicit equations for the local permeate pressure in steady state conditions and the increase of pressure in unsteady situations. During the water hammer formation the permeate pressure may increase so as to cause damaging results to the RO membranes.

Keywords: Destruction of RO membranes; Water hammer; Flow in porous media

* Corresponding author.