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CFD simulation of a membrane distillation module channel

A. Cipollina[a]*, A. Di Miceli[a], J. Koschikowski[b], G. Micale[a], L. Rizzuti[a]

[a]*Dipartimento di Ingegneria Chimica dei Processi e dei Materiali, Universita` di Palermo, Viale delle Scienze, Ed.6, 90128 Palermo, Italy*
Tel. +39 091 238 66780; Fax +39 091 70 25020; email: cipollina@dicpm.unipa.it
[b]*Fraunhofer ISE, Heidenhofstr. 2, D-79110 Freiburg, Germany*

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ABSTRACT

The interest towards the use of membrane distillation (MD) processes for seawater desalination has been rising recently due to the ease of coupling MD with waste and/or solar thermal energy. Notwithstanding the flexibility of the process and its potential for further developments in membrane performances, one of the main drawbacks is the thermal efficiency reduction caused by temperature polarization. Because of such phenomenon, only a small amount of the driving force potentially available for the separation process, i.e. the temperature difference between evaporating and condensing fluids, is actually used for the separation. In order to reduce temperature polarization a study on the effects of spacer and channel geometry has been performed using computational fluid dynamics (CFD) techniques. A simple reference geometry has been built to simulate the flow and temperature fields of a portion of a spiral wound MD module channel. Results show how spacers can significantly affect temperature gradients within the channel, therefore modifying the effective driving force between the faces of the membrane. The main features, which an optimal spacer should possess, have been thus indicated.

Keywords: Membrane distillation; Computational fluid dynamics; Temperature polarization; Spiral wound channel; Spacer

* Corresponding author.

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