



Simulation of vacuum membrane distillation coupled with solar energy: Optimization of the geometric configuration of a helically coiled fiber

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ABSTRACT

This work focuses on solar energy coupled with vacuum membrane distillation (VMD) for brackish water desalination. VMD is an evaporative process, using porous and hydrophobic membranes, permit to obtain the gaseous permeate, under vacuum, from the aqueous liquid feed. The aim of this work was to simulate the influence of operating conditions (feed flow, feed temperature) and hollow fibers membrane characteristics (pitch and curvature radius) on the permeate flow rate. The model formulation takes into consideration the variation of the physical characteristics of brackish solution and the water permeability of membrane. We used in this case a membrane module, composed of hollow fiber wound in helically coiled shape and placed in the absorber of the parabolic trough concentrator. Two dimensional Navier–Stokes equations were written and were solved with the finite element method. For the pitch of 32.2 mm and the coil radius of 95.7 mm, the simulation results of the permeate product are 0.2685 kg/h and $7.688 \cdot 10^{-3}$ kg/s m² for the permeate flux.

Keywords: Desalination; Vacuum membrane desalination; Solar energy; Helical fiber

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