

Performance Investigation of the Solar Membrane Distillation Process Using TRNSYS Software

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Distillation Processes - From Solar and Membrane Distillation to Reactive Distillation Modelling, Simulation and Optimization

Abstract

Membrane distillation (MD) is a separation process used for water desalination, which operates at low pressures and feeds temperatures. Air gap membrane distillation (AGMD) is the new MD configuration for desalination where both the hot feed side and the cold permeate side are in indirect contact with the two membrane surfaces. The chapter presents a new approach for the numerical study to investigate various solar thermal systems of the MD process. The various MD solar systems are studied numerically using and including both flat plate collectors (the useful thermal energy reaches 3750 kJ/hr with a total area of 4 m²) and photovoltaic panels, each one has an area

of 1.6 m² by using an energy storage battery (12 V, 200 Ah). Therefore, the power load of solar AGMD systems is calculated and compared for the production of 100 L/day of distillate water. It was found that the developed system consumes less energy (1.2 kW) than other systems by percentage reaches 52.64% and with an average distillate water flow reaches 10 kg/h at the feed inlet temperature of AGMD module 52°C. Then, the developed system has been studied using TRNSYS and PVGIS programs on different days during the year in Ain Temouchent weather, Algeria.

Keywords

- solar desalination
- membrane distillation
- photovoltaic system
- solar-thermal system
- cooling system