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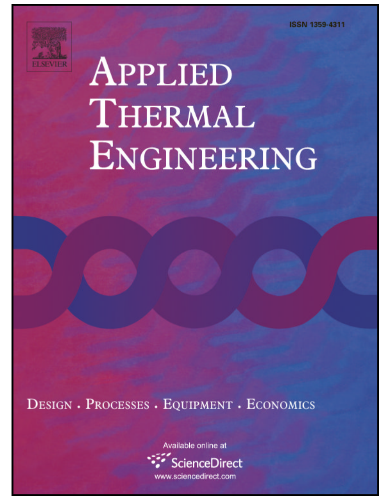

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Novel intermittent absorption cooling system based on membrane separation process

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Abstract

The present work analyses an intermittent absorption cooling system using a hydrophobic porous membrane unit as desorber/condenser and powered by thermal solar energy. Experimental test runs were carried out in a membrane unit to experimentally determine the amount of refrigerant produced at different operating temperatures. With the obtained information, an intermittent absorption cooling system was modelled at a larger scale using information from real solar collectors and considering a 1 m^2 membrane area. According to the experimental performance of the desorber/condenser unit, after 4 hours of operation, the total amount of refrigerant produced was 14.50, 11.59 and 7.20 kg for desorber temperatures of 95.1, 85.2 and 75.1 °C, respectively. The designed solar system was composed of a 0.3 m^3 storage thermal tank, and 30.2, 25.6 and 20.9 m^2 of solar collector area for each desorber thermal level. According to the simulation of the absorption cooling system, evaporator temperatures of 18 and 14°C were achieved for desorber temperatures of 75.1 and 85.2 °C, while evaporator temperatures of 17 and 12 °C were obtained at 95.1 °C. The COPs were 0.15, 0.21 and 0.26, which increased according to the increase in the desorber temperatures. Based on the clear desorber/condenser tendencies obtained from the refrigerant production, additional absorption conditions were calculated and may be useful for future designs. The lowest evaporator temperature was 6°C when the initial LiBr concentration was 54.83% w/w, instead of 50.30% w/w at a temperature of 95.1°C; however, the COP decreased 33%.

Keywords: Air Gap Membrane Distillation, water/LiBr mixture, absorption systems, thermal solar energy