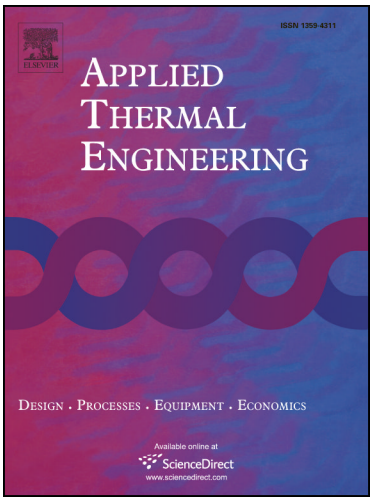

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Modeling and multi-objective optimization of a modified hybrid liquid desiccant heat pump (LD-HP) system for hot and humid regions

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Abstract

A hybrid liquid desiccant-heat pump (LD-HP) system for cooling in hot and humid regions is modeled and optimized in this paper. This hybrid LD-HP system contained dehumidifying and cooling sections. The whole system was modeled and analyzed in four energy, exergy, economic and environmental aspects. Then the system was optimized using multi-objective Genetic Algorithm (GA) method. With two objective functions (total annual cost and exergy efficiency) and eight system design parameters the optimum values of design parameters were estimated. Results for our case study showed that the proposed optimized LD-HP system decreased the electricity consumption for 33.2% in comparison with that for an electrical HP system during seven months of operation in a year (18.9% due to using desiccant dehumidifying system and 81.1% due to using a heat exchanger instead of an electrical heater). This amount of lower electricity consumption also provided 1.85×10^5 kg_{CO_2}/year lower CO2 production (33.2%) in comparison with that for a conventional HP system. The COP of LD-HP system at the optimum point was also about 4.83 (in comparison with 2.74 for the conventional case in which heat pump and electrical heater were used). Finally, added equipment to the traditional HP system (dehumidifier, regenerator, heat exchangers, pumps and fans) had 3.04 years payback period

Keywords: Hybrid liquid desiccant, Heat pump, Air-conditioning

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