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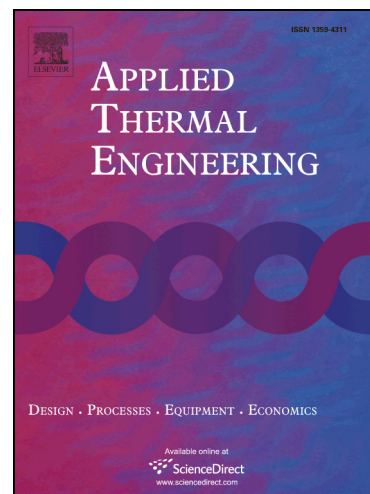
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Liquid Desiccant Air Conditioning System with Natural Convection

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Abstract

After introducing the concept of natural convection air dehumidifier system and establishing the feasibility of eliminating desiccant pump, this study aims to approve the application of natural liquid desiccant as an air conditioning system in real working conditions. The system consists of two heat/mass transfer modules: the absorber and the regenerator which are connected to constitute a closed loop. In each module hollow fiber membranes separate the air and desiccant streams. The liquid desiccant is aqueous solution of lithium chloride which is on the shell over the fiber surfaces and the air flows inside fiber lumens. The cold/hot water streams flow in the outer jackets of absorber/regenerator modules. The loop is redesigned to resolve the shortcomings of the previous design. The loop performance is studied experimentally under two inlet air conditions which resemble two climate conditions with relative humidity of 78% and 37% and temperature of 31.5 °C. The evaluation indexes of system such as moisture absorption rate, cooling capacity and coefficient of performance (COP) are presented. The results show that the loop can act as a natural convection liquid desiccant air conditioning system with electrical COP values of 3.95 and 4.56 for higher and lower humidity ratio air inlets respectively. Also, it is resulted that the system has better performance in higher humidity air inlet. It is observed that main electric power consumption of the system is required for supplying cold water stream and the performance of system could enhances remarkably if a free cold water supply is available.

Keywords: Hollow fiber membrane; Liquid desiccant; Lithium chloride; Mass transfer; Natural convection loop.

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