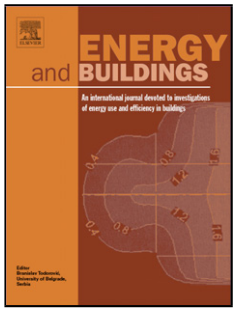

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Investigation of Liquid Desiccant Regenerator with Heat Recovery Heat Pipe System

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Abstract: To evaluate and compare the regenerator of Liquid Desiccant Dehumidification System (LDDS) without and with Heat Pipe Heat Exchanger (HPHE), this paper conducts performance analysis by hybrid heat transfer, mass transfer and heat recovery models, and the simulation results are then validated by the experimental results. 4 and 8 rows HPHE are compared to investigate the relationship between heat recovery rate and the additional fan energy consumption caused by the existence of HPHE. Effects of air mass flow rate on the regenerating and heat recovery performance are also discussed. The results show that the numerical computation is effective and accurate and the largest RE is only 10.87%. With heat recovery device, the regenerating performance is in general improved. The model predicted results reveal that the maximal net heat recovery ratios are 25% and 26.5% which contributes to 26.5% and 27% maximal energy saving for 4 and 8 rows, respectively, compared with regenerator without HPHE.

Key words: liquid desiccant dehumidification system; regenerator; heat recovery; heat pipe heat exchanger; numerical investigation; performance analysis.

1. Introduction

Humidity control is an important factor that related to Indoor Environment Quality (IEQ). The traditional cooling based air dehumidification systems have been proved to have several drawbacks, such as high energy consumption and breeding of mildew and bacteria. On the other hand, the liquid desiccant dehumidification system (LDDS) has been regarded as a viable alternative due to: (1) energy-saving by avoiding the occurrence of dew point condition in order to remove extra moisture; (2) energy-efficient by the potential replacement of the electricity with low-grade energy; and (3) high-quality of the supplied air by the bactericidal ability of the liquid desiccant solutions.

In LDDS, regenerator re-concentrates the desiccant solution which is diluted by absorbing the excess moisture in the dehumidifier. Majority of energy is consumed by regenerator in the system operation in order to keep a suitable regenerating rate [1]. To reduce the energy consumption, many research works have been conducted either experimentally or numerically to investigate the regenerator from different perspectives. The regeneration performance under different operating condition [2] and different

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