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EXPERIMENTAL DESIGN AND PERFORMANCE ANALYSIS OF A DESICCANT DEHUMIDIFICATION COLUMN UNDER CYCLIC OPERATING CONDITIONS

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Abstract

Sorption processes in packed beds are inherently transient and the maximum vapor removal occurs at the beginning of the adsorption cycle. Consequently, temperature swing adsorption (TSA), consisting of charging (adsorption) and regeneration (desorption), is required in order to frequently refresh the packed bed and provide sustainable dehumidification. In this study, the effectiveness of thin desiccant columns in controlling air humidity under periodic charge and regeneration cycles is analyzed. An experimental apparatus was designed to measure the rate of adsorption and desorption under different operating conditions. The TSA strategy is imposed by low and high temperature heat sources. Moreover, a numerical one-dimensional transient model is provided and validated by the experiments under different ambient conditions. Using this model, the effect of design factors such as cycle time, airflow, and regeneration temperature are investigated in order to optimize the performance of the desiccant dehumidifier.