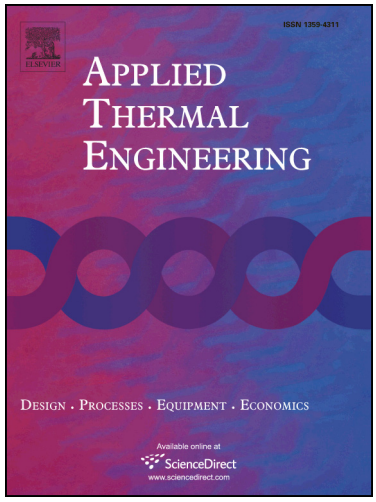

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Experimental Analysis of Hybrid and Conventional Air Conditioning Systems Working in Hot-Humid Climate

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Abstract

This paper reports the experimental performance characteristics of a hybrid air conditioning system consists of a conventional (vapor compression) system integrated with thin-multilayer activated alumina bed with single, double and triple-layers. The performance characteristics of both systems are investigated under hot very humid climate with fresh air mixing ratio from 40-100% that is replicated at various process air temperature (28-36^{o}C) and relative humidity (50-80%). The performance characteristics of hybrid and conventional evaporators and systems are compared under different conditions. Also, effect of desiccant cycle duration on hybrid system performance is investigated. The obtained results revealed that thin-multilayer alumina bed has substantial effect on hybrid system characteristics. Using the right desiccant layers, hybrid systems achieve better characteristics (smaller evaporator size system and compressor power with higher COP) than conventional system for all the mixing ratios. In the case of pure fresh air, the degree of superheat, pressure ratio and compressor power are lower than those for conventional system by 14.5, 2.0 and 2.7% with higher COP of hybrid system by 12.4%. Short cycle duration has higher sensible heat factor and lower evaporator size while long cycle duration has lower compressor power and higher COP.

Keywords:
Hybrid air conditioners; desiccant cooling; thin-multilayer desiccant; activated alumina; cycle duration; mixing ratio

1. Introduction

In hot-humid climate, the process air has excessive moisture, which presents the main problem for human comfort and the major load on air conditioning systems. Both desiccant and