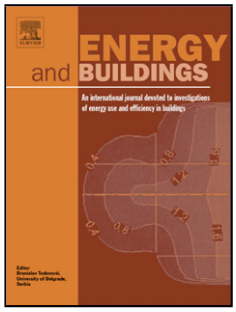

Title: Thermal performance assessment of a novel liquid desiccant-based evaporative cooling system: An experimental investigation

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<AT>Thermal performance assessment of a novel liquid desiccant-based evaporative cooling system:

An experimental investigation

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<ABS-HEAD>Highlights► DECS can provide an average of 5.3 ºC reduction in supply air temperature ► The dehumidification effectiveness of DECS is determined to be 63.7% ► For air velocity of 0.3 m/s, the COP of DECS is found to be 5.5 ► For air velocity of 0.5 m/s, the COP of DECS is found to be 4.8

<ABS-HEAD>Abstract

<ABS-P>Energy consumption in buildings due to heating, cooling and air conditioning (HVAC) systems has a steadily growing trend as a consequence of enhanced indoor thermal comfort conditions. The role of cooling in HVAC oriented energy consumption is remarkable especially in regions with extreme climatic conditions such as Africa and Middle East. In hot and arid climates, cooling demand is usually met by cost-effective evaporative cooling solutions. However, in hot and humid climates, evaporative cooling systems are not capable of providing cooling as the outdoor air is already almost saturated in most cases. Therefore in this research, a novel desiccant-based evaporative cooling system is presented. For different values of inlet supply air temperature and relative humidity provided by a standard environmental chamber, temperature and relative humidity values are measured experimentally at the inlet and outlet of dehumidification and humidification unit, respectively. Since the main purpose of the system developed is to provide cost-effective thermal comfort conditions especially in humid climates, dehumidification effectiveness is calculated for each case tested. The results indicate that the system provides attractive findings for temperate and humid climatic conditions, where stand-alone evaporative cooling systems are inconclusive. For a case of average inlet relative humidity of 94.7% and average inlet air temperature of 38.6 °C, the average outlet relative humidity and air temperature are determined to be 65.5% and 33.3 °C, respectively. An average of 5.3 °C reduction is achieved in supply air temperature as well as an average of 63.7% dehumidification effectiveness which is attractive and promising.

<KWD>Keywords: Dehumidification effectiveness; desiccant-based evaporative cooling; HVAC.

<H1>1. Introduction

Total world energy consumption has a steadily rising trend as a consequence of several key factors such as notable population growth, remarkable technological advancements and enhanced comfort demand of people in all fields of life [1]. Limited reserves of current fossil fuel based energy resources and growing importance of environmental issues due to fossil fuel consumption at global scale force developed countries to recheck their energy policies [2]. Clean energy generation and the techniques for its efficient use are in the centre of interest over the last four decades [3] to minimise the fossil fuel dependency of the world. Despite intensive efforts to narrow the gap between conventional energy resources and renewables, only about 14% of total world energy demand is met by renewable energy technologies at the moment [4]. In this respect, there is a consensus among scientists that research on energy management and