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Energy Saving Potential of a Desiccant-Based Indirect-Direct Evaporative Cooling System

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Abstract : Evaporative cooling systems are known as energy efficient cooling systems, with much lower electricity consumption than conventional vapor compression systems. A serious limitation of these systems, however, is that they are not applicable in humid regions. Combining a desiccant wheel with these systems, known as desiccant-based evaporative cooling systems, makes it possible to use evaporative cooling in humid climates. This paper evaluates the performane of a cooling system combining desiccant wheel, direct and indirect evaporative coolers (called desiccant-based indirect-direct evaporative cooling (DIDE) system) and then evaluates the energy saving potential of this system over the conventional vapor compression cooling and drying system. To illustrate the system ability of providing comfort conditions, a dynamic hourly simulation of this system is performed for a typical 60 m^2 building in Sydney, Australia. To evaluate the energy saving potential of this system, a conventional cooling and drying system is also simulated for the same cooling capacity. It has been found that the DIE system is able to provide comfort temperature and relative humidity in a subtropical humid climate like Sydney. The electricity and natural gas consumption of this system are respectively 39.2% and 2.6% lower than that of conventional system over a week. As the research has demonstrated, the innovative DIDE system is an energy efficient cooling system for subtropical humid regions.

Keywords : desiccant, evaporative cooling, dehumidification, indirect evaporative cooler
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