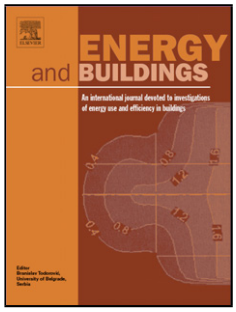

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New perspectives in solid desiccant cooling for hot and humid regions

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Highlights

> Desiccant cooling system (DCS) could function without regeneration heat.
> DCS should operate desiccant wheel at high speed without regeneration heat.
> DCS should operate desiccant wheel at low speed with regeneration heat.
> COP was found decreased with regeneration temperature T_{ra}.
> DCS would function worse than that without regeneration heat if T_{ra} > 60 °C.

Abstract

In this study, new perspectives in the desiccant cooling system (DCS) have been derived, which are helpful to achieve an energy-efficient design through the heat-driven cooling equipment. Under the circumstances of handling the ventilation load in the hot and humid regions, it was found that the DCS could provide tangible cooling capacity both with and without the regeneration heat. In the absence of regeneration heat, the DCS was preferable to have solid desiccant wheel operated at a high rotational speed together with a sensible heat exchanger. In the presence of regeneration heat, the DCS should operate the desiccant wheel at a low speed, with a sensible heat exchanger and a regenerative air evaporative cooler. The coefficient of performance was found decreased with the regeneration temperature in such scenario. It was also identified that the regeneration temperature should be higher than 60 °C, otherwise the DCS would function even worse than that without regeneration heat. This imposed a limitation of low-grade renewable or waste heat sources for DCS application. In fact, it would be more energy-efficient if the low-grade