

Application of Solar Energy for Recovery of Water from Atmospheric Air in Climatic Zones of Saudi Arabia

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ABSTRACT

In the present work, an investigation on the application of solar energy to heat a sandy bed impregnated with calcium chloride for recovery of water from atmospheric air is presented. The study also aimed at evaluating the effects of different parameters on the productivity of the system during regeneration. These parameters include system design characteristics and the climatic conditions. An experimental unit has been designed and installed for this purpose in climatic conditions of Taif area, Saudi Arabia. The experimental unit which has a surface area of 0.5 m², comprises a solar/desiccant collector unit containing sandy bed impregnated with calcium chloride. The sandy layer impregnated with desiccant is subjected to ambient atmosphere to absorb water vapor in the night. During the sunshine period, the layer is covered with glass layer where desiccant is regenerated and water vapor is condensed on the glass surface. Ambient temperature, bed temperature and temperature of glass surface are recorded. Also, the productivity of the system has been evaluated. Desiccant concentration at start of regeneration is selected on the basis of the climatic data of Al-Hada region, which is located at Taif area, Saudi Arabia. Experimental measurements show that about 1.0 liter per m² of pure water can be regenerated from the desiccant bed at the climatic conditions of Taif. Liquid desiccant with initial concentration of 30% can be regenerated to a final concentration of about 44%. Desiccant concentration at start of regeneration is selected on the basis of the climatic data of Al-Hada region. The climate of Taif city is dry compared with that for Al-Hada region. This method for extracting water from atmospheric air is more suitable for Al-Hada region especially in the fall and winter.

KEYWORDS

Extraction, Atmospheric Air, Absorption, Liquid Desiccant, Solar Energy, Dew Collection, Regeneration

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