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Sustainable Development of Adsorption Solar Cooling Machine

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Abstract : Solar radiation is by far the largest and the most world's abundant, clean and permanent energy source. The amount of solar radiation intercepted by the Earth is much higher than annual global energy use. The energy available from the sun is greater than about 5200 times the global world's need in 2006. In recent years, many promising technologies have been developed to harness the sun's energy. These technologies help in environmental protection, economizing energy, and sustainable development, which are the major issues of the world in the 21st century. One of these important technologies is the solar cooling systems that make use of either absorption or adsorption technologies. The solar adsorption cooling systems are a good alternative since they operate with environmentally benign refrigerants that are natural, free from CFCs, and therefore they have a zero ozone depleting potential (ODP). A numerical analysis of thermal and solar performances of an adsorption solar refrigerating system using different adsorbent/adsorbate pairs, such as activated carbon AC35 and activated carbon BPL/Ammoniac; is undertaken in this study. The modeling of the adsorption cooling machine requires the resolution of the equation describing the energy and mass transfer in the tubular adsorber, that is the most important component of the machine. The Wilson and Dubinin- Astakhov models of the solid-adsorbat equilibrium are used to calculate the adsorbed quantity. The porous medium is contained in the annular space, and the adsorber is heated by solar energy. Effect of key parameters on the adsorbed quantity and on the thermal and solar performances are analysed and discussed. The performances of the system that depends on the incident global irradiance during a whole day depends on the weather conditions: the condenser temperature and the evaporator temperature. The AC35/methanol pair is the best pair comparing to the BPL/Ammoniac in terms of system performances.

Keywords : activated carbon-methanol pair, activated carbon-ammoniac pair, adsorption, performance coefficients, numerical analysis, solar cooling system
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