

Performance of a dual-purpose solar continuous adsorption system.

ABSTRACT

A conceptual design and performance of a dual-purpose solar continuous adsorption system for domestic refrigeration and water heating is described. Malaysian activated carbon and methanol are used as the adsorbent–adsorbate pair. The heat rejected by the adsorber beds and condensers during the cooling process of the refrigeration part is recovered and used to heat water for the purpose of domestic consumption. In a continuous 24-h cycle, 16.9 MJ/day of heat can be recovered for heating of water in the storage tanks. In the single-purpose intermittent solar adsorption system, this heat is wasted. The total energy input to the dual-purpose system during a 24-h operation is 61.2 MJ/day and the total energy output is 50 MJ/day. The latter is made up of 44.7 MJ/day for water heating and 5.3 MJ/day for ice making. The amount of ice that can be produced is 12 kg/day. Using typical value for the efficiency of evacuated tube collector of water heating system of 65%, the following coefficient of performances (COP's) are obtained: 44% for adsorption refrigeration cycle, 73% for dual-purpose solar water heater, 9.1% for dualpurpose solar adsorption refrigeration and 82.1% for dual-purpose of both solar water heater and refrigerator.

Keyword: Solar thermal; Adsorption; Activated carbon-methanol pair; Continuous cycle; Dual system of refrigeration; Water heating.