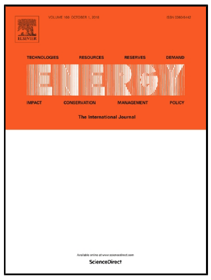
Accepted Manuscript



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PII:	S0360-5442(18)31844-9
DOI:	10.1016/j.energy.2018.09.080
Reference:	EGY 13774
To appear in:	*Energy*
Received Date:	21 April 2018
Accepted Date:	11 September 2018

Please cite this article as: Ji Wang, Eric Hu, Antoni Blazewicz, Akram W. Ezzat, Simulation of accumulated performance of a solar thermal powered adsorption refrigeration system with daily climate conditions, *Energy* (2018), doi: 10.1016/j.energy.2018.09.080

Simulation of accumulated performance of a solar thermal powered adsorption refrigeration system with daily climate conditions

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Abstract
Accumulated performance of an activated carbon/methanol adsorption refrigeration system driven by solar thermal energy, has been studied under various climate conditions. The previous studies mainly focus on the individual daily cycle with the assumption that the system restores back to its original point every day, regardless of a real climate condition. In reality, for such a refrigeration system, its daily performance would depend not only on the current day's weather conditions, but also on the previous day's situation, i.e. the current day cycle starts from where the previous day cycle ends, which is not necessarily the starting point of the previous day. There might be some leftover liquid at the end of a particular day, depending on the weather conditions during the night. A new configuration, which can accumulate the cooling capacity without removing ice daily, has been established. Possible cycles of such a system have been identified with consideration of realistic daily climate conditions. A desktop case-study was conducted to demonstrate the difference in the simulation of accumulated performance by two models, with the ideal assumption and real daily weather data respectively. The ice-making performance and COPs simulated by two models have been compared and evaluated in this study.

Key words: Accumulated performance; Adsorption refrigeration; Activated carbon/methanol; Daily climate conditions;

Nomenclature

x	concentration of adsorbate in adsorbent, kg/kg	*carbon*	activated carbon
T	temperature, K	*ice*	accumulated ice
ΔT	temperature variation, K	*cooling*	cooling capacity
P	pressure, bar	*methanol*	methanol liquid
m	mass, kg	*left*	leftover methanol liquid
H	heat of adsorption, kJ/kg K	*metal*	metal of the container
Cp	specific heat, kJ/kg K	*collector*	solar collector
Q	heat source, kJ/m^2	*exposure*	solar exposure
q	heat source for 1 kg carbon, $kJ/m^2/kg_{carbon}$	*12*	process from state 1 to state 2
D	coefficient of D-A equation	*34*	process from state 3 to state 4
n	coefficient of D-A equation	*41*	process from state 4 to state 1
L	latent heat of evaporation, kJ/kg	*sat*	saturation
A	surface area of a solar collector, m^2	*des*	desorption
Greek symbol		*w*	water
η	overall efficiency of a solar collector	*ini*	initial condition
Subscripts		*i*	on day i
c	condensing	*used*	used heat
ev	evaporating		
1 1' 1'' 2 2' 2'' 2''' 2'''' 2''''' 3 3' 3'' 3''' 3'''' 3''''' 4 4'		status of relevant processes	

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