Accepted Manuscript

Title: Exergy analysis of a liquid desiccant evaporative cooling system

Author: Donggen Peng, Junming Zhou, Danting Luo

PII: S0140-7007(17)30255-4
DOI: http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.06.021
Reference: JIJR 3686

To appear in: *International Journal of Refrigeration*

Received date: 11-12-2016
Revised date: 10-6-2017
Accepted date: 13-6-2017

Exergy analysis of a liquid desiccant evaporative cooling system

Donggen Peng, Junming Zhou*, Danting Luo

(School of Architectural Engineering, Nanchang university, Jiangxi, China)

Highlights

- The dead state is chosen to guarantee the uniqueness in liquid desiccant evaporative cooling system.
- The influence of various parameters on the exergy analysis of the system was analyzed.
- The optimal range of the influence parameters of the system is obtained, and the result of the study can guide the operation operation of the system.
- Exergy efficiency indicates the direction of system improvement.

Abstract: In this paper, a model of liquid desiccant evaporative cooling system is presented and simulated. The objective of this paper is to reveal the effects of various parameters on thermodynamic performance and to show the optimal range of those parameters. These results show that the system performance is strongly influenced by the hot water temperature, the flow ratio of air to solution and ambient air relative humidity, followed by the hot water flow rate. And the optimal range of each influencing factor is determined as follows: hot water temperature and the value of m_a / m_s are adopted about 75℃ and 1kg·kg^{-1} respectively, while hot water flow rate will not be greater than 0.6kg·s^{-1} and the range of the relative humidity of the atmosphere is wide. The analysis of the exergy efficiency ratio shows that the regenerator(REG), dehumidifier(DEH) and the enthalpy exchanger(EX) in the system are the weak parts of the system.

Keywords: Liquid desiccant, Evaporative cooling, Exergy analysis, Exergy efficiency

Nomenclature

A	Area(m^2)	Greek letter	
C_p	specific heat at constant pressure(kJ·(kg·k)$^{-1}$)	α	heat transfer coefficient (kW·(m^2·K)$^{-1}$)
d	humidity ratio(kg·kg^{-1})	α_m	mass transfer coefficient (kg·(m^2· s)$^{-1}$)
Ex	Exergy(kW)	ρ	density (kg·m^{-3})
h	specific enthalpy(kJ·kg^{-1})	μ	chemical potential (kJ·kg^{-1})
Le	Lewis number	φ	Relative humidity
m	mass flow rate (kg·s^{-1})	ζ	Thermal coefficient
NTU	number of transfer unit	η	effectiveness
P_s	Solution surface water vapor partial pressure	γ	exergy efficiency ratio