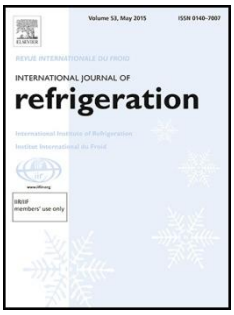
Accepted Manuscript



Title: Mathematical model and performance analysis of a novel outside evaporative cooling liquid desiccant dehumidifier

Author: Donggen Peng, Xiaosong Cheng, Shuangling Li, Xiaosong Zhang, Danting Luo

PII: S0140-7007(17)30262-1
DOI: http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.06.028
Reference: JIJR 3693

To appear in: *International Journal of Refrigeration*

Received date: 11-4-2017
Revised date: 13-6-2017
Accepted date: 23-6-2017

Please cite this article as: Donggen Peng, Xiaosong Cheng, Shuangling Li, Xiaosong Zhang, Danting Luo, Mathematical model and performance analysis of a novel outside evaporative cooling liquid desiccant dehumidifier, *International Journal of Refrigeration* (2017), http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.06.028.

Mathematical model and performance analysis of a novel outside evaporative cooling liquid desiccant dehumidifier

Donggen Peng[a,*], Xiaosong Cheng[a], Shuangling Li[a], Xiaosong Zhang[b], Danting Luo[a]

[a.] School of Civil Engineering and Architecture, Nanchang University, Nanchang 330031, China

[b.] School of Energy and Environment, Southeast University, Nanjing 210096, China

Highlights:

1. A novel outside evaporative cooling liquid desiccant dehumidifier was introduced.
2. The dehumidification rates of novel dehumidifier far outweigh adiabatic dehumidifier.
3. The mass flow rate of evaporative cooling air has an optimum value.
4. The optimum mass flow rate of LiCl solution is about 40kg/h.

Abstract: A numerical model of a novel outside evaporative cooling liquid desiccant dehumidifier (OECD) was developed and the effects of inlet parameters, including the inlet temperature and relative humidity of dehumidified air and evaporative cooling (EC) air as well as the inlet mass flow rate of solution and so on, on the device performances were investigated in this paper. The results show that as the inlet temperature of solution increased from 31 to 42ºC, the moisture removal rates of OECD were increased by 14.0%～18.0% and 31.1%～101.5% compared to the non-evaporative cooling dehumidifier (NECD) and the adiabatic dehumidifier respectively. Whereas the dehumidification rate was only decreased by about 1.6% with increase in the inlet temperature of LiCl solution from 24 to 44℃. All these results can provide guidance for the structural design and performance analysis of the dehumidifier in the future.

Key words:outside evaporative; liquid desiccant; dehumidifier; mathematical model; dehumidification rate

Nomenclature

A_i total tube surface area，m^2

A_f fin surface area，m^2

A_o total outside surface area(include fin surface area)，m^2

A_r fin root area，m^2

B standard atmospheric pressure，Pa

*Corresponding author. Tel.:+86079183969531;fax:+86079183969531.
E-mail address: ncu_hvac2013@163.com