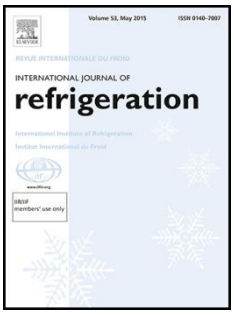
Accepted Manuscript



Title: Shell side direct expansion evaporation of ammonia on a plain tube bundle with inlet quality effect in the presence of exit superheat

Author: Ahmad Abbas, Zahid H. Ayub, Adnan H. Ayub, Javed A. Chattha

PII: S0140-7007(17)30231-1
DOI: http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.05.031
Reference: JIJR 3662

To appear in: *International Journal of Refrigeration*

Received date: 19-3-2017
Revised date: 29-5-2017
Accepted date: 31-5-2017

Please cite this article as: Ahmad Abbas, Zahid H. Ayub, Adnan H. Ayub, Javed A. Chattha, Shell side direct expansion evaporation of ammonia on a plain tube bundle with inlet quality effect in the presence of exit superheat, *International Journal of Refrigeration* (2017), http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.05.031.

Shell side direct expansion evaporation of ammonia on a plain tube bundle with inlet quality effect in the presence of exit superheat

Ahmad Abbas[1], Zahid H. Ayub[2*], Adnan H. Ayub[2] and Javed A. Chattha[1]

[1]Natural Fluids Refrigeration Center, Faculty of Mechanical Engineering, GIK Institute of Engineering Sciences and Technology, Topi, Pakistan

[2]Isotherm, Inc., 7401 Commercial Blvd. E., Arlington, Texas, USA

*email: zahid@is-therm.com telephone: +1-817-472-9922 fax: +1-817-472-5878

Highlights:

- Direct expansion of ammonia on shell side of a shell and tube evaporator.
- Reduced charge compared to conventional flooded or spray evaporator.
- Inlet quality effect in the presence of exit superheat
- Correlation developed with inlet quality effect in the presence of superheat.

Abstract

In the present study, tests were performed to investigate the direct expansion evaporation characteristics of ammonia on shell side of triangular pitch plain tube bundle at saturation temperature of -1.7 ºC and -20ºC, with heat flux ranging from 5 to 45 kW m^{-2}, and inlet quality from 0 to 30% with exit degree of superheat ranging from 2 to 10ºC. The results suggest that heat transfer coefficient increases with both saturation temperature and heat flux and decreases with degree of exit superheat. The inlet quality effects were more significant at higher saturation temperature than at lower saturation temperature. A correlation was developed for outside boiling of ammonia on plain tube bundle in direct expansion mode with inlet vapor quality and compared with previous pool boiling and bundle correlations with ammonia as a refrigerant.

Keywords: Boiling, ammonia, refrigeration, inlet quality, direct expansion, superheat, shell and tube