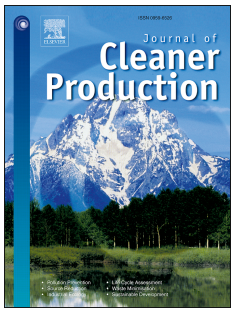
Accepted Manuscript



A thermo-economic analysis of a combined cooling system for air conditioning and low to medium temperature refrigeration

Kasra Mohammadi, Jon G. McGowan

PII: S0959-6526(18)32827-0

DOI: 10.1016/j.jclepro.2018.09.107

Reference: JCLP 14242

To appear in: *Journal of Cleaner Production*

Received Date: 12 March 2018

Revised Date: 10 September 2018

Accepted Date: 12 September 2018

Please cite this article as: Mohammadi K, McGowan JG, A thermo-economic analysis of a combined cooling system for air conditioning and low to medium temperature refrigeration, *Journal of Cleaner Production* (2018), doi: https://doi.org/10.1016/j.jclepro.2018.09.107.

A thermo-economic analysis of a combined cooling system for air conditioning and low to medium temperature refrigeration

Kasra Mohammadi* and Jon G. McGowan

Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, Massachusetts 01003, USA

*Corresponding author email address: kmohammadi@umass.edu

ABSTRACT

This work investigates an integrated dual temperature system for combined air conditioning and low to medium temperature refrigeration applications (−40 °C to −10 °C). The system combines a steam driven parallel flow triple effect H_2O–LiBr absorption cooling cycle with a CO_2 refrigeration cycle. In this integrated system, the generated cooling effect by the H_2O–LiBr absorption cycle is utilized in two different evaporators connected in series: the first evaporator as a heat sink or condenser for the CO_2 refrigeration cycle, and the second evaporator as a regular evaporator for the absorption cycle. The system performance was evaluated from thermodynamic and economic viewpoints, and also detailed parametric studies were conducted. The integration of cycles assisted to significantly decrease the power requirements and annual operating cost of the CO_2 refrigeration cycle as well as to increase its coefficient of performance. On the other hand, integration required a larger size absorption cooling cycle with a higher steam requirement, leading to an increase of the total capital cost and annual operating cost as well as a decrease of coefficient of performance of the absorption cycle. The economic analysis showed that integration causes a significant reduction in the annual operating cost and the unit production cost compared to the separate construction of both cycles. For the specified design and operating conditions, the annual operating cost and unit production cost of the integrated system reduced between 35.5% to 48.5% as well as between 23.4% and 34.5%, respectively.

Keywords: Combined system, CO_2 refrigeration system, Economic evaluation, Thermodynamic analysis, Triple effect absorption chiller, Unit production cost.