Exergy analysis of a solar-assisted MED desalination experimental unit

Luopeng Yang, Tao Shen, Bo Zhang*, Shengqiang Shen, Kun Zhang

Key Laboratory for Sea Water Desalination of Liaoning Province, School of Energy and Power Engineering, Dalian University of Technology, Dalian 116024, China
Tel. +0086 411 84 70 79 63; email: zhangbo@dlut.edu.cn

Received 5 March 2012; Accepted 18 July 2012

ABSTRACT

A five-effect distillation desalination experimental unit thermally assisted by a flat plate solar collector is thermo-economically investigated. The exergy-based methodology is used to identify the specific contributions of any sub-process to the overall exergy destruction under a series of different operating conditions. The integration of the solar heat collectors using the heating carrier medium of hot water with multi-effect distillation (MED) is an effective combination for solar desalination. The calculation results reveal that the exergy efficiency in individual MED effects is as high as the design of MED contributes to reducing the exergy destruction in pre-heaters. Reasonably reducing heat transfer temperature difference would serve as a priority for an efficient design. Appropriately increasing heating steam temperature, which will extend the total evaporation range, would be a possible way to improve the systematic efficiency due to lowering the dominant exergy destruction of evaporation process in evaporators.

Keywords: Multi-effect distillation; Exergy efficiency; Exergy destruction; Desalination

*Corresponding author.

Presented at the International Conference on Desalination for the Environment, Clean Water and Energy, European Desalination Society, 23–26 April 2012, Barcelona, Spain