

Rigorous steady state modeling of MSF–BR desalination system

Fuad N. Alasfour*, Hassan K. Abdulrahim

*Kuwait University, College of Engineering and Petroleum, Mechanical Engineering Department, P.O. Box 5969 Safat 13060, Kuwait
Tel. +965 481-1188 ext. 5799; Fax +965 484-7131; email: alasfour@kuc01.kuniv.edu.kw, ahassan@kuc01.kuniv.edu.kw*

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ABSTRACT

The aim of this paper is to model and simulate a multistage flashing with brine recirculation (MSF–BR) desalination system. A rigorous steady state mathematical model was formulated and implemented using process simulation software IPSEpro®. To enable detailed simulation of the processes, the flashing stage was decomposed into three main components; flashing pool, distillate tray and tube bundle. The model considered thermo-physical properties as a function of temperature and salinity, in addition, the stream enthalpy was used in the model instead of the specific heat to account for the effect of infinitesimal changes in temperature. The energy losses from the flashing stage and the brine heater were taken into consideration. The overall heat transfer coefficient was evaluated at each stage using convective heat transfer coefficient for internal and external flows, beside thermal and fouling resistance. The variation in tube thermal conductivity with temperature was also considered in the heat transfer analysis. The developed model was used to predict the performance of MSF–BR processes in the light of first and second law of thermodynamics. The computational results obtained in this research were verified and validated against the actual data at MSF–BR Azzour South Plant in Kuwait. Results showed good agreement between the computational results and actual plant data.

Keywords: MSF–BR; Steady state; Modeling; First and second law; Desalination

* Corresponding author.