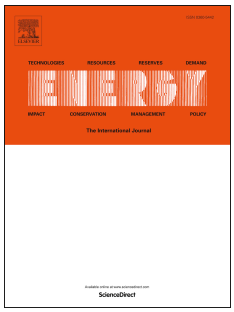
Accepted Manuscript



Thermodynamic analysis of a packed bed latent heat thermal storage system simulated by an effective packed bed model

R. Pakrouh, M.J. Hosseini, A.A. Ranjbar, R. Bahrampoury

PII: S0360-5442(17)31433-0

DOI: 10.1016/j.energy.2017.08.055

Reference: EGY 11424

To appear in: *Energy*

Please cite this article as: R.Pakrouh, M.J.Hosseini, A.A.Ranjbar, R.Bahrampoury, Thermodynamic analysis of a packed bed latent heat thermal storage system simulated by an effective packed bed model, *Energy* (2017), doi: 10.1016/j.energy.2017.08.054

Thermodynamic analysis of a packed bed latent heat thermal storage system simulated by an effective packed bed model

R. Pakrouh[a], M.J. Hosseini[b,*], A.A. Ranjbar[a], R. Bahrampoury[c]

[a] School of Mechanical Engineering, Babol University of Technology, POB 484, Babol, Iran

[b] Department of Mechanical Engineering, Golestan University, P. O. Box 155, Gorgan, Iran

[c] Department of Mechanical Engineering, K.N.Toosi University of Technology, Tehran, Iran

Abstract

The present paper numerically investigates the performance of latent heat storage systems during solidification, which involves phase change material (PCM) capsules. Paraffin wax is considered as the PCM and water plays the role of heat transfer fluid (HTF). The simulation is conducted for two inlet temperatures, 30 °C and 40 °C, while the capsules' diameter varies in the range of 10 mm to 60 mm. Among various existing models, the effective packed bed model which is not only able to provide temperature gradient data but also is capable of reporting entropy generation details. Results indicated that both reduction in capsules' diameter and the HTF inlet temperature unfavorably increase the amount of the system's irreversibility. However, it is demonstrated that the increase in the irreversibility does not essentially result in a reduction in performance of the latent heat storage system. In other words, the efficiency of the storage system is not a pure function of entropy generation number. In fact, the reduction in the diameter results in an improve in the second low efficiency while the inlet temperature reduction diminishes the efficiency. Results also implies that decisive parameters vary significantly only when the diameter reduces to 20 mm and further reduction doesn't affect the system performance noticeably.

Keywords: PCM, Entropy generation, Exergy analysis, Packed bed storage

[*]Corresponding Author: (Seiyed Mohammad Javad Hosseini) Department of Mechanical Engineering, Golestan University, P.O. Box 155, Gorgan, Iran. Tel/Fax: +98 17 32440206, Email: Mj.hosseini@gu.ac.ir