

Accepted Manuscript

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PII: S0167-7322(17)30418-X
DOI: doi: [10.1016/j.molliq.2017.03.096](https://doi.org/10.1016/j.molliq.2017.03.096)
Reference: MOLLIQ 7131
To appear in: *Journal of Molecular Liquids*
Received date: 3 February 2017
Revised date: 19 March 2017
Accepted date: 26 March 2017

Please cite this article as: Alibakhsh Kasaeian, Reza Daneshazarian, Fathollah Pourfayaz, Comparative study of different nanofluids applied in a trough collector with glass-glass absorber tube. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Molliq(2017), doi: [10.1016/j.molliq.2017.03.096](https://doi.org/10.1016/j.molliq.2017.03.096)

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Comparative study of different nanofluids applied in a trough collector with glass-glass absorber tube

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Abstract

New forms of solar collectors are presented as direct absorption solar collectors which have higher performance versus the conventional solar collector. In this work, parabolic trough collector is utilized with three different receivers: a bare glass tube, non-evacuated glass-glass tube, and a vacuumed absorber tube. Nanofluids including 0.2% and 0.3% silica and carbon nanotubes in ethylene glycol as base-fluid are used as working fluid. The outlet temperature and thermal efficiency for five types of working fluids are investigated. The results show that carbon nanotubes have higher temperature and efficiency which are equal to 74.9% and 338.3 K in the vacuumed glass-glass absorber tube. Also, the results indicate that the efficiency of the vacuumed glass-glass tube is averagely 20% higher than bare glass tube. An optimum volume fraction should be achieved due to the agglomeration of the nanoparticles. The optimum point has the volume fraction and thermal efficiency for carbon nanotubes are 0.5, and 80.7%, respectively, and for nanosilica are 0.4 and 70.9%, respectively.

Keywords: Direct absorption; nanofluid; thermal efficiency; trough collector.

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