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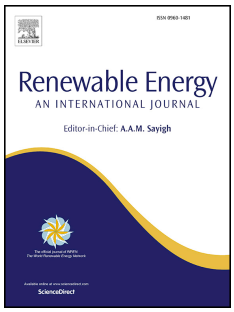

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J. Subramani, P.K. Nagarajan, Omid Mahian, Ravishankar Sathyamurthy

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Efficiency and heat transfer improvements in a parabolic trough solar collector using TiO_2 nanofluids under turbulent flow regime

J.Subramani[a], P.K.Nagarajan[a]*, Omid Mahian[b], Ravishankar Sathyamurthy[a]

[a]Department of Mechanical Engineering, S.A.Engineering College, Chennai, Tamil Nadu,Affiliated to Anna University, India. Pin-600 077

[b]Department of Mechanical Engineering, Engineering Faculty, Ferdowsi University of Mashhad, Mashhad, Iran

** Corresponding author. Tel.:+91-9789815744; Fax: +91-44-26801899*

E-mail: pknagarajan@saec.ac.in, krishnaga77@gmail.com

ABSTRACT:

The efficiency of a parabolic trough solar collector (PTSC) was enhanced by using TiO_2/DI-H_2O (De-Ionized water) nanofluid. Test samples consisting of nanofluids with concentrations of 0.05%, 0.1%, 0.2%, and 0.5% were compared with deionized water (the base fluid) at different flow rates under turbulent flow regimes ($2950 \leq Re \leq 8142$). All the experiments were conducted to meet ASHRAE 93(2010) standards. Heat transfer and the flow characteristics of nanofluids through the collector were studied, and empirical correlations were developed in terms of the Nusselt number, friction factor, and performance index. The convective heat transfer coefficient was improved up to 22.76% by using TiO_2 nanofluids instead of the base fluid. It was found that TiO_2 nanofluid with a volume concentration of 0.2% (at a mass flow rate of 0.0667 kg/s) can provide the maximum efficiency enhancement in the PTSC (8.66% higher than the water-based collector). Consequently, the absorbed energy parameter was found to be 9.5% greater than that of the base fluid.

- *Keywords: Parabolic trough collector, nanofluid, titanium oxide, collector efficiency.*

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