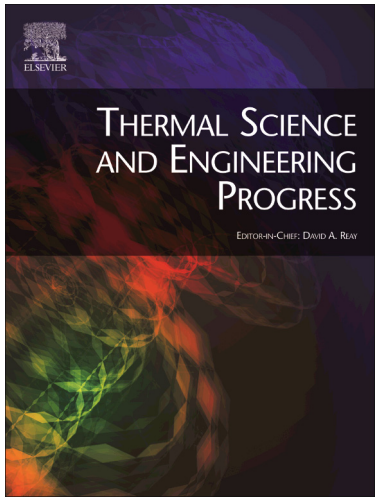


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# Parametric investigation of nanofluids utilization in parabolic trough collectors

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**Abstract**

The objective of this study is to investigate the use of nanofluids in parabolic trough collectors for various cases. The two most usual nanoparticles ($Al_2O_3$ and CuO) are examined in the usual thermal oil Syltherm 800. A detailed thermal model is developed in EES (Engineering Equator Solver) and its results are validated with experimental results from the literature. In the first part of the analysis, the Eurotrough ET-150 module is examined for various inlet temperature levels (25 $^oC$ to 325$^oC$) for the three examined working fluids. The results prove that both nanofluids are more efficient than the Syltherm 800, with Syltherm 800/CuO to be the best choice. The heat transfer enhancement with the use of nanofluids is proved to be approximately to 50% and this enhancement is greater at higher temperature levels. In the parametric analysis part, the mean thermal efficiency enhancement is determined for various combinations of flow rates and concentration ratios for both nanofluids. The use of CuO is able to increase the thermal efficiency up to 1.26% and the use of $Al_2O_3$ up to 1.13% when the concentration ratio is maximized and the flow rate is relative low.

**Keywords**

Nanofluids, PTC, Thermal enhancement, Nusselt, heat transfer

## 1. Introduction

Energy production and management are essential problems of our society because of the existence of many environmental problems as air pollution, global warming, climate change and water pollution [1-2]. The conventional energy sources, as fossil fuels, will be depleted in some decades and also creates high carbon dioxide emissions [3-4]. Thus, the use of renewable energy sources seems to be one of the most promising solutions in order to produce clean energy. However, the cost of these technologies is usually high, the fact that makes the majority of these technologies not to be financially feasible at this time [5].

Solar energy is one of the most promising renewable energy sources because it is able to be converted into useful heat and to electricity [6]. However, solar thermal energy does not catch the attention of investors because of the low viability of the high temperature.