CFD modelling of different properties of nanofluids in header and riser tube of flat plate solar collector

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ABSTRACT

This paper aimed to evaluate the state of three different flow parameters of nanofluids and hybrid nanofluids flowing through inside header and riser tube of flat plate solar collector. This research work studied with Computational fluid dynamics (CFD) modelling method using nanofluids (Al_2O_3, TiO_2, ZnO) and hybrid nanofluids (Al_2O_3+TiO_2, TiO_2+ZnO, ZnO + Al_2O_3). The modelling was three dimensional under k-epsilon turbulence model, which was set with Standard and Standard Wall Functions. Besides, Absolute reference frame and calculative intensity percentage was fixed. The base fluid was water as well as volume fraction of nanofluids and hybrid nanofluids was 0.1%. Single-phase viscous model with energy equation used. Three types of design models (Model A, B and C) used with fixed inlet and outlet diameter. The number of header tubes fixed with two, but the number of riser tube varied such as two, seven and twelve. Maximum dynamic pressure increased in model B for both nanofluid and hybrid nanofluid of about 48% and 16% respectively. Velocity magnitude enhanced in maximal for both nanofluid and hybrid nanofluid in model B. Besides, highest turbulence kinetic energy achieved in model A (5.5%) for nanofluids and in model B (18%) for hybrid nanofluids. Model B perform better comparing with model A and model C.

KEYWORDS:

CFD modeling; Nanofluids; Riser tube