Abstract

In this research, experimental and numerical investigations are conducted to study the performance of a parabolic trough solar water collector fitted with twisted tape. The parabolic trough solar collector (PTSC) has a length of (2 m) and a width (2.34 m), its area is (4.68 m 2). The arches frame of parabolic trough is covered with a chrome steel sheet. The copper tube is used as a receiver to absorb the heat from reflected rays. Its outer diameter is (22 mm) and thickness (1.25 mm).Water is used as a working fluid. The tube was painted with a black layer to increase the absorption of radiation and enveloped with a vacuum glass tube to decrease heat loss. The mass flow rate was ($\dot{m}$ = 0.05Kg / sec). A twisted tape was used to enhance the heat transfer through the absorber tube with a twist ratio (y = 3.0). The numerical simulation was carried out using ANSYS FLUENT V.15 software for the fluid flow and heat transfer inside the receiver tube. Experimental measurements and numerical computations were made under the climatic conditions in the industrial zone of Fallujah city (33.34°N,43.8°E) in the 5th and 6th of September 2020. The performance of the parabolic trough solar collector was evaluated by calculating the useful heat, thermal efficiency and exit water temperature. Experimental results for exit temperature, useful heat and thermal efficiency obtained in the absence of twisted tape (94 ° C, 2003 W, 14) respectively, while in the case of twisted tape (97.4 ° C, 2609 W, 19.1) respectively. Numerical results for exit temperature, useful heat and thermal efficiency obtained in the absence of twisted tape (94.5 ° C, 2078 W, 15.3) respectively, while in the case of twisted tape (97.4 ° C, 2609 W, 19.1) respectively.