

Numerical Investigation of Heat Transfer Enhancement in Parabolic Trough Solar Collector with Twisted Tape Insert

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ABSTRACT

In this research, an experimental and theoretical study was conducted to show the performance of a parabolic trough solar collector in the case of inserting a twisted tape and in the case of not inserting a twisted tape. The parabolic trough solar collector (PTSC) is designed and manufactured with a length of (2m) and with a width of (3.48m) and an area of (5.48m²). The parabolic trough is coated with chrome steel sheets. A copper tube is used to absorb heat. Its outer diameter is (0.022m) and its thickness (0.0195m) through which water used as a heat transfer medium passes where the mass flow rate was ($\dot{m} = 0.05\text{Kg} / \text{sec}$). A twisted tape was used the twist ratio is ($\gamma = 4$). Simulation studies were carried out using the (ANSYS FLUENT 17) software on the receiver tube. Measurements and calculations were made under the climatic conditions in the industrial zone of Fallujah city on 5, 6 September. The performance of the parabolic trough solar collector was evaluated by calculating the

useful heat, thermal efficiency, and exit temperature numerical and experimental for both cases (insert, noninsert of twisted tape), and a comparison of experimental results between the two cases was made. For both cases, the results showed that the efficiency of the parabolic trough solar collector by inserting a twisted tape is higher than the efficiency of the parabolic trough solar collector without a twisted tape insert.