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Performance Evaluation of Conical Solar Concentrator System with Different Flow Rate

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Abstract : Solar energy has many advantages of infinite and clean source, and also it can be used for reduction of greenhouse gases and environment pollution. Concentrated solar system is a very useful to achieve reasonably high thermal efficiency. Different types of solar concentrating systems have been developed such as parabolic trough and parabolic dish. Conical solar concentrator is one of the most reliable and promising renewable energy systems for higher temperature applications. The objectives of this study were to investigate the influence of flow rate affecting the thermal efficiency of a conical solar collector, which has a double tube absorber placed at focal axis for collecting solar radiation. A conical solar concentrator consists of a conical reflector, which reflects direct solar radiation into an absorber. A double tube absorber was placed at the center of focal axis for collecting the solar radiation reflected from a conical reflector. A dual tracking system consists of a linear actuator and slew drive with driving cycle of 6 seconds. Water was used as circulating fluid, which flows from inlet to outlet of an absorber for collecting solar radiation. Three identical conical solar concentrator systems were installed side by side at the same place for the accurate performance analysis under the same environmental conditions. Performance evaluations were carried out with different volumetric flow rate of 2, 4 and 6 L/min to find the influence of flow rate affecting on thermal efficiency. The results indicated that average thermal efficiency was 73.24%, 81.96%, and 79.78% for each flow rate of 2 L/min, 4 L/min, and 6 L/min. It shows that the flow rate of circulating water has a significant effect on the thermal efficiency of the conical solar concentrator. It is concluded that an optimum flow rate of conical solar concentrator is 6 L/min.

Keywords : conical solar concentrator, performance evaluation, solar energy, solar energy system
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