Efficiency evaluation of the heating medium on the solar collecting system

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1. Introduction - A lot of renewable energy systems have been developed as the counterplane for unstable energy price rise and rapid depletion of fossil fuels. Especially, diverse solar collecting systems have developed to produce the thermal energy with converting solar radiation to heat energy. Many researches are in progress to increase an efficiency of solar energy systems, but it is not sufficient on the studies for the thermal efficiency of heating medium affecting on the solar collecting system. Thus, many researches on heat transfer fluids are required to develop the better solar energy systems in the near future. A conical solar concentrator as one of solar collecting system consists of a conical concentrator, which converts solar radiation into heat energy and an absorber for obtaining the collected solar energy [1–3]. Objectives of this study were to analyze the thermal efficiencies of heating media affecting on the solar collecting system.

2. Experimental - Experimental apparatus is composed of the conical solar concentrator, a storage tank for storing the heating medium, a circulation pump for forcibly circulating the heat transfer fluid, a flow meter for measuring the flow rate, the thermal sensors to measure the temperature, a data logger for collecting temperature data, and an equipment for solar radiation measurement. The conical solar concentrator was installed on the solar tracker, which can receive a direct ray of sun light to maximize an thermal efficiency. Distilled water and nanofluids (Al_2O_3 and CuO) were used as the heating medium. The heat transfer fluid was circulated through an absorber fixed at the center of conical concentrator and the heat storage tank by a pump to absorb the solar radiation generated in the conical solar concentrator. Experiments for the thermal efficiency analysis of the conical solar collecting system were performed with various heat transfer fluids under sunny clear skies. The thermal efficiency of conical solar collecting system was analyzed and compared with using various heating media.

3. Results and Discussion - The results showed that the thermal efficiency for nanofluid with Al_2O_3 was the highest as 72.5%. The thermal efficiency of CuO nanofluids was 65%, which is higher than that of 52% for the distilled water.

4. Conclusions - It can be concluded that Al_2O_3 nanofluid as heating medium is greatly effective to improve the thermal efficiency of solar collecting system.

5. References

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