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Energy and energy efficiency of a flat plate solar collector using pH treated Al_2O_3 nanofluid

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The use of nanofluids in solar collectors offers better performance, as they are very efficient in transporting heat even under small temperature difference. The effect Al_2O_3-water nanofluid, as working fluid, is used to evaluate the thermal efficiency of a flat plate solar collector experimentally. The volume fraction of the nanoparticles was 0.1%, while the size of the nanoparticles was ~13 nm and 20 nm, respectively. The mass flow rates of the nanofluid varied from 0.5 to 1.5 kg/min. Experiments were carried out using a stable nanofluid. The stability of nanofluid was obtained by controlling the pH of the solution. An ASHRAE Standard 93-2003 was used to analyze efficiency of the solar collector. The results reflect the contribution and significance of each of these parameters to the collector overall energetic and energetic efficiencies. Two different sizes of Al_2O_3-water nanofluid (13 nm and 20 nm) are examined and results show that 13 nm Al_2O_3 nanofluid shows higher thermal conductivity enhancement and efficiency, compared to that of 20 nm Al_2O_3 nanofluid and water. Critical point of Al_2O_3-water nanofluid is also presented.

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