EFFECTS OF NANOFLUID'S BASE FLUID ON A VOLUMETRIC SOLAR COLLECTOR

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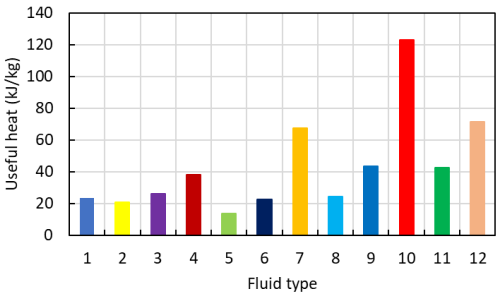
Solar energy is one of the most effective ways of meeting energy needs whilst also protecting the environment. In this research, a direct absorption solar collector (DASC) is proposed for the conversion of solar radiation into thermal energy. In an indirect absorption solar collector (IASC), the performance is adversely affected because of the increase in heat losses between the heat transfer fluid and the absorber [1]. In contrast, working fluid in a DASC serves as both an absorbing and storing medium and a heat transfer fluid, and, therefore, may offer advantages over an IASC. When the literature is examined, it is seen that water is generally used as a base fluid. However, other new types of base fluids can also be used. Therefore, it is not seen that the effects of water and other base fluids are not compared in the same study. In addition, there is not enough numerical studies on hybrid nanoparticles using DASC as hybrid nanofluids are still in preliminary stage. Consequently, this study aims to investigate and compare the underlying mechanisms of optical characteristics of working fluid on heat transfer and fluid flow of a DASC enclosure with different base fluids and a combination of them with nanoparticles by using a numerical model.

Figure 1 shows the effect of pure fluids and nanofluids on the useful heat of DASC. When nanoparticles are added to the pure fluid, the thermophysical properties of the heat transfer fluid are improved. In addition, because nanoparticles have higher optical properties, a greater increase in the temperature of fluid is observed by increasing the solar radiation absorption capacity of the pure fluid. It is observed that the temperature gain is the highest as the hybrid nanofluid absorbs more radiation and the extinction co-efficient of hybrid nanoparticles is the combination of mono nanoparticles [2]. Therefore, the performance of the collector increases. However, the addition of Al nanoparticles to the Therminol VP1 and Ethylene gylcol surprisingly decreases the collector's average temperature, reducing the performance of the collector when compared to pure fluids. This could be because the temperature gradients do not develop as a result of an insufficient amount of radiation being absorbed because of low concentration. This study illustrates that, because the thermal performance of the hybrid nanofluids has the best properties, the use of them increases the amount of storage in the DASC.



1 Water; 2 Therminol VP1
3 Ethylene glycol; 4 Al+water
5 Al+Therminol VP1; 6 Al+Ethylene glycol
7 Al2O3+water; 8 Al2O3+Therminol VP1
9 Al2O3+Ethylene glycol; 10 Al+Al2O3+water
11 Al+Al2O3+Therminol VP1
12 Al+Al2O3+Ethylene glycol

Figure 1. Effect of different base fluids on the collector's performance

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