and heat transfer more than the base liquid, and the efficiency of the nanofluid is higher than the efficiency of the base liquid [22]. Similarly, the heat transfer in the absorber increases depending on the generator temperature. In this process, the effects of nanoparticles were seen. Also, with the increase of the generator temperature, there was a slight decrease in the heat transfer in the condenser.

Conclusions

In this study, a performance analysis of an absorption cooling system was performed. Heat load necessary for the generator was provided with a flat plate solar collector. The LiBr-Al_2O_3-H_2O nanofluid has been used in the absorption cooling system as working fluid. Change of COP values was determined for different operation conditions depend on Al_2O_3-H_2O nanoparticle concentration ratio. This study showed that nanoparticles added to the working fluid in absorption cooling systems increase the COP. In the absorption cooling system in this study, using the nanoparticle together with increasing the generator temperature increases the cooling performance. Therefore, in an absorption cooling system, several variables need to be optimized to achieve optimum cooling performance. As result of this study, it has been observed that the nanoparticles added to the working fluid increase the heat transfer and therefore, affect the system performance positively. Nanoparticles increase the heat transfer coefficient of the fluid, as a result, it increases heat transfer too. As the nanoparticle concentration in the working fluid increases, the thermal conductivity coefficient of the nanofluid increases. However, as the nanoparticle concentration of the working fluid increases, the viscosity of the nanofluid also increases. Also, increased viscosity increases the pressure drop in the flow channel and the pump power required for the flow. Therefore, it is very important to achieve a 'minimum viscosity with maximum thermal conductivity' balance in practice.

There are studies in the literature showing that nanoparticles improve heat transfer and system performance. However, some studies have shown the opposite of these results. Therefore, studies on this subject should continue rapidly. It will continue to be used in nanofluid refrigeration systems, chemical processes and nuclear reactors as studies increase and positive results are achieved.

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Nomenclature

A – surface area, [m^2]
A_c – area of collector absorber plate, [m^2]
C – specific heat capacity, [Jkg^{-1}K^{-1}]
C_p – specific heat, [Jkg^{-1}K^{-1}]
F – solar-collector efficiency factor
I_R – solar irradiance, [kWm^{-2}]
$\dot{m}_i$ – mass-flow rate, [kgs^{-1}]
P – pressure, [kPa]
$\dot{Q}_A$ – absorber heat load, [kW]
$\dot{Q}_C$ – condenser heat load, [kW]
$\dot{Q}_E$ – evaporator heat load, [kW]
$\dot{Q}_{hex}$ – solution heat exchanger heat load, [kW]
$\dot{Q}_G$ – generator heat load, [kW]
$\dot{Q}_u$ – uniform solar heat flux, [kW]
T – temperature, [°C]
T_A – absorber temperature, [°C]
T_E – evaporator temperature, [°C]
T_C – condenser temperature, [°C]
T_G – generator temperature, [°C]
ΔT – dimensionless temperature difference
U – heat transfer coefficient, [Wm^{-2}K^{-1}]
U_L – overall heat transfer coefficient, [Wm^{-2}K^{-1}]
v – velocity, [ms^{-1}]
W_p – pump work, [kW]
x – mass fraction

Greek symbols

α – absorption coefficient

ε – effectiveness
η_c – solar collector efficiency
τ – transmission coefficient
ψ – nanoparticle volume fraction
ρ – density, [kgm^{-3}]

Subscripts

in – inlet
nf – nanofluid
np – nanoparticle
out – outlet
1, 2, 3 – state point

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