Abstract

In the present work,the flow and the enhancement of heat transfer characteristics of distilled water, 100%Ethylene glycol, distilled water 50% - Ethylene glycol 50% and metal oxide nanofluid type Al_2O_3 with distilled water at concentrations of φ = 0.1, 1, 3% by volume in a double-pipe heat exchangercounter flow have been studied.

The test section is a double pipe heat exchanger.It is constructed from concentric tubes with 82 cm length. Copper tube with outer diameter of (12.7mm) was chosen as inner tube, and a PVC tube with outer diameter of (50.8mm) as outer tube. The hot fluid flows in the inner tube while the cooling fluid flows in the annulus.The used inlet temperature of hot fluid are (40, 50, 60 and 70°C) with flow rates of the fluid (1.1, 1.3 and 1.5 L/min). while the temperature of fluid in annulus is the atmospheric temperature (23-33°C) with flow rate (10.75L/min).

Also, the double pipe heat exchanger issimulated using Fluent under ANSYS.To demonstrate the effect of the turbulence, a model that involves the solution of two transport equations (k-ε) model is used andthree-dimensional geometry is generated. ANSYS version (14.5), is used to simulate the heat exchanger for case of water at different inlet temperatures.

The results show that the temperature of fluid increases as moving from the water to EG and to nanofluid. While, the average temperature along the inner pipe in general remains constant with the increase in flow rate.Also the change in fluid properties increases the values of Nusselt number. The Ethylene Glycol has the highest Nusselt number (41) at inlet

Temperature (70°C) and flow rate (1.5 L/min) among the other working fluids due to the high Prandtl number. The mixture of ethylene glycol and water has Nusselt number lower than that for the ethylene glycol alone .For nanofluid, the Nusselt number increases with increasing concentration (φ=0.1, 1and 3%), as the concentration increases the Nusselt number increases to (26.5) at (φ=3%,T=70 and flow rate 1.5 L/min) and Reynolds number was (3783.14) .Correlations between Nusselt number and Reynolds number are made using power method for each of the working fluids used.The maximum heat transfer enhancement was (1.6250) for ethylene glycol at inlet temperature (70°C) and the minimum enhancement was (0.2024) for Al_2O_3nanofluid at φ=0.1%.

Also, comparisons, which includes comparing the theoretical and experimental results and comparing the obtained results with open literature results.the comparisons shows a good agreement.