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Experimental investigation of CNT nanofluid utilization to enhance air conditioning thermal performance

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The increased demand of energy in domestic applications nictitates the development of low power consumption air conditioning (AC) systems. AC systems consume up to 80% of buildings` energy during hot summer months. By replacing the conventional single pipe evaporator with a double pipe evaporator in heating ventilating and air conditioning (HVAC) systems, there is a great potential for an enhanced thermal performance. In this study, a homogeneous nanofluid of dispersed carbon nano tubes (CNT) was used as the secondary fluid in the double pipe evaporator of a 17 kW HVAC system. Three concentrations of CNT nanofluid of 0.025, 0.05, and 0.1 by weight percentage were circulated separately using a small 104 W pump connected to a 150 liters tank. The AC unit was placed in a 45 m3 balanced calorimeter of 2.24 kW heat load. Experimental results showed a promising reduction in the compressor work and an increase in the system coefficient of performance (COP). The collected data showed that system thermal performance depended on the evaporator, secondary fluid flow rate more than condenser secondary fluid flow rate. By increasing the concentration of CNT nanofluid, the compressor work was shown to decrease while the COP was shown to increase. In comparison with the standard rated AC unit, utilizing a double-pipe evaporator and a condenser with maximum nanofluid concentration resulted in a decrease of about 52% in the compressor work and a similar percentage of increase in the system COP. As a result of the enhanced heat transfer, the operating electrical current was reduced by 30% in comparison to the rated compressor current.

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