ABSTRACT

Aluminium oxide (Al_2O_3), also known as alumina, is one of a relatively high thermal conductivity material. In this research, the main element for creating alumina is aluminium chloride ($AlCl_3$). The Al_2O_3 nanoparticles were synthesized from $AlCl_3$ by sol-gel method, using citric acid from pineapple extract. Subsequently, Al_2O_3 was characterized using Scanning Electron Microscopy (SEM) to determine the morphology and the size of nanoparticles and X-Ray Diffraction (XRD) to determine the crystalline properties of alumina nanoparticles. The result of characterization showed the average size of nanoparticles was 35.1 nm, the crystalline size of the nanoparticles was 15.48 nm, and the crystal system, which was cubical, with the value of a = 7,645792. After characterization, alumina nanoparticles would be applied on a cooling machine in the form of nanofluids with some various concentration of nanoparticles to increase the cooling machine coefficient of performance. In addition to looking at the effect of nanofluids on the cooling machine coefficient of performance, this research will also look at the effect of Al_2O_3 nanoparticle concentration on the thermal conductivity and nanofluids viscosity. The results of this research indicate that the cooling machine coefficient of performance continues to increase from a concentration of 0 % to 0.21 %. Yet, at concentrations of 0.28 % and 0.49 %, the coefficient of performance of the cooling machine had decreased due to the increased power required by the compressor. On the other hand, at a concentration of 0.49 % compressor power was increased but the temperature drop time becomes very fast that reaches 303 seconds. Consequently, at a concentration of 0.49 % the coefficient of performance of the cooling machine becomes higher than the previous concentration. Thus, the highest coefficient of performance of this research is 0.437 at concentration of 0.21 %.

Keywords: Alumina, nanoparticles, viscosity, thermal conductivity, concentration, and coefficient of performance