Numerical and Experimental Studies of Two-Phase Flow in Cooled / and Adiabatic Capillary Tubes

A numerical and experimental study was performed to predict the flow and thermal performance of a capillary tube that used in air conditioning and refrigeration systems. In the numerical study, the (CFD) technique was employed to model the problem using the finite volume method for a two-phase, two dimensional flow in the pipe. In the experimental part, an experimental rig was constructed using a split unite to measure the temperature and pressure along the capillary tube. These measurements were taken for (R-22) refrigerant with different ambient temperatures. It was found that for a fixed length and diameter of capillary tube the mass flow rate of (R-22) increases as the inlet temperature increases. The numerical study was then applied to predict the flow and heat transfer along several types of capillary tube, i.e. several lengths, diameters, and refrigerants, for cooled and non cooled tube. In the non cooled capillary results, the capillary tube length of R-407C (R-32/125/134a(23/25/52)) was found to be shorter than that required for (R-22). It was also found that (R-22) vaporized later than its corresponding (R-407C). The same condition was found for (R-12) and its alternative R-134a (CF3CH2F). The numerical results show a large effect of the length of capillary tube on the refrigeration system performance. When the length increases, the drop in pressure, temperature, and density decreases, while the velocity and dryness fraction increases.