CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Heat transfer fluids, such as water, ethylene glycol and mineral oil play an important role in many industrial processes, including power generation, heating and cooling processes. These common fluids have poor heat transfer performance compared to those most solids (Eastman, 1997). The earlier studies to enhance heat transfer properties have done by Maxwell (1873), and used suspensions of millimeter or micrometer sized particles, which although showed some enhancement but some problems experienced such as poor suspension stability and channel clogging, extra pressure drop and erosion of pipeline. Although the solutions show better thermal performance compared to common heat transfer fluids, they are still not suitable for use as heat transfer fluids in practical applications. In 1995, Choi has been advanced the concept of nanofluids that showed substantial augmentation of heat transported in suspensions of copper or aluminum nanoparticles in water and other common liquids by dispersions of nanoparticles in liquids that are permanently suspended by Brownian motion. Nanofluid has been found to be an attractive heat transport fluids. It has exhibited a significant potential for heat transfer augmentation relative to the conventional pure fluids. It has been expected to be suitable for the engineering application without severe problems in pipeline and with little or no penalty in pressure drop. Here, attention to study a convective heat transfer coefficient of nanofluid is draw in term of enhancing the rate of heat transfer.

1.2 PROBLEM STATEMENT

Heat transfer is one of the most important processes in many industrial and consumer product. The inherently poor thermal performance of conventional fluids puts a limitation on heat transfer and restricted in developing energy efficient heat transfer fluids that are required for ultrahigh performance cooling. With increasing global competition, industries have a strong need to develop advanced heat transfer fluids with significantly higher thermal performance than are presently available. Therefore, scientists and engineers have made a great effort to break this fundamental limit by dispersing metallic and non-metallic particles in liquids. This concept of new kind of fluid called 'nanofluid' has introduced by Choi, (1995).

In order to commercialize this new kind of fluid, many researchers have attempted study on heat transfer performance and flow characteristic of this fluid. From the previous publish report of nanofluid, they have claimed that nanofluid thermal properties is higher than base fluid such as water, mineral oil and ethylene glycol. Nanofluid technologies have offer a great potential for further development of high performance, compact and cost effective cooling to utilizing in industrial applications.

Thus, studies of heat transfer behavior for nanofluids are essential in providing authentification result that have found by previous researchers.

1.3 OBJECTIVES OF STUDY

In this study, there are several objectives need to fulfill as described below;

i. To estimate the heat transfer coefficient (HTC) of nanofluid flowing through a plain tube.
ii. To validate result obtain from experiment by comparing with the previous result in literature and numerical method.

1.4 SCOPE OF THE STUDY

There are several scopes included in this research as follow:

i. Alumina (Al_2O_3) nanofluids dilute by water is flow under fully developed turbulent region.
ii. Nanofluids flow through a plain tube with constant heat flux boundary conditions.
iii. Using Al_2O_3/Water Nanofluids with volume concentration 0.02%, 0.05% and 0.5%
iv. Evaluate HTC under turbulent region with Reynolds number ranged between 4,000 and 20,000.

1.5 SIGNIFICANCE OF STUDY

Heat transfer coefficient (HTC) is a better indicator in evaluate of thermal performance of the fluid. Thus, it is really important to know how to get the value of HTC since it is not a property of the fluid and it is experimentally determine parameter whose value depends on all variables influencing convection such as the surface geometry, the nature of fluids motion, and the properties of the fluid and bulk fluid velocity.

Volume concentration, flow condition, constant heat flux and surface temperature of the wall tube is played a big role in nanofluid thermal performance, study of the HTC effect with varies parameter will give a guideline to produce nanofluid with ideal composition.

1.6 PROJECT FLOW CHART

Figure 1.1 shows the process flow of the project with step by step start from beginning of the project until the end.