CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The use of petroleum products in the transportation sector has been steadily increasing, which contribute in a larger extent to the rapid depletion of the natural resources. Even a 10% increase in the efficiency of engines by decreasing friction is considered to be a significant improvement. Lubrication is essential to reduce friction and wear in engine parts thus minimizing the associated dissipative energy loss. Thermal conductivity is the most important property of lubricating oil, which accounts for its heat transferring ability. Other important properties of lubricating oil include the flash point and the pour point, which are related to oil storage and handling. These properties of lubricant can be further improved by the use of various wear reducing agents. With the development of nanostructured materials in the recent years, this project attempts to use nanoparticles as lubricant additives to improve their lubrication properties.

Nanolubricant is a new class of lubricant engineered by dispersing nanometer size solid particles in base lubricant to increase heat transfer and tribological properties. Dong et al. (1998) and Guo et al. (2009) showed that when some nanoparticles added into the lubricating oil, their lubrication properties can be effectively enhanced. The thermal conductivity and the convection heat transfer coefficient of the fluid can be largely enhanced by the suspended nanoparticles. Also, lubricants with nanoparticle additives exhibit improved load-carrying capacity, anti-wear and friction reduction properties. These features make the new lubricant very attractive in some lubricating application in engines.

In this project, aluminium oxide, Al_2O_3 has been chosen as additives with lubricants to demonstrate the said aspect. Experiments have been carried out with two different sizes of Al_2O_3nanoparticlesand the experimental results have been evaluated and analyzed to justify the improved performance through the choice of the Al_2O_3nanoparticles.

1.2 PROBLEM STATEMENT

With an increase in the number of vehicles, the problem with fuel consumption and environmental pollution are becoming more prominent. The use of an energy-conserving and emission-reducing automotive engine oil additive would have a great impact on energy conservation and environment protection. However, such an additive would need to enhance, or at least maintain, the most important desirable lubrication properties, such as viscosity index, low-temperature performance, high temperature performance and oxidation resistance.

Therefore, there is a need for an engine oil additive that decreases the fuel consumption and environmental pollutants while maintaining or enhancing the key lubrication properties.

1.3 OBJECTIVES

The objectives of this project are as given below.

i. To study and compare the thermal-physical properties of standard lubricants added with various volume concentrations of 13 nm Al_2O_3 and 52 nm Al_2O_3 with pure engine oil.

ii. To develop a nanolubricant, based on the outcome of study and comparison through objective (i), with enhanced characteristics to improve the performance of diesel engines.

1.4 SCOPE OF THE PROJECT

The present work is an attempt to study the effect of inclusion of nanoparticles on the thermal conductivity, pour point and the flash point of lubricating oil. For this purpose, Al_2O_3 nanoparticles have been chosen as an additive because of its excellent dispersibility and high surface area stability characteristics when compared to that of the other oxide nanoparticles. The nanoparticle Al_2O_3has been chosen in two different sizes, 13 nm and 52 nm, which have been added with the engine oil. The operational characteristics of lubricants have been determined and compared with different volume concentrations like 0%, 0.5%, 1.0%, 1.5%, 2.0% and 2.5% at different temperatures. Finally, the testing and the evaluation of characteristics of the proposed lubricants has been performed as per the American Standard for Testing Materials (ASTM).