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EXPERIMENTAL STUDY AND SYSTEM ANALYSIS OF FINDING THE BEST INORGANICS ADDITIVE TO ENHANCE QUALITY OF MALAYSIAN ENGINE OIL

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of study and research.

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ABSTRACT

This study performed a system analysis for specifying the best inorganic metals in engine oil by evaluating its ability on behavior of the system. Inorganic metals is one of the additives in engine oil and this research realized on the difficulty in specifying it's optimum concentration since the types and concentration of that elements did not disclosed by marketers to the public due to their important and highly details. Five different samples were prepared and tested on purpose of understanding on its types and concentration, heat capacity, viscosity behavior, kinematic viscosity and viscosity index. Evaluation of inorganic metal concentration was assessed by Inductively Coupled Plasma Optical Spectrometer. Samples viscosity was obtained using rotational viscometer. Tests were made under constant shear rate of 600 s^{-1} and temperature setting from 40 to 100°C. By collecting the information of the samples viscosity, determination of the best engine oil was carried out by measuring area under the curve for each of samples graph. Heat capacity for each samples were determined using bomb calorimeter in adiabatic mode of operation. Kinematic viscosities of engine oils were assessed using VH2 Viscometer Houillion at 40 and 100°C and viscosity index was calculated according to ASTM D2270 method. System analysis performed found that, the quality of Malaysian engine oil increased by increasing the concentration of elements by; Ferrum = 0.04-0.05 ppm, Arsenic = 0.1 ppm, Cobalt = 1.3-1.4 ppm, Cuprum I = 0.3-0.4 ppm, Cuprum II = 0.3-0.4 ppm, Nickel = 0.04-0.05 ppm, Cadmium = 0.1 ppm and Titanium =0.03-0.04 ppm. In addition, an attempted of adding Aluminum oxide had also been made. A set of experiment (heat capacity, viscosity behavior and kinematic viscosity) to validate system identification was carried out and it was found that; Titanium, Copper, Cadmium, and Arsenic had a big effect in increasing the quality of Malaysian engine oil, whereas, Nickel, Cobalt and Aluminum does not.

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CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION TO LUBRICANT

Nowadays, the use of lubricants covers wide range of many applications and one of the largest is in automotive field. Automotive is defined as something related to the motor vehicles and most, not all, its locomotives ability produced by internal combustion engine. The internal combustion engine is an engine in which the combustion of a fuel occurs with an oxidizer (usually air) in a combustion chamber. In an internal combustion engine, the expansion of the high-temperature and high - pressure gases produced by combustion apply direct force to pistons of the engine. This force moves the automotive vehicles over a distance by means of transforming chemical energy into useful mechanical energy. Therefore, lubrication is required in internal combustion engines due to the relative motion of engine parts and rubs against each other (Rajput, 2007).

Lubrication is defines as utilization of a lubricant that provides an enhancement to the movement of one surface over another by minimizing friction and wear (Mia, 2010; Boyde, 2002). The primary purpose of lubricant in internal combustion engine is to reduce friction and wear between two surfaces in contact. Lubricants also required carrying out a range of other functions, including provision of reliable engine operation in a wide temperature range, corrosion prevention, cleaning the engine parts from sludge, sealing piston ring - cylinder gap, foam prevention and removal of heat (Boyde, 2002). In order to perform these roles, lubricating oils must have specific physical and chemical characteristics.

Figures 1.1 and 1.2 illustrates on the mechanism of the lubrication. The lubricant forming intermediary film between two solid surfaces in contact that holds the surface apart and one surface hydrodynamically floats on the others surface. Other than that, to give full potential of oil to act as a lubricant, it must wet the surfaces of the metal. The resistance exists to this relative motion is the shearing of fluid layers between the surfaces, which is less than of dry or non-lubricating surface motion. Without using lubricant, the high spots of roughness surfaces will tends to touch each