STUDY OF WEAR AND FRICTION PERFORMANCE OF LOW – COST COMMERCIAL ENGINE OIL

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DECLARATION

I declare that this thesis entitled " Study Of Wear And Friction Performance Of Low - Cost Commercial Engine Oil " is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : NUR SYAHIRAH BINTI M MAZLAN

Date : 18 JANUARI 2022

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

Signature :

Supervisor Name :

TS. SHIKH ISMAIL FAIRUS BIN SHIKH ZAKARIA

Date : 18 JANUARI 2022

DEDICATION

I dedicate this project to my loving mother and father, Zuriyaton Binti Mohamad and M Mazlan Bin Tolot, along with my supervisor, Ts. Shikh Ismail Fairus Bin Shikh Zakaria, and my colleagues, Wahadatul Nur Fati'hah Bin Sa'audi, Anis Soraya Binti Zucafly, and Nur Sabarina Binti Mohd Sobry, for their continuous support and encouragement in completing this. I am expressing my gratitude to all of them because without them, I would not have progressed as far as I have.

ABSTRACT

The main objective of this research is to examine how low-cost commercial friction and wear engine oil performance towards branded engine oils. In this research also the viscosity of motor oil was studied. Engine oil lubricates an internal combustion engine component and protects it against corrosion and keeps it cool while in operation. To determine the friction coefficient, four ball tests were conducted. After that, the diameters of wear scars on the balls were determined using the inverted microscope. The American Society for Testing and Materials (ASTM) 04172 was the basis for all standards in this technique. ASTM 04172 is the standard wear preventive method for lubricating fluid (Four-Ball Method). Viscosity heated was employed for viscosity determination of the oil. For the commercial engine oil, KUMO SAE 5W40 and 10W40 is selected. While the branded engine oil is Shell Helix HX8 and Shell Helix HX7. Finally, the results indicate whether commercial engine oil is suitable for usage or not.

ABSTRAK

Objektif utama penyelidikan ini adalah untuk mengkaji bagaimana geseran komersial kos rendah dan prestasi minyak enjin terhadap minyak enjin berjenama. Kelikatan minyak enjin juga diperiksa dalam kajian ini. Minyak enjin melincirkan komponen dalaman mesin pembakaran dalaman, serta melindunginya dari kakisan dan menjadikannya sejuk semasa beroperasi. Empat ujian bola dilakukan untuk mengukur pekali geseran. Setelah itu, mikroskop terbalik digunakan untuk menentukan diameter bekas luka pada bola. Semua piawaian dalam kaedah ini didasarkan pada American Society for Testing and Materials (ASTM) 04172. ASTM 04172 adalah Kaedah Ujian Piawai untuk Memakai Ciri-Ciri Pencegahan Cecair Pelincir (Kaedah Empat Bola). Kelikatan yang dipanaskan digunakan untuk menentukan kelikatan minyak. Untuk minyak enjin komersil, KUMO SAE 5W40 dan 10W40 dipilih. Sementara minyak enjin berjenama adalah Shell Helix HX8 dan Shell Helix HX7. Akhirnya, hasil kajian akan menunjukkan sama ada minyak enjin komersil kos rendah sesuai atau tidak.

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LIST OF SYMBOLS AND ABBREVIATIONS

V	-	Velocity
ASTM	-	American Society for Testing and Materials
VM	-	Viscosity Modifiers
FM	-	Friction Modifiers
ZDPP	-	Zinc Dialkyl Dithio Phosphates
SAE	-	Society of Automotive Engineering
DI	-	Detergent Inhibitor
Q	-	Volume lost from the surface per unit sliding distance
N	-	Normal load
H	-	Hardness
K	-	Wear Coefficient
°F	-	Degree Ferenheit
W	-	Winter
F	-	Force
A	-	Area
h	-	Height
η	-	Dynamic Viscosity
τ	-	Shear stress
u/h	-	Shear rate
cSt / cS	-	Centistokes
°C	-	Degree Celcius
υ	-	Kinematic Viscosity
ρ	-	Fluid Density
SI	-	International System of Unit
S	-	Stoke
CCS	-	Cold Cranking Simulator
HTHS	-	High – Temperatue, High Shear
VI	-	Viscosity Index
νL	-	Low VI oil viscosity

vH	-	High VI oil viscosity
vU	-	Viscosity of the oil at 100 °F
WP	-	Wear Preventive
EP	-	Extreme Pressure
PCMO	-	Passenger Car Motor Oil
API	-	American Petroleum Institute
ml	-	Millimeters
COF	-	Coefficient of Friction
SEM	-	Scanning Electron Microscope

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CHAPTER 1

INTRODUCTION

1.1 Background

In the manufacturing industry, lubrication is essential, since the shipment and other appliances are utilised frequently. To reduce friction between the two moving surfaces or to avoid metal-on-metal contact, a lubricant is employed. It may also improve a machine or engine's dependability by preventing wear and corrosion and by prolonging their lives (Duzcukoglu, H. and Şahin, O.S, 2010). The use of lubricant in an internal combustion engine was critical for lubricating components and protecting and extending the engine's existence. An important aspect of prolonging the life and output of the engine is the efficacy of the lubricating oil of the engine.

Wear occurs when two surfaces rub against one other, and more specifically when the surface is removed and deformed as a consequence of the rubbing motion. The most frequent source of wear is surface contact at deformation. Following the removal of just a little amount of material or a roughing-up of the surface due to heavy wear, components in an automobile engine may fail and require replacing. A higher wear rate means a shorter motor life Wear may influence engine life. The length of time an oil lasts is determined by its thickness or viscosity. Because a thick oil coating would have separated the rubbing components' surfaces to minimise wear, (A. K. Gangopadhyay , R. O. Carter Iii , S. Simko , H. Gao , K. K. Bjornen & E. D. Black, 2007).

Since wear is the leading cause of loss in lubricated equipment, it would have a significant economic effect (Shizhu Wen, Ping Huang, May, 2017). Furthermore, according to Kunc et al., the key factors that cause engine wear are friction and abrasion between rubbing surfaces. Surface fatigue, abrasive wear, adhesive wear, corrosion wear, fretting wear, electrical wear, erosion wear, and cavitation wear are the most common types of wear seen in lubricated machinery. Any of this wear may be caused by either touch or non - contact wear. Non - contact wear happens where there is no physical contact between two surfaces, while contact wear develops where there is metal-to-metal contact. To reduce friction, a lubricant can have a stable lubrication film between two moving surfaces. It's because one of a lubricant's functions is to reduce friction. The key factors that cause engine wear are friction and abrasion between rubbing surfaces (Kunc et al., 1952).

When two interacting surfaces move relative to one another, friction develops. It opposes movement and produces heat and a rise in temperature. Friction of vehicle braking systems, clutches, belts and pulleys is needed in equipment. Friction, on the other hand, may be troublesome in other situations, such as bearing support systems and the piston ring contact, and it should be avoided wherever feasible. Mechanical energy is lost as a consequence of increased friction in an engine, and more fuel is needed to accomplish the same job. Furthermore, the engine quickly overheats owing to excessive friction, and its working components may wear or seize. (Bahari, October 2017).

When selecting a lubricant the viscosity of the oil is essential since the correct lubricant may assist prolong the engine's life. The Society of Automotive Engineers (SAE) has developed a viscosity categorization system to describe the cinematic viscosity of motor oil. The first number in the SAE Specification 10W-30 indicate that the flow of oil in a cold-heat environment, with the smaller the number, the larger the flow at cold-heat temperatures. The higher the amount, the more the flow at cold-heat conditions. At 100 °F, the second figure shows the minimal viscosity necessary for adequate lubrication at the final operating temperature.The viscosity of the oil will increase as the temperature rises, preventing the oil from thinning (G. Pereira, A. Lachenwitzer, M. Kasrai, G. M. Bancroft, P. R. Norton, M. Abrecht. P. U. P. A. Gilbert, T. Regier, R. I. R. Blyth and J. Thompson, 2007). Temperature does have a significant impact on viscosity and oil film thickness; once the temperature is elevated, the oil molecules break into smaller molecules, causing viscosity to decrease (S. Syahrullail, N. Nuraliza, M.I. Izhan, M.K. Abdul Hamid, D. Md Razaka, 2013). As a result, failure of additives and base oils would be encouraged. The wear resistance properties of an engine are influenced by the viscosity of the engine oil.

1.2 Problem Statement

Low-quality oils can lead to expensive engine maintenance as well as increased fuel consumption. Because of engine injury, oils that do not meet specified specifications can void your vehicle's engine warranty. If a major injury happens at the end of using engine oil that does not follow the manufacturer's requirements, your warranty will be voided, and you will have to repair or replace your engine. Low-quality oils are harmful to the atmosphere because they do not follow industry requirements established by regulatory bodies such as the ACEA and API, which are in charge of developing CO2 emission rules (Oil Quality: cheap or expensive oil, what's the difference?, 2020). There is a lack of research on the wear and friction performance of low-cost commercial engine oil. As a result, the friction and wear performance of low-cost commercial engine oil will be known after this study.

1.3 Research Objective

The main objectives of this study are as follows:

a) To study the performance of low-cost and branded commercial engine oil in terms of wear and friction.

b) To inspect the friction coefficients of low-cost and branded commercial engine oil

c) To investigate the viscosity of low-cost and branded commercial engine oil.