UNIVERSITI TEKNOLOGI MARA

WEAR CHARACTERIZATION BY OIL ANALYSIS IN AUTOMATIC AND MANUAL BUS ENGINE GEARBOX

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of the requirements for the degree of
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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 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 my study and research.

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ABSTRACT

In Malaysia, public transportation has become the main way for citizen to go from one place to another. One of the popular and yet the very important ways of public transportation is the bus. Ease of availability, cheap and fast were the reasons why people choose bus in comparison to other means of public transport. In order to maintain the bus life span so that it can be used for a long time without any major problem; the bus should be maintained and serviced according to its mileage usage. Thus, this research focuses on the analysis of transmission fluid sample by using experimental approach after a certain mileage. The objectives of this work are to collect the oil sample from automatic and manual transmission systems of engine bus according to manufacturer's recommendations, to analyse collected oil sample using oil analysis technique i.e. ferrographic, FTIR, AES and to predict the wear morphology, spectral outcomes and wear element concentration from the oil analysis results. The sample transmission fluid which was taken from the automatic and manual transmission gearbox has been experimentally analyzed. The oil sample were taken with an interval of 5,000km, 30,000km, 50,000km, 80,000km, 180,000km and 300,000km for automatic transmission bus operation, and 5,000km, 50,000km, 100,000km, 150,000km and 200,000km for manual transmission bus operation. This sample then has been analyzed by comparing between new and used transmission fluid using FM-III Ferrogram Maker, FTIR and spectrometer. Oil analysis by ferrographic, FTIR and spectrometric technique is a form of Predictive Maintenance (PdM) to avoid major failure in machine elements. Most machine elements are not easily accessible in the transmission system. Having a reliable technique would avoid the needs to open the components unnecessarily, hence, help to prevent catastrophic failure which are very costly, and ease of regular monitoring. In order to identify the major failures of automatic gearbox, forecasts can be made regarding the lube transmission fluid analysis test. By using these test, the minor problem can be determine before become into major failures. At the end of this research, the wear particles profile for interval mileage of automatic and manual transmission system were obtained.

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CHAPTER ONE

INTRODUCTION

In this chapter, four aspects of study were described: problem statement, objective, scopes and limitations and significance of research. At the end of this chapter, a review of each chapter was included to give an overview of the entire thesis.

1.1   PROBLEM STATEMENT

Public transportation is one of the important sectors that drive the country's economy growth. Statistic from Road Transport Department Malaysia shows that the total number of vehicle registered in year 2012 is 2.27 million compared to 2.12 million in year 2011. These numbers will definitely increasing in the coming years [1].

During vehicle operation, engines will experience wear and tear which can be detrimental to engine operation system and overall performance if are not maintained and serviced properly. The cost of improper maintenance and services of engine will be escalating overtime. The issue of wear and tear falls under tribology. Similar to mechanical part components, the lubricant itself also competent to change thus leads to failure in lubricants properties. Hence, another concern is on oil changing maintenance. In common practice, oil changing in buses are maintained by the manufacturer according to the schedule mileage services. Nevertheless, up to this date there are no thorough studies related to oil change maintenance by mileage have been made so far.

This research is to present a study which deals with deploying oil analysis technique to predict wear and tear based on the condition of the transmission fluids found in automatic and manual transmission gearbox. The outcome may lead to some understanding of whether the oil changing schedule is justified.