UNIVERSITI TEKNOLOGI MARA

SYNTHESIS OF BIOLUBRICANT FROM VARIOUS BASED METHYL ESTERS

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ABSTRACT

Revolution and development towards mineral based lubricant has been widely consumed since few years back. Nevertheless, the consumption on these lubricants has turned out the negative impact to environment pollution and sources depletion. This issue has been raising the worldwide concern to establish a new generation of lubricant, in which made up of renewable and biodegradable sources. Recently, the research on biolubricant production has been emerged towards substitution on the existing lubricant. The purpose of this research is to emphasize on the production of eco-friendly biolubricant from various based methyl ester by using the process of two stages transesterification. Biolubricant derived from trimethylolpropane (TMP) and methyl ester based of waste cooking oil (WCOME) and rubber seed oil (RSOME) were synthesized via transesterification reaction in the three-necked bottom flask. 2 % (w/w) of *para*-Toluenesulfonic acid (*p*-TSA) was added as catalyst in the reaction. The transterification reaction parameters varied in the study such as time, temperature and molar ratio of fatty acid methyl ester (FAME) to TMP. Analysis of resulting biolubricant was carried out by Gas Chromatograph-Mass Spectrophotometer (GC-MS) system to determine the composition of the synthesized biolubricant while the presence of ester functional group was displayed by performing Fourier Transform Infrared Spectroscopy (FTIR) analysis. The synthesized lubricant were characterized according to American Society for Testing and Materials (ASTM) standard method based on these properties: Cloud point (ASTM D97), Point Pour point (ASTM D97), Specific gravity (ASTM D941-55) and Viscosity (ASTM D445). Experimental results has reviewed that the study did not successfully managed to produce TMP triester as the reaction mostly do not go to completion. These polyol based ester, however, exhibit suitable properties as it demonstrates comparable properties as a lubricant correspond to the standard lubricant ISO VG46.

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TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1. Research background

Lubricant is an organic substance used to reduce the friction between two contact surfaces as well as to prevent wear in machining. Higher demand of commercial lubricant is about 35-47 million tons per year globally (Hernández-Cruz et al., 2018; Mobarak et al., 2014). Lubricant is mainly made of mineral based substances which are toxic and non-biodegradable. The accidents of sources such as leaking and spills cause 50% of the lubricants were exposed to the environment (Hernández-Cruz et al., 2018). This issue has led to an environmental impact and increase in lubricant cost. It has been a significant concern in the research area to develop environmental friendly oil and also to explore the alternative solution for existing lubricant by introducing bio-based lubricant, also known as biolubricant. Vegetable oil based is preferred as the feedstock for production of biolubricant because of having criteria being a renewable resource, economical and non-toxic. The idea of biolubricant synthesis is not a new thing in oleochemical field since previous researchers has found that biolubricant gives similar lubricating properties as mineral based lubricant.

There are few studies has been discussed in the research papers for biolubricant production from the application of vegetable oil based such as palm oil, Jatropha curcas oil, rubber seed oil, karanja oil, rapeseed oil, waste cooking oil and sesame oil (Dodos, Zannikos, & Lois, 2011; Kamalakar, Rajak, Prasad, & Karuna, 2013; Menkiti, Ocheje, & Agu, 2017; Salih, Salimon, & Jantan, 2013; U. C. Sharma, Sachan, & Trivedi, 2018; E. Wang, Ma, Tang, Yan, & Wang, 2017; Y. Wang, Zhou, Zheng, & Sun, 2014). Some of these vegetable oils are edible as the food sources around the world. This might be a competition to apply the same source for synthesis of biolubricant. Besides, the higher in cost to produce biolubricant from virgin vegetable oil is also a concern to use much cheaper base stock (E. Wang et al., 2017). Therefore, research and development area has a greater interest to focus on the synthesis of biolubricant from base stock of waste material as much as to reduce the production costs.