

**UNIVERSITI TEKNOLOGI MARA**

**CHARACTERISATION OF TREATED SPENT  
LUBRICATING OIL USING ACTIVATED  
VOLCANIC MUD**

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Thesis submitted in fulfillment of the requirements  
for the degree of  
**Master of Science**

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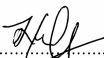
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## ABSTRACT

Spent or used lubricating oil generated from car engine is a hazardous waste that can pollute the soil, surface water or underground water as it contains toxic chemicals and heavy metals. Efforts are made to reuse this spent lubricating oil, if not properly managed can cause pollution to the environment. Bleaching clay is usually used to treat or improve the quality of spent lubricating oil. In this study, volcanic mud from Sabah was used as an alternative to bleaching clay to treat spent lubricating oil. The potential of the volcanic mud to improve the adsorption capacity of removing metals, impurities and carbonaceous particle in spent lubricating oil were investigated. The volcanic muds were first activated with sulfuric acid at four different concentrations namely 1M, 2M, 2.5M and 3M. The properties of the activated volcanic mud were analyzed by X-ray diffraction (XRD), fourier transform infrared spectroscopy (FTIR), atomic absorption spectrometry (AAS) and BET surface area. The properties of the treated spent lubricating oil were analyzed by the color of oil, inductive couple plasma (ICP), flash point, pour point and viscosity. The results showed that upon activating volcanic mud with sulfuric acid, the surface area and pore volume increased. This indicates that the adsorption capacity of activated volcanic mud improved. Further test such as changing color of oil, lowering flash point, pour point and viscosity support this fact. The volcanic mud that was activated with 3M  $H_2SO_4$  was found to be more effective than 1M, 2M and 2.5M to remove impurities in oil. Activated volcanic mud was then combined with bleaching clay at 75%, 50%, and 25% to find the efficiency of activated volcanic mud. The mixture of 25% activated volcanic mud and 75% of bleaching clays was found to achieve the same efficiency as 100% of bleaching clay. From these observations, we can conclude that the spent lubricating oil can be treated with activated volcanic mud. Hence, the quality of spent lubricating oil can be improved by adding mixture of the activated volcanic mud and bleaching clay.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background to the research

Lubricating oil is a useful resource and usually a petroleum based product. Since the Roman era, many liquids, including water, have been used as lubricants to minimize the friction, heat, wear and tear between mechanical parts in contact with each other. Lubricating oil is used to reduce friction and wear by interposing a film of materials between rubbing surfaces. Any class of lubricating materials applied as fluids are considered as lubricating oils (Wills, 1980). It is made from the more viscous portion of crude oil the in refinery that is known as base oil. On average, the lubricating oils contain about 93% base oils and 7% additives (Mang and Dresel, 2001). Base stocks used to formulate lubricants are normally of petroleum origin along with synthetic and vegetable oils, which may be incorporated for specialized applications. The performance of a finished lubricant, therefore essentially depends upon the type and quality of its base stocks and on the additives used.

Lubricants are classified into two major groups: automotive lubricants and industrial lubricants. Automotive lubricants have to perform in different types of vehicles, both petrol and diesel, under a variety of operating conditions. On the global lubricants market, automotive lubricants account for more than 60% of volumes sold. The rapid development of automotive industry has to certain extent stimulated the growth of lubricating oil industry. The adverse impact on the environment is the increasing volume of used lubricating oil which is considered as hazardous waste.