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PRODUCTION OF FATTY ACID METHYL ESTER (FAME) USING OPKS AND POTASSIUM AS A HETEROGENOUS CATALYST.

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ABSTRACT

Since biodiesel (FAME) burns more efficiently in the engine and has a higher oxygen content than traditional mineral diesel, less carbon dioxide, hydrocarbons, and particulates are released into the atmosphere when it is used in an engine. Transesterification of vegetable oil with methanol in the presence of a heterogeneous base is how FAME is performed. OPKS serves as a catalytic support for a catalyst (KOH). The primary goal was to determine the best reaction temperature (50,55,60 degree Celsius) where the high percentage yield of fatty acid methyl ester (FAME) is produced with the catalyst loading of 10wt%. To create a heterogeneous catalyst, the KOH solution was doped with OPKS and calcined at 500 °C for 4 hours before being cooled to room temperature. In order to produce FAME during the trans-esterification process, vegetable oil required to be heated at a 50-degree Celsius temperature. The yield percentage of FAME was calculated using GCMS in the analysis. The greatest results for the synthesis of FAME came from trans esterifying vegetable oil employing a catalyst with a KOH and a constant weight percent of 10%.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

Biodiesel is one of the main energy resources that is very important for the sustainability and cannot be separated from human life. It has been claimed as a renewable alternative energy as a substitution to the petroleum that have high cost of production and low in environmental-friendly aspect. Biodiesel is a mixture of fatty acid methyl ester produced from raw materials such as vegetable oil, animal oil, cooking oil and other oil that is suitable. A triglyceride (fat/oil) reacts with an alcohol to make esters and glycerol in the presence of a catalyst to produce biodiesel by the transesterification of vegetable oils with alcohol. Alcohol must be provided in excess to the reversible interaction between the fat or oil and alcohol in order to move the reaction in the appropriate direction and guarantee complete conversion.

Depending on whether it is in the same phase as or a distinct phase from the reactants, oil and alcohols, the catalyst may be homogeneous or heterogeneous. The use of homogeneous catalysts has some shortcomings in terms of efficiency and cost. It cost extra since the already-formed biodiesel still needs to be separated from its catalyst. A homogeneous catalyst can only be used once throughout production, making its use less effective. Because it is less corrosive, easier to separate, and more ecologically friendly, heterogeneous acid/base catalysts have been commonly utilised in transesterification reactions to circumvent this issue.

The carbonization of imperfect natural products led to the creation of Biochar, a brand-new kind of catalyst. In comparison to other solid acid catalysts, biochar offers higher stability and superior FFA esterification catalytic activity. The most recent and promising solid acid catalyst is made of biochar and is safe for the environment. The two-part process of making biodiesel (esterification and transesterification) can be completed in one step at a time with the use of a heterogeneous solid acid catalyst, which reduces the need for additional washing, neutralisation, and catalyst sophistication.

1.2 Literature Review

1.2.1 Fatty Acid Methyl Ester (FAME)

Fatty acid methyl ester or as known as FAME are one of the types of fatty acid that has been produce from the process of transesterification of fats such as oil and methanol. According to Umer Rashid 2019, fatty acid methyl ester has been produced about 70000 metric tons annually in Malaysia. From the number of productions, it has shown that the demand of Fatty acid methyl ester (FAME) is very high because of its advantages as it is regarded as an environmentally friendly product as a replacement of petroleum diesel. It also has widely used in the production of detergent, soap. Robiah Yunus 2019 also stated that fatty acid methyl ester had enjoyed its advantages over other type of fatty acid and oils because it has high miscibility in alcohol which is methanol where it can increase the mass transfer, a main component needed for high catalytic activity and conversion.

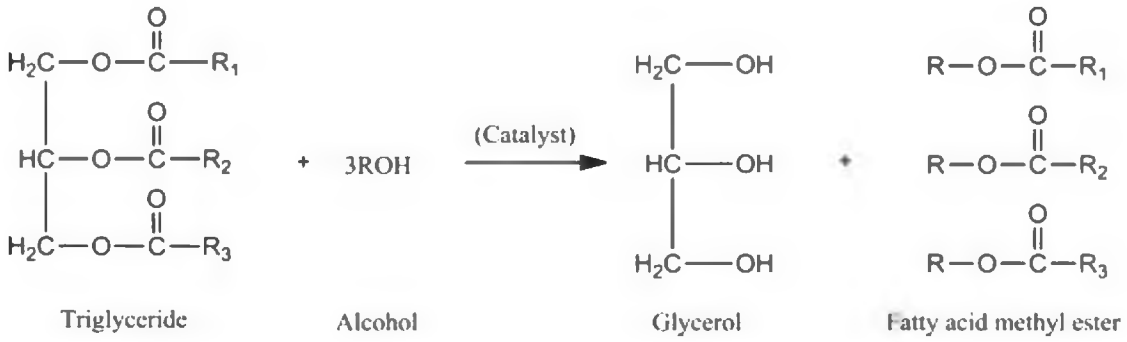

Fig 1. General transesterification reaction scheme

According to Azman Azid (2017), biodiesel or chemically known as FAME can be produce from the chemical reaction of feedstock either vegetables oil or animal fats and alcohol with or without the presence of catalyst. However, the transesterification process mainly with alcohol which is methanol can reduce the reaction rate and make the separation process of FAME and glycerol more difficult since the main method transesterification is sensitive to the free fatty acid (FFA) in the feedstock and consumed the basic catalyst.(Dian Celante, 2018) Several studies also stated that FAME can be produced using several types of oils known as edible oil including palm oil, sunflower oil, and soybean oil. Shengli Niu, 2020 also added that