TITLE: HETEROGENOUS NA/OPKS FOR BIODIESEL PRODUCTION

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ABSTRACT

My study is about the production of fatty acid methyl ester by using the Na heterogenous based catalyst from fresh cooking oil. The problem that causes my research is the proportion of oil converted to biodiesel has nothing to do with the reaction temperature. Because of this, my research is about to find the optimum reaction time for the fatty acid methyl ester produced to the highest yields which is 3.5 hours, 4.5 hours, and 5.5 hours. The objective of this study is to determine the effects of reaction times in transesterification process to produce fatty acid methyl ester (FAME). The methodology that I will conducting in this research are the preliminary clearing process, the process where the oil palm kernel shell will involve. In this process, the oil palm kernel shell that have been obtained from nearby palm oil factory will be wash first to get rid of fungi and debris that will interfere in later process. Next is activated carbon preparation from oil palm kernel shell, to make activated carbon, heat the OPKS in two separate furnaces for four hours each at 700°C and 800°C. Activated carbon should be sieved using a 250-micron sieve. Using a pestle and mortar, crush the carbonized OPKS until it is fine In three separate beakers, combine 1.74g of NaOH with 30 ml of distilled water while stirring with a glass rod. Add 4, 3, and 9g of carbonized carbon to the liquids in each of the three beakers once all the NaOH has been dissolved, and stir the mixtures over a hot plate set to 30°C. The temperature should be gradually raised to 40, 50, 60, and 70°C until 90% of the water has evaporated. Transesterification process as a main process in this research, Reheat the impregnation product at 500°C for three hours in the furnace to complete the calcination process. Give the furnace some time to cool. For the transesterification process, Collect new cooking oil, methanol, and catalyst prior to beginning the procedure. In this experiment, the 1:9 ratio between oil and methanol remained unchanged. Ensure that the mass percentage of the catalyst is 5% and the mass percentage of the oil is 95%. Prepare the 500 ml round-bottom flask with three necks and the heating mantle. To eliminate excess water, heat the palm oil to 100 degrees Celsius. Add NaOH dissolved in methanol to the palm oil at a constant temperature. Using a magnetic stirrer, stir the mixture at a constant revolutions per minute. In this method, the reaction time parameter will vary between 3.5 hours, and 4.5 hours, and 5.5 hours. Finally, the analysis process by using the gas chromatography-mass spectrometry. Then, this report will be discussed about the data and results that obtained by GC-MS analysis that will show the data for percentage yield of fatty acid methyl ester produced. In conclusion, certain reaction times must be observed to get a higher yield of fatty acid methyl ester (FAME). The highest yield was 62.28% fatty acid methyl ester at 4.5 hours reaction time. It because a long reaction time are important to produced fatty acid methyl ester.

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CHAPTER ONE

BACKGROUND

1.1 Introduction

There is evidence that palm oil was cultivated more than five thousand years ago. Palm oil has surpassed all other vegetable oils as the most popular choice for cooking. Palm oil, often known as palm fruit oil, originates from palm fruit. The fleshy center of an oil palm fruit (Elaeis guineensis). The high beta-carotene concentration gives this tropical fruit its distinctive red color. Palm nut oil, also called palm kernel oil, is made from the fruit's lone seed, or nut. Oil content ranges from 30-35% in every palm fruit. Research by (Gesteiro et al., 2019)

Shell from palm kernels is a byproduct of palm kernel processing. The kernel of the palm fruit is housed within the shell. In addition, the shell is encompassed by fleshy fiber containing palm oil. For the production of palm kernel shell, the fibrous, fleshy fruit must be processed in order to extract palm oil. In order to obtain the shell, however, it is possible to remove the fleshy fiber without regard for the palm oil. In order to obtain the palm kernel nut, the shell is obtained by cracking the shell. (Baffour-Awuah et al., 2021)

Biodiesel fuel is acknowledged as an environmentally beneficial and renewable alternative to petroleum diesel. Frequently, biodiesel fuel can be created via transesterification or alcoholysis reactions of animal fats, vegetable oils, microalgae, or waste cooking oils in the presence of alkaline or acidic catalysts. (Razavi et al., 2019)

Introduction

In this section, I will be described the reaction time impacts, heterogeneous catalyst, and oil to alcohol molar ratio. This parameter is essential to produce fatty acid methyl ester (FAME).

Literature Review

1.1.1 Reaction Time

The reaction time influences fatty acid methyl ester yields directly (FAME). In catalytic activity, reaction time is significant because methyl ester yield growth is proportional to time. Longer exposure to the catalyst and methanol decreases yield but increases the rate of fatty acid conversion. (Baskar et al., 2017) As response time increased, the rate of ester conversion increased. Due to the dispersion of the reactants in the mixture, the initial reaction is slow; but, after a certain period of time, the reaction develops rapidly. In general, the yield reaches its peak within three minutes of a reaction's initiation and remains relatively consistent as reaction time increases. (Colombo et al., 2017) In order to convert oil into biodiesel successfully, a significant reaction time is required. (Lin & Chen, 2017) The acid-catalyzed process requires more time and a greater temperature than the alkali-catalyzed reaction. (Gebremariam & Marchetti, 2017)

1.1.2 Heterogenous Base-Catalyst

The base-catalyzed transesterification reactions are substantially faster than their acid-catalyzed counterparts. Unlike its acid catalyzed sibling, the based catalyzed