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TITLE:
TRANSESTERIFICATION OF FATTY ACID METHYL ESTER USING NAOH AQUEOUS CATALYSTS

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ABSTRACT

The research looks at the transesterification process, which transforms triglycerides from vegetable oils into fatty acid methyl esters (FAMEs). Biodiesel is a renewable fuel that emits less CO2 than fossil fuels and is used in internal combustion engines. The research looks at how the methanol-to-oil molar ratio and catalyst concentration affect the production of FAMEs in the transesterification process, which employs waste cooking oil, methanol, and sodium hydroxide as catalyst. The experiment was carried out at 60°C for 30 minutes with a 1:3 oil-to-methanol ratio and 1% catalyst addition, which resulted in enhanced yield utilisation. The advice for additional research is to find the ideal reaction time for the best biodiesel generation while taking the molar ratio and catalyst concentration into account. An increase in reaction time to 60 minutes believed to result in higher yield utilization of FAME. Further research will aid the transition to sustainable fuels.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

Transesterification is a chemical process that involves the exchange of an ester molecule's alcohol group for another alcohol molecule. Transesterification is used to transform triglycerides present in vegetable oils or animal fats into fatty acid methyl ester (FAME). An aqueous solution of sodium hydroxide (NaOH), which acts as a base catalyst, catalyses the reaction. As a by-product of the process, FAME, glycerol, and water are produced. FAME is a typical biodiesel fuel, and the transesterification process is a critical step in producing biodiesel from renewable resources. Biodiesel is a sustainable alternative fuel created by the transesterification of vegetable oils and animal fats. The production of biodiesel from the transesterification process is affected by various parameters, including feedstock type, catalysts utilised, reaction conditions, and reaction time. Domestically generated biodiesel is a clean-burning, renewable alternative to petroleum diesel that improves energy security and contributes to environmental sustainability. The use of biodiesel in automobiles and power generators has various advantages, including improved air quality, lower greenhouse gas emissions, and less reliance on non-renewable fossil fuels. Biodiesel commercialization is likely to accelerate soon, with the fuel being used in diesel engines and electric generators.

The purpose of this research is to look at the manufacture of biodiesel from leftover cooking oil. Biodiesel is a renewable, biodegradable, and non-toxic alternative to fossil fuels that may be made from a variety of sources, including vegetable oils, animal fats, and algae. Because the use of edible oils creates problems regarding food availability, non-edible plant oils and edible oil waste products are desired. Biodiesel manufacturing produces 40% fewer CO2 emissions than petroleum diesel, making it ecologically benign. Previous research has revealed that the starting materials for transesterification must fulfil certain criteria, such as having a low acid value and being anhydrous. Transesterification by alkali is quicker than transesterification by acid, and sodium hydroxide is often utilised due to its inexpensive cost (Al-Tabbakh et al., 2016).

The purpose of the study is to examine the impact of temperature on the production of biodiesel from used cooking oil (WCO) using rice bran lipase (RBL) enzymes. The rising usage of fossil fuels, along with the depletion of global petroleum reserves, has prompted the quest for alternative fuels, such as biodiesel. Biodiesel is an environmentally benign, sustainable, and carbon neutral fuel manufactured from mono alkyl esters of long chain fatty acids. The classic technique of manufacturing biodiesel by transesterification processes with acidic or basic catalysts has several drawbacks, including soap contamination and significant energy and chemical consumption. Enzymatic transesterification using lipase enzymes is a more efficient process with several advantages, including the absence of soap formation and minimal energy needs. The study intends to employ RBL (Istiningrum et al., 2017).

The generation of biodiesel from waste materials such as river catfish oil (RCFO) and waste cooking oil was examined in this study (WCO). Before transesterification, the oils were processed with a catalyst generated from discarded eggshells. Using a one-factor-at-a-time method, the effects of catalyst loading and oil to methanol molar ratio on FAME yield were investigated. When compared to vegetable oil generated biodiesel, fish oil derived biodiesel had a higher cetane number and performed better in terms of lowering environmental pollution. The study attempted to use the non-edible sections of river catfish, a popular aquaculture species, as a viable feedstock source for biodiesel synthesis (Santya et al., 2019).

Biodiesel manufacturing is a significant strategy to lessen the environmental and human health impacts of energy usage. Vegetable oils are a dependable biofuel source. They cannot, however, be used directly as fuel in diesel engines and must be enhanced through the transesterification reaction. Numerous research has been conducted to evaluate various feedstocks for biodiesel production, including waste cooking oil, jatropha curcas, camelina, rice bran, butia yatay coconut oil, norouzak seeds, kutkura seed oil, and ricinus communis L. oil. This research studied the influence of several process factors on the qualities of the generated biodiesel, such as methanol to oil ratio, catalyst concentration, reaction temperature, and reaction time. According to the findings of these research (Hoseini et al., 2018).

Biodiesel is a green fuel generated from renewable sources that offers various advantages over fossil fuels, including being renewable, non-toxic, containing less pollutants, and emitting fewer hazardous gases. The key steps for manufacturing biodiesel include determining the quantity of free fatty acid in the parent oil and executing an acid-catalysed homogeneous esterification process to reduce the oil's FA