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BIODIESEL PRODUCTION FROM SUNFLOWER OIL BY TRANSESTERIFICATION METHOD.

BY

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**A PROJECT REPORT SUBMITTED TO THE FACULTY OF SCIENCE AND EDUCATION,
DEPARTMENT OF CHEMISTRY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE AWARD OF BACHELORS DEGREE IN SCIENCE EDUCATION IN BUSITEMA UNIVERSITY**

MAY, 2022

DECLARATION

I LODIM ROBERT LOMER declare that this research project report is my own original work otherwise cited, and where such has been the case reference has been stated and that the same work has not been submitted for any award in any other university or other tertiary institute of higher education.

Signature.....

Date.....

APPROVAL

This research review has been submitted for examination and has been approved by my supervisor.

Dr. Owor Richard Oriko

Signature.....

Date.....

DEDICATION

This research is dedicated: - to my dear parents *Mr. John Abong* and *Mrs. Joyce Loukae and straight talk foundation family* who have always supported me spiritually, emotionally, physically and financially in the entire walk in pursuing my dream. Special thanks also goes to my friends namely Akol Michael Owen, Loyep Gabriel Lochii, Longes Andrew, Kocho Andrew, Lokee Michael and Iriama John Chakuma and my siblings Kodet Emma lotee, Loyep Gabriel, Akol mark, Angella maria, Ilukol Anna and Looyan Samuel who have always supported me in their prayers. Not forgetting my uncles Angella Max Remy and Longole Paul who have always advised and guided me in my academic endeavours.

This research is also dedicated to my colleagues in the same race: Lokiru John Aleper, Mwozezi Derrick, Okongo Ian, Rotich Sam, Kisisho Walter, Chelimo Jabeth, Apio Mary Valentine, Moris Okiror, Chemutai Charity, Opige Hudson, Namaasa Bright and Oketta Gaspare obukka for their special time and support for the success of my research

ACKNOWLEDGEMENT

Special thanks goes to the almighty God for the gift of life, wisdom, knowledge good health and his mighty protection in the entire life both in and out of school not forgetting straight talk foundation.

With great pleasure, I also thank the fraternity of Busitema University, faculty of science and education Nagongera campus for their efforts to produce quality teachers.

With great honour to department of chemistry, and all the lecturers, namely Dr Kamoga Omar, Dr. Andima Moses, Dr. Richard Oriko Owor, Mr. Egor Moses and Mr. Musagala peter not forgetting the lab technicians Dr. Kigozi Moses and madam Nakijoba Lydia, for their entire commitment and time to support me from the start of the course to the end.

I also highly thank my supervisor Dr. Oriko Richard Owor who always guided me and provided necessary support towards completion of my research review.

Special appreciation goes to Lokiru John Aleper and chemistry students more so Chemutai Charity, Oketta Gaspare Obukka, Esther Nabwana, Kisisho Walter and all the students of faculty of science and education for the great company during the entire stay in Nagongera. Last but not least, I bow my head before Almighty God for the blessings bestowed upon me which made me to materialize this endeavours.

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SYMBOLS AND ABBREVIATIONS

WCO – Waste Cooking Oil

UCO – Used Cooking Oil

FFA – Free Fatty Acid

Fig. - Figures

HPLC – High Performance Liquid Chromatography

UV – Ultraviolet

AV – Acid Value

SV – Saponification Value

EV – Ester Value

PV – Peroxide Value

MW – Molecular Weight

FAME – Fatty Acid Methyl Ester

AMS – American Society for Testing and Materials

VFSO– Vacuum Fried Sunflower Oil

RSFO – Refined Sunflower Oil

SFME –Sunflower Methyl esters

USO – Used Sunflower Oil

CV -Calorific Value

°C – Degree Celsius

ABSTRACT

Growing concern regarding energy resources and the environment has increased interest in the study of alternative sources of energy. To meet increasing energy requirements, there has been growing interest in alternative fuels like biodiesel to provide a suitable diesel oil substitute for internal combustion engines. Biodiesels offer a very promising alternative to diesel oil since they are renewable and have similar properties. It is a promising substitute as an alternative fuel and has gained significant attention due to the predicted shortness of conventional fuels and environmental concern. The utilization of liquid fuels such as biodiesel produced from waste cooking oil by trans esterification process represents one of the most promising options for the use of conventional fossil fuels. However, as the biodiesel is produced from vegetable oils and animal fats, there are concerns that biodiesel feedstock may compete with food supply in the long-term. Hence, the recent focus relies on using waste cooking oil as the substantial feed stocks for biodiesel production.

In this study, cooking oils such as refined sunflower oil, vacuum fried sunflower oil and used soya bean oil has been subjected to trans esterification reaction by catalytic method obtaining the biodiesel. In the catalytic trans esterification free fatty acids and water always produce negative effects since the presence of free fatty acids and water causes soap formation, consumes catalyst, and reduces catalyst effectiveness. Pre-treatment of oils were employed to reduce the moisture content of the oils. Acid esterification prior to alkali esterification was employed to neutralize the FFA content which reduced the FFA content for alkali esterification increasing the yield up to 97%

CHAPTER I

INTRODUCTION

Biodiesel is defined as fuel with mixture of mono-alkyl esters of long chain fatty acids. It is usually derived from renewable sources for example vegetable oils or animal fats. Direct use of vegetable oils is not advisable as it will affect the engine performance as well as initiate more problems to the engine. All these setbacks are caused by the high viscosity of vegetable oils. To overcome the problems, transesterification process is used in order to reduce the viscosity of the vegetable oils as well as animal fats into the desired level (Demirbas, 2018). Transesterification in addition can be classified into several approaches like alkaline catalyzed transesterification, acid catalyzed transesterification, heterogeneous catalyst transesterification process, acid –alkaline catalyzed two stage and enzyme catalyzed as has been studied by (Rashid, U., Anywar, F., 2017). Biodiesel or also known as FAME fatty acid methyl ester is acknowledged to be biodegradable, zero toxic level and also produce little emission when being used in engines. The name of biodiesel was first started by National Soy Diesel Development Board or known as National Bio-diesel Board in 1992 corresponding to (Mendef, 2016). Biodiesel is free from any petroleum products but can be used in conventional diesel engines or blend it with fossil based diesel. This is due to the fact that its properties are almost similar or identical with conventional diesel. Biodiesel has slightly different physical properties compared to fossil fuel diesel. The sulphur content, flash point and aromatic content all are better than diesel even though the 7 energy produce is lower than conventional diesel. Biodiesel do not has any sulphur while having zero aromatic scent and higher cetane number. With this, it is expected to help in reducing pollution caused by emission from transportation. Nonetheless, the price of vegetable oils restricts the widespread use of biodiesel. Limited availability as well as restricted land for growing oilseeds has been major issues in biodiesel production (Zamberi, 2017). the current price of virgin vegetable oils, the price of biodiesel would be 1.5 times higher than current price of retail diesel fuel. By using waste vegetable oils, the cost of biodiesel production would drop about 60-70 because the price of vegetables oils covered almost 95% of total cost of biodiesel production. (Diwani .G. E ,Attia. N.K, Hawash.S.I, , 2019) emphasized that there is huge amount of waste vegetable oil (WVO) generated daily by restaurants, fast food restaurants and food processing industries all around the world. A little amount of the WVO is used for goods like soap processing and as an additive in fodder making. Nevertheless, vast amount of it is unloaded onto landfills or being dumped illicitly into rivers and sea. This definitely has its consequence in the long term towards the sustainable environment as well as its effect on human. As an alternative, the sunflower oil could be used to produce biodiesel and use it for better purpose.

1.1 PROBLEM STATEMENT

Currently the growing concern regarding energy resources and the environment has increased interest in the study of alternative sources of energy. To meet increasing energy requirements, there has been growing interest in creating an alternative of biofuels like biodiesel to provide a suitable diesel oil substitute for internal

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