Comparative Biodiesel Synthesis using Biowaste-based Catalysts

BANKOLE Isaac Sewanu
LCU/PG/1779

Being a MSc Thesis Submitted to the Department of Chemical Science, Faculty of Natural and Applied Sciences, Lead City University, Ibadan, Oyo State, Nigeria

In Partial Fulfillment of the Requirements for the Award of Master Degree (MSc) in Industrial Chemistry

2023

Certification Page

This is to certify that Isaac Sewanu **BANKOLE** with matriculation number **LCU/PG/1779** carried out this research work titled "Comparative Biodiesel Synthesis using Biowaste-based Catalysts in Southwest Nigeria" in the Department of Chemical Sciences, Faculty of Natural and Applied Sciences, Lead City University, Ibadan, Oyo state, for the award of Master Degree (MSc) in Industrial Chemistry and that this has not been previously submitted.

……

……

Dr. Olayinka K. Oderinde Date

Supervisor

…… ……

Prof. Ighodaro, M.O Date

Head of the Department

Dedication

This research work is dedicated to God Almighty and to all Chemistry Educators

Acknowledgement

My first appreciation is to the Almighty God for giving me the enabling grace and mercy throughout the course. This thesis would not have been completed without the support of many great men and women. I appreciate the Laboratory Technologists and all staff of Federal University of Agriculture, Abeokuta, Ogun State Institute of Technology, Igbesa, Ogun State, Covenant University, Ota, Ogun state and Bowen University, Iwo, Osun State, for allowing me use of their laboratories for the conduct and analysis of the samples used for the thesis.

I say very big thank you to my supervisor, Dr. Olayinka Oderinde for his patience, tolerance, unrelenting support and guidance that saw me through this thesis. My special thanks to Prof. Macdonald Ighodaro, the Head of Chemical Sciences Department and Dr. O.O. Ogunlaja, the Coordinator of Chemistry Unit for their advice, encouragement and corrections. The intellectual contributions of men and women of great honour in the Department cannot but be appreciated. They include Prof. Akinola K. Akinlabi, the Department's Postgraduate Coordinator, Dr. Abayomi O. Bamisaye, Dr. Sarah O. Oni, Dr Gabriel O. Oladipo, Dr John Dewole, Mr M.O. Bamidele and Mrs Morenikeji O. Adeshina. Also, I owe my colleagues, Mr Abati M. Shakirudeen, Miss Adaramaja A. Abisoye, Mrs. Adedeji A. Olubunmi, Miss Akintobi A. Oluwakemi, Mrs Asaolu R. Oluwabukola, Mrs. Omolola A. Ifeoluwapo and Miss Samuel M. Omolola for their encouragement and support that kept me through the programme. The guidance and support given by Prof. Samuel O. Sojinu, Dr. Samuel O. Babajide and Dr. Kayode Koleoso are greatly appreciated.

My sincere appreciation to Mrs. Esther Oluwatowo and Oluwaremilekun Bankole for their love and sacrifices that made it possible for me to complete this work. I appreciate all my children for their cooperation and support during the period of this course. The contributions of Late Chief and Mrs. John Gbediga Bankole, the Baale of Idoye must not go on

unappreciated. They showed me the light and importance of Education. I appreciate in a special way the encouragement and prayers of Rev and Mrs. Sola Aborode the under shepherd of Bethsaida Baptist Church, Atan – Ota.

Despite the fact that the above-mentioned institutions and persons have assisted me in the process of this research work, I, alone stand responsible for the errors, if any, found in the work.

Abstract

Over the last three decades, effort of chemists has been geared towards the search for an ecofriendly fuel as an alternative to fossil fuel. The search light has been beamed at plant seed oil and waste. This study compared the biodiesel synthesis from *Chrysophyllum albidum* using biowaste -based catalysts of African star apple shell and cow bone. The seeds were collected, washed, dried and cracked. The mesocarp (cotyledon) was separated from the shells, cut into pieces, sundried and was mechanically powered. The powder was Soxhlet extracted for oil using mixture of methanol and n-hexane in ratio 50:50mL as solvent. Four catalysts used were pristine African star apple (ASA) seed shell, carbonized waste Cow bone, sulphonated ASA shell and sulphonated cow bone characterized with XRD and FTIR while GC-Ms was used for characterization of the biodiesel. The result shows that the percentage oil extracted from the African star apple seeds with the mixture of n-hexane and chloroform in a ratio 50:50mL was 28.88%. The percentage biodiesel yield using pristine African star apple shell catalyst was 72.90 % while using carbonized cow bone catalyst was 74.60% as the highest catalyst dose of 1g. The biodiesel yield with 1g catalyst dose of sulphonated African star apple shell catalyst was 75.50% while using sulphonated cow bone catalyst was 78.40%. The study concluded that the sulphonated Cow bone catalyst was more effective for the production of biodiesel and that the African star apple seed oil yield is not sufficient for the feedstock of commercial production of biodiesel but can be used for other industrial purposes.

Keywords: African Star Apple, Biowaste, Cow bone, African Star Apple Shell, Biodiesel

Word Count: 264

Table of Contents

List of Tables

List of Figures

List of Figures

List of Acronyms

Abbreviation		Meaning
ASA	-	African Star Apple
ASASC	-	African Star Apple-Shell Sulphonated Catalyst
ASASO	-	African Star Apple Seed Oil
CBSC	-	Cow Bone Sulphonated Catalyst
CASAS	-	Carbonized Africa Star Apple Shell
CCB (Pristine)	-	Carbonized Animal Bone