DESIGN, FABRICATION, AND TESTING OF A MOTORIZED SCREW-TYPE COPRA OIL EXPELLER WITH INTEGRATED ACTIVATED CHARCOAL FILTRATION

AN UNDERGRADUATE THESIS

Presented to the Faculty of
College of Agriculture and Forestry
MISAMIS UNIVERSITY – Ozamiz City
H.T. Feliciano St., Aguada, Ozamiz City, Misamis Occidental

In Fulfillment
of the Requirements for the Degree
BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING

JONAFE M. OLHON
JE TON CRAIG L. PADOGDOG

May 2026

Misamis University
Ozamiz City, Philippines 7200
Tel. No. +63 88 521 0367 / Telefax No. +63 88 521 2917
Website : http://www.mu.edu.ph
CERTIFIED: ISO 21001:2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)

CERTIFICATE OF PANEL APPROVAL

This research paper, entitled **"DESIGN, FABRICATION, AND TESTING OF A MOTORIZED SCREW-TYPE COPRA OIL EXPELLER WITH INTEGRATED ACTIVATED CHARCOAL FILTRATION"**, prepared and submitted by, JONAFE M. OLHON, in fulfillment of the requirements for the degree of **Bachelor of Science in Agricultural Biosystems Engineering,** has been examined and is recommended for acceptance and approval.

ENGR. BERNIE P. AGUSTIN, MBA
Adviser
06 - 01 - 26
Date

Approved by the Committee of Oral Examination with a grade of ***Passed.***

OLIVER S. TALIP, Ph.D.
Chairman
06 - 01 - 26
Date

YUNALYN L. VILLANTES, Ph.D.
Member
05 - 29 - 26
Date

GETHER P. ENARIO, Ph.D.
Instructor/Member
06 - 01 - 26
Date

Accepted and approved in fulfillment for the degree Bachelor of Science in Agriculture.

OLIVER S. TALIP, Ph.D.
Dean, College of Agriculture and Forestry
06 - 01 - 26
Date

DEDICATION

We dedicate this thesis to God for His constant guidance, strength, and wisdom throughout our journey. We are deeply grateful for His presence, which gave us hope and perseverance in times of difficulty.

We also dedicate this work to our beloved parents, whose unwavering support, sacrifices, and encouragement made this achievement possible. Their love and belief in us have been our greatest source of motivation in overcoming every challenge. We sincerely thank them for their patience, understanding, and continuous prayers for our success. This accomplishment reflects their efforts and God's grace in our lives.

Above all, we dedicate this thesis to ourselves for our perseverance, hard work, and determination throughout this journey. Despite the challenges, pressures, and sacrifices we faced, we remained committed to achieving our goals and completing this study successfully. This accomplishment serves as a reminder that with patience, teamwork, and faith in our abilities, we can overcome any obstacle and reach our aspirations.

Jonafe M. Olhon

Je ton Craig L. Padogdog

ACKNOWLEDGEMENT

The authors would like to extend their heartfelt gratitude to all the individuals who contributed to the completion and success of this study.

Above all, they offer their sincerest thanks to God Almighty for providing strength, wisdom, guidance, and blessings throughout the entire process of conducting this research.

They are deeply grateful to their parents and families for their endless love, understanding, encouragement, and financial and emotional support. Their sacrifices and motivation served as inspiration for the researchers to continue despite the challenges encountered during the study.

They would also like to express their sincere appreciation to Dr. Gether P. Enario, their statistician and thesis instructor, for sharing his knowledge, giving valuable advice, and guiding the researchers in improving the quality of the study.

Special thanks are also given to Engr. Bernie Agustin, the authors' adviser, for his patience, support, suggestions, and guidance that greatly helped in the completion of this research.

They likewise acknowledge their friends and schoolmates for the encouragement, ideas, and motivation they shared throughout the conduct of the study.

Warm appreciation is also extended to Al's Machine Shop for their assistance and efforts in the fabrication of the machine used in this research.

Lastly, they would like to thank everyone who, in one way or another, showed concern, support, and encouragement for the success of this study. This accomplishment would not have been possible without all of their help and support.

Jonafe M. Olhon

Je ton Craig L. Padogdog

TABLE OF CONTENTS

	Page
TITLE PAGE	i
APPROVAL SHEET	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF APPENDICES	x
ABSTRACT	xi
INTRODUCTION	
Background of the Study	3
Objectives of the Study	3
Hypothesis of the Study	4
Significance of the Study	4
Scope and Limitation	6
Definition of Terms	7
MATERIALS AND METHODS	
Date and Place of the Study	8
Materials	9
Methods	
Design Conceptualization	11
Fabrication of the Machine	11
Testing Performance	13
Experimental Procedure	15
Data Gathered	16
Statistical Analysis	17
RESULTS AND DISCUSSION	
Design Conceptualization	20
Performance Evaluation of the Machine	24
Cost Analysis and Evaluation of the Machine	27

Technology Readiness Level (TRL) of the Developed Machine 28
CONCLUSION, AND RECOMMENDATION 31
REFERENCES CITED 36
APPENDICES 59
CURRICULUM VITAE 51

LIST OF TABLES

TABLE NO.	TITLE	PAGE
1	Mean values and significance levels for all performance variables	20
2	Summary of two-way ANOVA results	22
3	Cost and Return Analysis of the Motorized Screw-Type Copra Oil Expeller with Integrated Activated Charcoal Filtration (per Batch of 2 kg Copra)	24
4	Machine Fabrication Cost	24
5	Breakeven Analysis (Farmer uses own copra harvest)	25
6	Materials Used Throughout the Fabrication Process	38
7	Treatment, treatment combinations, treatment codes of the study on Design, Fabricate, and Test of a Motorized Screw-type Copra Oil Expeller with Integrated Activated Charcoal Filtration	39
8	Data on Time, Oil Yield, Weight of Residue, Extraction Efficiency, and Processing Capacity of the Study	41
9	ANOVA of the Pressing Time of the Copra Under Different Levels of Copra Sizes and Weights	42
10	Tukey HSD Analysis of Pressing Time of Copra Under Different Levels of Copra Sizes	42
11	Tukey HSD Analysis of Pressing Time of Copra Under Different Levels of Copra Weights	42
12	ANOVA of the Oil Yield of the Copra Under Different Levels of Copra Sizes and Weights	43
13	Tukey HSD Analysis of Oil Yield of Copra Under Different Levels of Copra Sizes	43
14	Tukey HSD Analysis of Oil Yield of Copra Under Different Levels of Copra Weights	43
15	ANOVA of the Extraction Efficiency Under Different Levels of Copra Sizes and Weights	44
16	Tukey HSD Analysis of Extraction Efficiency Under Different Levels of Copra Sizes	44
17	Tukey HSD Analysis of Extraction Efficiency Under Different Levels of Copra Weights	44
18	ANOVA of the Processing Capacity Under Different Levels of Copra Sizes and Weights	45

19	Tukey HSD Analysis of Processing Capacity Under Different Levels of Copra Sizes	45
20	Tukey HSD Analysis of Processing Capacity Under Different Levels of Copra Weights	45
21	Mean and Standard Deviation of the Results Under Different Levels of Copra Sizes	46
22	Mean and Standard Deviation of the Results Under Different Levels of Copra Weights	46

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1	Map showing the location of the study area	7
2	Frame of the Machine	17
3	Hopper of the Machine	17
4	Extraction Chamber of the Machine	18
5	Activated Charcoal Filter	18
6	Drive System of the Machine	19
7	An image showing an isometric view of the 3D design model	19
8	Outer Barrel of the Machine	47
9	Screw and Threaded roller of the Machine	47
10	Frame of the Machine	47
11	Drive System of the Machine	48
12	Fabricated Machine	48
13	Initial Testing of the Machine	48
14	Experimental Testing of the Machine	48
15	Oil Filtration of the Oil Using Activated Charcoal	48
16	A screenshot showing the Turnitin result	49
17	A screenshot showing the writing quality using Grammarly	50

LIST OF APPENDICES

APPENDICES	TITLE	PAGE
A	Material Specification of the Machine	39
B	Treatments, Treatment Combinations, and Treatment Codes	40
C	Experimental Layout	41
D	Data Table	42
E	ANOVA Table	43-47
F	Documentation	48-49
G	TURNITIN Result	49
H	GRAMMARLY Result	50

ABSTRACT

This study focused on the design, fabrication, and testing of a motorized screw-type copra oil expeller with integrated activated charcoal filtration intended for coconut oil extraction suitable for small-scale coconut farmers. The machine was developed to improve the extraction and filtration process through a single operating system. Performance testing was conducted using different copra sizes and batch weights to determine their effects on pressing time, oil yield, extraction efficiency, and processing capacity. A Completely Randomized Design (CRD) with a 3 × 3 factorial arrangement and three replications was employed in the study. Results showed that copra size and copra weight significantly influenced the performance of the machine. Medium-sized copra (0.75 inch) produced the highest oil yield, while smaller copra sizes resulted in shorter pressing time and higher processing capacity. Larger batch weights generated greater oil yield and processing capacity; however, extraction efficiency decreased as batch weight increased. Significant interaction effects between copra size and batch weight were observed for extraction efficiency, indicating that both factors influenced oil recovery performance. The combination of smaller copra size and lower batch weight produced the highest extraction efficiency. The developed machine successfully integrated oil extraction and activated charcoal filtration into a single system and achieved Technology Readiness Level (TRL) 4, indicating successful laboratory validation of the prototype. The findings suggest that the developed machine has potential for efficient coconut oil extraction and filtration under controlled operating conditions.

Keywords: *pressing time, oil yield, extraction efficiency, processing capacity.*