

**DEVELOPMENT AND PERFORMANCE EVALUATION
OF COCONUT FIBER POT MAKING MACHINE**

**ALLYSSA MARI B. CARREON
DANIELA G. MAGBITANG**


An Undergraduate Thesis Submitted to the Faculty of the Department of Agricultural
and Biosystems Engineering, College of Engineering, Central Luzon
State University, Science City of Muñoz, Nueva Ecija, Philippines
in Partial Fulfillment of the Requirements
for the Degree of

**BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS
ENGINEERING
(AB Machinery and Power Engineering)**

JULY 2024

ACCEPTANCE SHEET

This undergraduate thesis entitled "DEVELOPMENT AND PERFORMANCE EVALUATION OF COCONUT FIBER POT MAKING MACHINE" prepared and submitted by **ALLYSSA MARI B. CARREON** and **DANIELA G. MAGBITANG**, in partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS (AB MACHINERY AND POWER ENGINEERING)**, is hereby accepted:


ROY SEARCA JOSE P. DELA CRUZ
Member, Advisory Committee


06-21-24

Date Signed


MARLON V. BELOS SANTOS
Member, Advisory Committee

06-21-24


Date Signed


RUEL G. PENEYRA
Chair, Advisory Committee

06-21-24

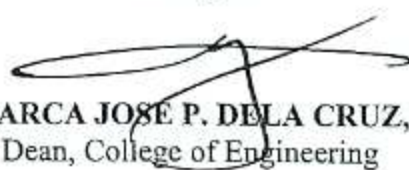
Date Signed

Accepted as partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING (AB MACHINERY AND POWER ENGINEERING)**:


JOHN PAULO C. SACDALAN, Ph. D.
Head, Department of Agricultural and Biosystems Engineering

06-21-24

Date Signed


ROY SEARCA JOSE P. DELA CRUZ, Ph. D.
Dean, College of Engineering

06-21-24

Date Signed

BIOGRAPHICAL SKETCH

Allyssa Mari Bernal Carreon was born on February 12, 2001, in Guimba, Nueva Ecija. She is the second oldest daughter of Mr. Edwin Carreon and Mrs. Marilou Carreon. She finished her elementary education at Guimba East Central School. She attended Bartolome Sangalang High School from 2013 to 2017 and went on to complete her Senior High School Education (2017-2019) at Our Lady of the Sacred Heart College of Guimba, Inc., taking up the General Academic Strand (GAS).

Daniela Grospe Magbitang was born on October 26, 2000, in San Jose City, Nueva Ecija. She is the youngest of Daniel Ratcho Magbitang's five children with Gina Grospe Magbitang. She finished her elementary education at Bagong Sikat Elementary School in 2013. Daniela attended Constancio Padilla National High School from 2013 to 2017, where she continued her academic success. She then went on to complete her Senior High School education (2017-2019) at San Jose City National High School in San Jose City, focusing on Accountancy and Business Management (ABM).

They are both currently pursuing their bachelor's degree in Agricultural and Biosystems Engineering at Central Luzon State University (CLSU). Their undergraduate thesis, "Development and Performance Evaluation of Coconut Fiber Pot Making Machine," was inspired by their desire to go further into their field of study, demonstrating their commitment to comprehensive research along with knowledge development. As important contributors, their combined efforts represent a significant step toward a more effective future.

ACKNOWLEDGMENT

The thesis's achievement was made possible by the contributions of various persons who devoted their time and effort to the writers, eventually contributing to the paper's success.

First and foremost, to their thesis adviser, Sir Ruel G. Peneyra, for his patience and unwavering guidance that greatly helped them with the progress of their study. His expertise and encouragement have been instrumental in shaping the direction and quality of this study. They consider themselves extremely fortunate to have him as their mentor.

To the members of their thesis committee, Sir Marlon T. Delos Santos and Sir Roy Searca Jose P. Dela Cruz, for sharing their insightful comments, directions, and constructive feedback which significantly broadened their thesis from various perspectives.

To their fabricator, they are eternally grateful for lending his time and knowledge, which greatly helped in the completion of this thesis. They are genuinely in awe of the effort he has given them to accomplish everything in due course.

To their family and friends, who provided them with the much needed emotional and financial support – the research endeavor would not have come to fruition without you unwavering love, prayers, understanding, and encouragement. Their presence not only made this journey bearable, but fulfilling.

Above all, they are grateful to Almighty God for giving them the wisdom, tenacity, fortitude, and guidance required to finish this work. Lord, thank You for giving them hope throughout their lowest moments.

ALLYSSA MARI B. CARREON
DANIELA G. MAGBITANG

TABLE OF CONTENTS

	PAGE
INTRODUCTION	
Background of the study	1
Statement of the problem	2
Objectives of the study	2
Significance of the study	3
Scope and Limitation of the study	4
Time and place of the study	4
REVIEW OF RELATED LITERATURE	
Coconut waste	5
Coconut fiber	5
Developing coconut fiber	9
Bio-based pots	10
Coconut fiber pot production	11
Traditional production of coconut fiber pot	12
Binder use in coconut fiber pot	12
The benefits of growing plants in coconut fiber pot	13
METHODOLOGY	
Conceptualization of the study	16
Flowchart of activities	18
Collection and preparation of materials	19
Materials preparation and making process of coconut fiber mat	19
Design considerations	20
Design of coconut fiber pot making machine	23
Coconut fiber pot molding	24
Fabrication of the machine	24
Preliminary testing of the machine	25
Data gathered	25
Evaluation of the different performance parameters	26
Machine capacity	26
Molding efficiency	26
Testing and evaluation of the product	26
Durability and stability	26
Experimental design	26
Comparison of means	27
Coconut fiber to binder ratio	27
Cost Analysis	28
Fixed cost	28

Depreciation	29
Interest on investment	29
Repair and maintenance	30
Taxes, investment and housing	30
Variable cost	30
Total cost	30
Annual capacity	30
Unit cost of production	31
Break-even point	31
Gross income	31
Net income	31
Payback period	32
RESULTS AND DISCUSSION	
Coconut fiber pot making machine	33
Machine performance	34
Machine capacity	34
Molding efficiency	35
Coco fiber mat dimension	35
Pot dimension	36
Pot shape	36
Durability test of coconut fiber pots	37
Cost analysis	38
Environmental impact and sustainability	40
SUMMARY, CONCLUSION AND RECOMMENDATIONS	
Summary	43
Conclusion	44
Recommendation	45
LITERATURE CITED	46
APPENDICES	48

LIST OF TABLES

TABLE		PAGE
1	Specifications of the mold mechanism of the coconut fiber pot making machine	22
2	Coconut fiber to binder ratio	28
3	Specifications of coconut fiber pot making machine	34
4	Machine performance	35
5	Specifications of the coco fiber mat	36
6	Durability test of the coconut fiber pots	37
7	Assumptions for the cost analysis of coconut fiber pot making machine	38
8	Operational cost of coconut fiber pot making machine	39
9	Cost analysis of the coconut fiber pot making machine	40

LIST OF FIGURES

FIGURES		PAGE
1	The components of a coconut.	6
2	Cross section (a) and longitudinal section (b) of coconut fibers.	7
3	Conceptual framework of the study	17
4	Flowchart of activities	18
5	The coconut fiber pot making machine	33
6	Coconut fiber mat	36
7	Coconut fiber pot	37

LIST OF APPENDIX TABLES

APPENDIX TABLE		PAGE
1	ANOVA test for binder ratio efficiency	60
2	Post hoc test to determine the significance among the ratios	61

LIST OF APPENDIX FIGURES

APPENDIX FIGURES		PAGE
1	Weight of binder and water	49
2	Weight of coconut fiber	50
3	Frame and press of coconut fiber mat	50
4	Coconut fiber mats	50
5	Weight of coconut fiber mat per piece	51
6	Temperature at boiling point of water	51
7	Filling the lower mold with water	51
8	Positioning the mats into the mold	52
9	Pressing the mats into the mold	52
10	Coconut fiber pots	52
11	Weight of pot after cutting the excess	53
12	Height drop test	53
13	Weight of soil	53
14	Free fall drop testing of the pots	54
15	Pots after the free fall drop testing for ratio 2:1:1.3	55
16	Pots after the free fall drop testing for ratio 1:1 :1.3	55
17	Pots after the free fall drop testing for ratio 1:2:1.3	56
18	Actual sample of pots when they were planted with plants	57
19	Front and rear elevation of the machine	58
20	Left and right elevation of the machine	59

ABSTRACT

CARREON, ALLYSSA MARI B. & MAGBITANG, DANIELA G.,
Department of Agricultural and Biosystems Engineering, College of Engineering, Central
Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines, **July 2024,**
DEVELOPMENT AND PERFORMANCE EVALUATION OF COCONUT FIBER
POT MAKING MACHINE

Adviser: RUEL G. PENEYRA, M.Sc.

In response to the escalating environmental concerns surrounding the waste of coconut fiber or husk, the study introduces a pioneering solution by producing a commercial product from the said waste. This paved way to the development of a coconut fiber pot making machine. The machine incorporates the environmental sustainability of the production process of biodegradable pots using coconut fiber as the primary raw material. Transforming agricultural by-products into value-added materials. The coconut fiber pot making machine was designed to produce 4 pots per molding that can produced 88 pots per day and can be used for ornamental purposes.

The researchers produced coconut fiber mats using three different ratios of binder and water: 1:1, 1:2 and 2:1, to effectively establish the best ratio for the pot making. The study reveals that the 1:2 and 2:1 ratios are the best for molding pots, with no significant differences in durability. The 1:2 ratio, with 30 g of glue, 72 g of water, and 58 g of fiber, provides high durability and consumes less raw material, making it cost-effective and resource-efficient. This ratio is recommended for large-scale production and sustainability.

Keywords: coconut fiber; ratio; durability

LITERATURE CITED

- Akbarningrum Fatmawati, & Agustriyanto, R. (2015). Kinetic study of enzymatic hydrolysis of acid-pretreated coconut coir. *Nucleation and Atmospheric Aerosols*. <https://doi.org/10.1063/1.4938297>
- Amir Al-Ahmed, & Inamuddin. (2020). *Advanced Applications of Bio-degradable Green Composites*. Materials Research Forum LLC.
- Asmah Amir, Andi Hajar, Fatmawati Ramli, & Sitti Asmah. (2022). Empowerment of Housewives through Activities of Processing Coconut into Flower Pots at Palakka District. *International Journal of Community Engagement Payungi*, 2(1), 7–14. <https://doi.org/10.58879/ijcep.v2i1>.
- Azzaki, D. A., Iqbal, M., Maulidia, V., Arifin, A., Apriani, I., & Jati, D. R. (2020). POTENSI PEMANFAATAN LIMBAH SERABUT KELAPA (COCOFIBER) MENJADI POT SERABUT KELAPA (COCOPOT) (The Potential Utilization of Coconut Fiber Waste into Vase of Coconut Fiber (Cocopot)). *Jurnal Teknologi Lingkungan Lahan Basah*, 8(1), 039. <https://doi.org/10.26418/jtllb.v8i1.42730>
- Cherian, E., Arackal, J. J., Jayasree Joshi, T., & Anitha Krishnan, V. C. (2022). Biodegradable Pots—For Sustainable Environment. *Biodegradable Materials and Their Applications*, 653–671. <https://doi.org/10.1002/9781119905301.ch23>
- Dhanya, B. (2020). "Environmental impact of biodegradable pots in horticulture." *Environmental Science and Pollution Research*, 27(3), 3456-3464.
- Enokela, O. S., & O, A. P. (2012). Strength Analysis of Coconut Fiber Stabilized Earth for Farm Structures. 1(2), 5–11.
- Global Market Insights (2020). "Sustainable gardening products market forecast." *Industry Analysis Reports*, 8(3), 22-35.
- Maheswari, U. S., & Rao, K. P. (2019). "Manufacturing process and applications of coconut coir products." *Journal of Natural Fibers*, 16(3), 394-405.
- Market Research Future (2021). "Global biodegradable pots market analysis." *Market Research Reports*, 12(1), 34-46.
- Martins, A. P., & Sanches, R. A. (2019). Assessment of coconut fibers for textile applications. *Matéria (Rio de Janeiro)*, 24(3). <https://doi.org/10.1590/s1517707620190003.0743>

- Maulana, A., Udiantoro, U., & Agustina, L. (2019). Utilization of Waste Coconut Coir (*Cocos nucifera* L) and Palm Oil Empty Bunch Fiber (*Elais guineensis* JACQ) as a Combination of Raw Materials for Making Particle Board. *Ziraa'Ah Agricultural Scientific Magazine*, 44(1), 106. <https://doi.org/10.31602/zmip.v44i1.1724>
- Patel, R., & Kumar, A. (2019). "Sustainable agricultural practices using natural fibers." *Sustainable Agriculture Review*, 41, 233-250.
- Ru, S., Zhao, C., & Yang, S. (2022). Multi-Objective Optimization and Analysis of Mechanical Properties of Coir Fiber from Coconut Forest Waste. *Forests*, 13(12), 2033. <https://doi.org/10.3390/f13122033>
- Sasria, N. (2022). Composite Manufacturing of Coir Fiber-Reinforced Polyester as a Motorcycle Helmet Material. *JMPM (Jurnal Material Dan Proses Manufaktur)*, 6 (1). <https://doi.org/10.18196/jmpm.v6i1.13756>
- Why are pots typically wider at the top than at the bottom? (n.d.). Gardening & Landscaping StackExchange. <https://gardening.stackexchange.com/questions/2624/why-are-pots-typically-wider-at-the-top-than-at-the-bottom>