

**INVESTIGATION OF MECHANICAL AND PHYSICAL
PROPERTIES OF COMPOSITE MADE OUT OF
KITHUL FIBER WITH WASTE POLYETHYLENE**

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Department of Civil Engineering

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Thesis/ Dissertation submitted in partial fulfillment of the requirements for the
degree Master of Science/ Master of Engineering in Civil Engineering

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Abstract

In Sri Lanka, waste polyethylene leads to significant social and environmental issues. The optimal solution lies in the advancement of fiber-reinforced polymer matrix composites. Natural fibers made from agricultural waste have several benefits, including low cost and density, non-toxicity, and reduced concern for the environment and waste disposal issues.

The research study was conducted to determine the diameter, density, water absorption, SEM, FTIR, and tensile strength of these selected natural fibers.

The values for Palmyra and banana fibers obtained maximum average diameter and lowest average diameter are 523.0138 μm and 156.996 μm , respectively. Sisal fiber has the highest average density (1.159 g/cm^3), and Watakeiya fiber has the lowest average density (0.762 g/cm^3). The results of water absorption tests performed on seven fibers were analyzed. Banana and Watakeiya fibers had the highest water absorption value, while bamboo and Palmyra fibers had the lowest. Banana and sisal fibers had tensile strengths of 772.5 MPa and 586 MPa, respectively. Kithul fiber was selected as a natural fiber for the investigation.

Composite sheets were created using a hot press machine and kithul fibers of various weights with the appropriate polymer matrix, processing temperature, processing pressure, and kithul fiber length. The tests were conducted following ASTM D790 and D3039, respectively. When the kithul fraction was 10% of the total weight, the processing temperature was 150°C, the processing pressure was 30 tons, and the kithul fiber length was 10mm, the maximum tensile strength, and flexural strength were observed as 12.237 MPa and 12.51 MPa, respectively. The final product has an impact resistance of 66.67J/m and flammability of 20.85mm/min, respectively. The final application of this product cannot yet be defined. Further studies are suggested to finalize the application of this product.

Keywords: Kithul Fiber, Waste Polyethylene, Physical Properties, Mechanical Properties, Sustainable Construction Material

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Contents

Declaration	iii
Abstract	iv
CHAPTER 1	1
1.1 Introduction	1
1.1.1 Recycling of waste thermoplastics	3
1.1.2 Composites made of natural fiber-reinforced polymers (Thermoplastic composites)	7
1.1.3 Kithul fiber as a natural fiber in natural fiber polymer composites	7
1.2 Aims and Objectives	9
1.3 Scope	9
1.4 Thesis Outline.....	10
CHAPTER 2	12
2.1 Literature Review	12
2.1.1 Chapter Introduction	12
2.1.2 History of composite materials	12
2.1.3 Overview of composites.....	13
2.1.4 Natural fiber	17
2.1.5 Classification and Properties of natural fibers	17
2.1.6 Natural fiber as a fiber reinforcement in composite.....	19
2.1.7 Manufacturing of Polymer Composites	23
2.1.8 Matrix material.....	24
2.1.9 Thermoset.....	25
2.1.10 Thermoplastic.....	26
2.1.11 Properties of natural fiber composites.....	29
2.1.12 Advantages of Natural Fiber Composites [86]	30

2.1.13	Opportunities and Challengers	32
2.1.14	Uses for natural fiber composites.....	33
2.1.15	Opportunities and Challenges	Error! Bookmark not defined.
2.1.16	Chapter Summary.....	35
CHAPTER 3		37
2.1	Material and Method	37
2.1.1	Overview of the Experiment	37
	Stage One - Characterization of Natural Fibers and Waste Polyethylene	39
2.1.2	Preparation of natural fibers.....	39
2.1.3	Physical Properties of Fibers.....	40
2.1.2	Mechanical Properties of Fibers.....	43
2.1.4	Chemical Properties of Fibers.....	44
2.1.5	Chemical Properties of Waste Polyethylene	44
	Stage Two – Preparation of Kithul Fiber Reinforced Polymer Composite	45
2.1.4	Selection of natural fibers	45
2.1.5	Preparation of kithul fiber	45
2.1.6	Manufacturing of laminates sheets.....	46
2.1.7	Manufacturing of composite materials.....	47
2.1.8	Tensile Strength	51
2.1.9	Three-Point Bending Strength.....	52
2.1.1	Impact Test.....	52
2.1.2	Water Absorption	54
2.1.3	Thickness Swelling Test	55
2.1.4	Flammability Test	56
CHAPTER 3		57
2.1	Results and Discussion	57

2.1.1	Characteristics of the selected natural fibers.....	57
2.1.2	Characteristics of the waste polyethylene	58
2.1.3	Physical Properties of Natural Fibers.....	59
2.1.4	Mechanical Properties of Natural Fibers.....	67
2.1.5	Chemical Properties of Natural Fibers.....	68
2.1.6	Summary of the section one.....	72
2.1.7	Chemical Properties of Selected Polyethylene Sample	73
2.1.8	Tensile Strength (Select the optimum ratio)	75
2.1.9	Flexural Strength (Select the optimum ratio).....	80
2.1.10	Tensile Strength (Select the optimum temperature).....	85
2.1.11	Flexural Strength (Select the optimum temperature).....	87
2.1.12	Tensile Strength (Select the optimum pressure)	89
2.1.13	Flexural Strength (Select the optimum pressure).....	91
2.1.14	Tensile Strength (Select the fiber length).....	93
2.1.15	Flexural Strength (Select the fiber length).....	96
2.1.16	Impact Strength	98
2.1.17	Water Absorption	100
2.1.18	Thickness Swelling Test	103
2.1.19	Flammability Test	104
CHAPTER 4	106
4.1	Conclusion.....	106
	Recommended Future Studies.....	108
	References	109

Figures

Figure 1: In Sri Lanka, there is an increase in the use of plastic	2
Figure 2: Classification of reinforcement composites using the dispersed phase.....	15
Figure 3: Matrix-based composite classification	16
Figure 4: The categorization of natural fibers.....	18
Figure 5: Different fabrication processes of composites	23
Figure 6: HDPE profile	28
Figure 7: Selected natural fibers	39
Figure 8: Collected Kithul fibers.....	46
Figure 9: Purchased Polyethylene.....	46
Figure 10: Hot Press Machine and Prepared Laminated Sheets	47
Figure 11: Hot Press machine and prepared composite board.....	48
Figure 12: Tensile strength machine and tensile test specimens.....	52
Figure 13: Universal testing T-machine.....	52
Figure 14: V-notch marker and Cantilever Beam (Izod –Type) Impact Machine.....	53
Figure 15: Analytical balance with the test specimen.....	55
Figure 16: Software-controlled Metallurgical Microscope and diameter measurement of Banana fiber.....	60
Figure 17: Results of water absorption of natural fibers.....	63
Figure 18: FTIR spectra of the banana fiber	69
Figure 19: FTIR spectra of the coir fiber	69
Figure 20: FTIR spectra of the Watakeiya fiber	70
Figure 21: FTIR spectra of the kithul fiber	71
Figure 22: FTIR spectra of the Palmyra fiber	71
Figure 23: FTIR spectra of the Sisal fiber.....	71
Figure 24: FTIR spectrum of a bamboo fiber sample	72
Figure 25: FTIR test for selected polyethylene sample	73
Figure 28: Variation of tensile strength with kithul fraction.....	77
Figure 29: Variation of flexural strength with kithul fraction.....	80
Figure 30: Prepared composite boards with improper bonding	84
Figure 31: Variation of tensile strength with composite processing temperature.....	85

Figure 32: Variation of flexural strength with temperature	87
Figure 33: Variation of tensile strength with pressure	90
Figure 34: Variation of flexural strength with pressure	91
Figure 35: Variation of tensile strength with fiber length.....	94
Figure 36: Flexural strength varies with fiber length.....	96
Figure 37: Cantilever Beam (Izod –Type) Impact Machine and Prepared samples ..	98
Figure 39: Water absorption for first test series (All 4 edges and two surfaces of samples exposed to water)	102
Figure 40: Water absorption for second test series (Two surfaces exposed to water and the other 4 sides are properly sealed with waterproofing material).....	102
Figure 41: Thickness swelling	104

Tables

Table 1: Characteristics of synthetic and natural fibers	19
Table 2: Products and applications of natural fibers	21
Table 3: Properties of High-Density Polyethylene	28
Table 4: Mechanical characteristics of natural and synthetic fibers	30
Table 5: Sample preparation plan according to the kithul weight fraction (% of total weight).....	48
Table 6: Sample preparation plan according to the composite processing temperature (°C).....	49
Table 7: Sample preparation plan according to the composite processing pressure (tons)	50
Table 8: Sample preparation plan according to the fiber length (cm).....	51
Table 9: Diameter values of the selected fibers	60
Table 10: Diameter of natural fibers	61
Table 11: Density values of the fibers.....	62
Table 12: SEM images of the cross-section and longitudinal surface of the chosen fibers.....	64
Table 13: Tensile strength and Young's Modulus of the fibers.....	67
Table 14: Composite Impact Strength.....	99
Table 15: Flammability test for developed composite boards	105

Abbreviations

NFCS	- Natural Fiber Composites
SEM	- Scanning Electron Microscopy
FTIR	- Fourier-Transform Infrared Spectroscopy
HDPE	- High-Density Polyethylene
LDPE	- Low-Density Polyethylene
LLDPE	- Linear Low-Density Polyethylene
UTS	- Ultimate Tensile Strength
PP	- Poly Propylene
PS	- Polystyrene
PLA-EFB	- Polycyclic Acid 3051D with Palm Empty Fruit Bunch Fiber
PLA-KE	- Polycyclic Acid 3051D with Kenaf
PS-KE	- Polystyrene with Kenaf