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**UTILIZATION OF DRIED BANANA TRUNK AS POTENTIAL
ALTERNATIVE ROPE/TIE FOR CONSTRUCTION**

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APPROVAL SHEET

This is to certify that we have supervised the preparation of and read the research paper entitled **UTILIZATION OF DRIED BANANA TRUNK AS POTENTIAL ALTERNATIVE ROPE/TIE FOR CONSTRUCTION** prepared by **JESSA MAY P. GONZALES, NOREEN T. LUMACAD, KYLE D. MURILLO, JOHN MARK M. VILLONO** and that the said paper has been submitted for final examination by the Oral Examination Committee.

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TABLE OF CONTENTS

Abstract	i
Approval	ii
Acknowledgement	iii
Table of Contents	iv

INTRODUCTION

1.1 The setting or context of reference	1
1.2 Review of previous research	1
1.3 The gap/ missing information	2
1.4 Statement of Purpose	2
1.5 Statemen of value	2
1.6 The Scope and Delimination	2

REVIEW OF RELATED LITERATURE AND STUDIES

2.1 Review of Related iterture	3
2.2 Related Studies	4
2.3 Comparison of Related Studies	6

MATERIALS AND METHODS

3.1 Materials and Tools Used	7
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3.2 Methodology	8
Result and Discussion	9
4.1 Estimated Cost	11
CONCLUSION AND RERCOMMENDATION	
5.1 Conclusion	12
5.2 Recommendation	12
REFERENCES	13
GLOSARRY OF TECHNICAL TERMS	14
APPENDICES	15

LIST OF FIGURES

Figure 2.1 Banana Trunk	3
Table 5.1 Breaking Strength for Manila Rope	9
Table 5.2 Test Result	10
Table 5.3 Estimated Cost	11

ABSTRACT

Jessa May P. Gonzales, Noreen T. Lumacad, Kyle D. Murillo, and John Mark M. Villono, “UTILIZATION OF DRIED BANANA TRUNK AS POTENTIAL ALTERNATIVE ROPE/TIE FOR CONSTRUCTION”, Undergraduate Technical Research in Bachelor of Science in Civil Engineering, October 2018.

Adviser: Engr. Jayson J. Jaranilla

The study, “UTILIZATION OF DRIED BANANA TRUNK AS POTENTIAL ALTERNATIVE ROPE/TIE FOR CONSTRUCTION”, is to create an alternative rope/tie from banana fiber that can be used for construction. Production of banana ropes ties can lessen the waste disposal of banana trunks during harvest season. The proposed ropes/ties were produced to consider the people from rural areas and the waste utilization of banana trunks. Cutting, extracting and braiding are the methods of doing banana ropes. The rope created by the researchers were found to be not effective for lifting heavy materials objects but only for the tying purpose (as shown in table 5.1). Banana can be found everywhere , therefore anyone can make it without expensive materials needed. The result can be used as a starting point for production, a banana rope that can help the resident from rural areas to save money and to protect the environment through waste utilization of banana trunks.

CHAPTER I

INTRODUCTION

In the Phillipines one of the most important fruit crops is banana. It is cultivated around the country. One of its part, the trunk is woven into very thin transparent fabric which is the principal material for men's shirt and many finished products like yarn, cardboard, paper bags, and tea bags. According to several studies that have been conducted, these products only use 10% of pseudostem. Banana is the major source of pseudostem. It left a huge amount of pseudostem which when dumped or burned causing environmental pollution. For this reason the researchers conducted this study to make a rope from banana fiber, specifically to be used in construction. Mankind has been strongly dependent on plant fibers for different purposes. In earlier days, the natural fibers served a crucial role to answer the everyday needs of the people. But in recent years, synthetic products are dominating over the natural fiber, due to the low cost. But the synthetic fibers are non-degradable and causing serious pollution problems. (Balakrishna, 2013).

Previous researchers conducted about the banana fibers proved that handicrafts such as mats, yarns, bags, baskets and ropes are made from banana fibers. Such reserches gave the researchers the idea to propose about the utilization of banana trunks as construction rope, an alternative rope for synthetic commercial rope. In other construction sites, like in areas where heavy equipment and machinery cannot be provided, the only way for the laborers to transfer heavy load is by manually carrying the load, a method which is

strenuous on their part. In consideration to the laborer's situation, the researchers proposed an alternative rope created from banana fibers. The rope will serve as a hoisting material that is inexpensive and useful. Also this research is for the residence in rural areas for them to save money as well as to reduce waste in their community.

This research focused only in making potential alternative rope or tie for construction. The main objective of this study is to know if the fibers of banana trunks can be effective substitutes for commercial rope. The specific objectives of this research are as follows: To test the tensile strength of banana fibers, and to compare the banana rope to the abaca ropes in terms of cost and tensile strength.

The researchers focused on the outer and inner layer of the banana trunks because the thicker and sturdier fibers come from the outer and inner sheaths. To test the strength of the rope, the researchers decided to conduct the testing using tensile test equipment. This study is limited only on tensile strength of dried banana trunks for utilizing alternative ropes or ties to be used in construction. The researchers compared the strength of a rope made of banana fiber from abaca rope. This research was conducted from November 2017 to October 2018.

CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

In this chapter, the researchers gathered insights concerning the topic, which provided information that would help the readers understand how the researchers came up with the idea of Utilizing banana trunk as rope/tie.

2.1 Review of Related Literature

- BANANA TRUNK

Banana is one of the most important fruit crop plants. After harvesting the fruit, the plant is cut down and thrown away, mostly as waste. Author stated in 2010 that banana is the second most produced fruit after citrus. It has 16% contribution in the world's total fruit production. It has also stated that India is the most or the largest producer of banana in the world estimating up to 27% of banana's production. According to them, every part of the banana is useful just like food, feed, pharmaceutical, packaging, and many other industrial applications.



Figure 2.1 Banana Trunk

2.2 Review of Related Studies

Banana Fiber: Scope and Value Added Product Development: (C. Vigneswaran e. , 2015)

In terms of chemical properties, one of the benefits carrying the banana fibers is that it can be used as good raw materials. The main objective of the above detailed article is to determine the mechanical properties such as impact strength, tensile strength, flexural strength and hardness of fabricated composites. Using zig saw the synthesis material has been cut in appropriate dimensions. By its specification and detail composition it was then detect. The researchers found out that having a 15% fiber burden with 10 mm fiber length, that it was good for composite reinforced. (C. Vigneswaran e. , 2015).

Effects of Fiber Configuration on Mechanical Properties of Banana Fibre/PP/MAPP natural Fiber Reinforced Polymer Composite: (N. Amira, 2017)

According to the above cited article, the researchers observe the outcome of different arrangement of unbroken banana fiber on mechanical properties. The fibers of banana were cut based on the desired length and put it constantly in the mold. Using the knitting tools to unite the banana fibers, it were plait and it was cut into the mold shape. Composite reinforced have better mechanical strength than unreinforced composites which it can give a higher tensile strength. (N. Amira, 2017).

Physical and Chemical Properties of Banana Fiber Extracted from Commercial Banana Cultivars Grown in Tamilnadu State: (Balakrishna, 2013)

According to the above cited article, in Pachanadan the percentage of fibers are high and at Bilba the properties of banana fibers found out that the cellulose has 31-35%, hemicellulose has 14-17% and the lignin has 14-17% were according to above cite article, the Yang analysed the processes, properties in structure are the results for industrial applications. (Balakrishna, 2013)

2.3 RESEARCH COMPARISON

The first article which is Scope and Value Added Product Development, points at the many advantage of a banana as a good raw material and used a good resources also states that the better mechanical property is the 10 mm long. The second article, Effects of Fiber Configuration on Mechanical Properties of Banana Fiber/PP/MAPP natural fiber Configuration researchers observe the outcome of different in terms of length, dimension, knitting, and even the arrangement of the unbroken banana fiber on mechanical properties And the third article, the Physical and Chemical Properties of Banana Fiber Extracted from Commercial Banana Cultivars Grown Tamilnadu State indicates the percentage of fibers are high. It has its own physical. This study used a 0.5 meter sample of banana rope as alternative tie/rope for construction by using Universal Testing Machine.

CHAPTER III

MATERIALS AND METHODS

This chapter contains the research methodology used in the study.

4.1 Materials and Tools Used

Materials:

Varnish – used as coating

Banana trunk – cut into 3ft to 4ft long

Paint brush – used in applying the coat

Tools:

Knife – tool used in extracting the banana fiber

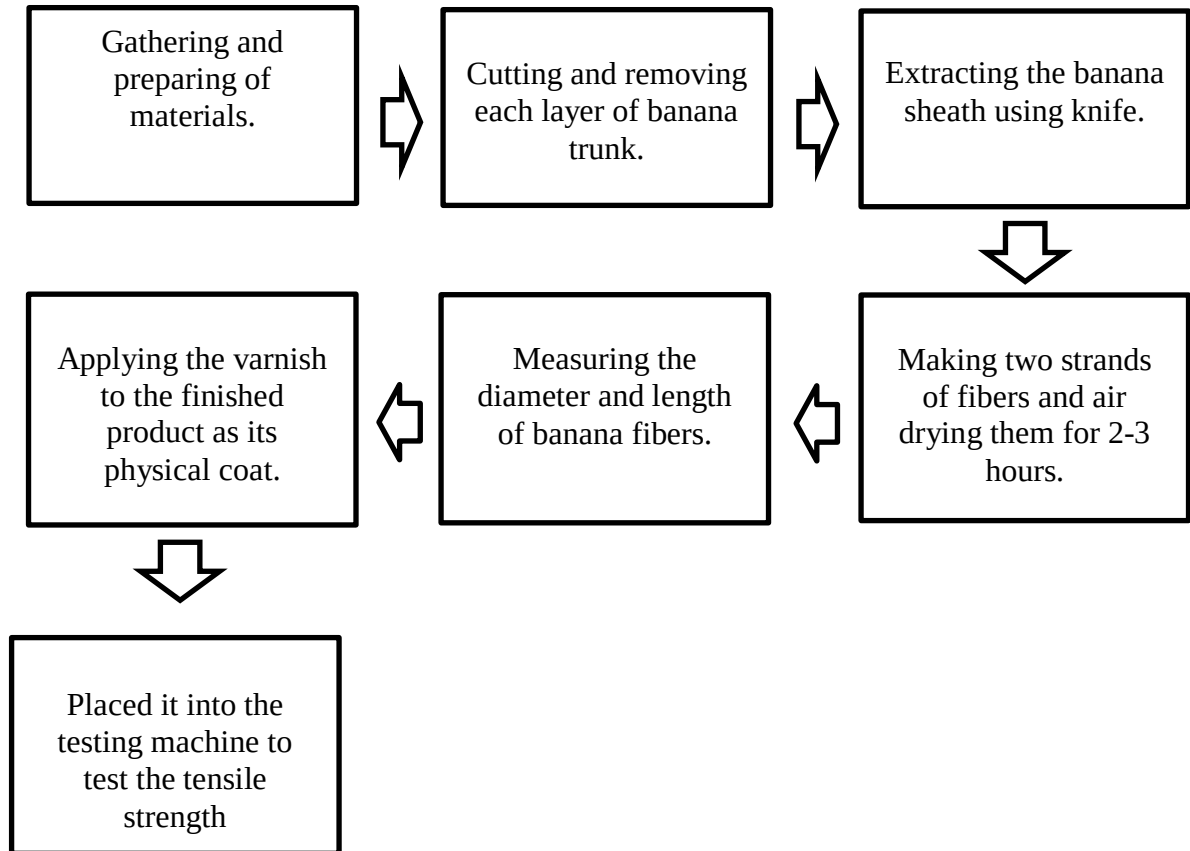
Vernier Caliper – used to measure the diameter of the rope

Tape measure- used to measure the length of the rope

Tensile Strength Equipment – machine used in testing the strength of rope

4.2 Methodology

The researchers performed the following procedure in producing rope from banana fibers:



The proponents harvested the banana trunks at Teacher's Village, Golden Valley Subdivision, Bgy. Sicsican Puerto Princesa City. They used bolos in cutting the banana trunks and knives in removing the banana leaves. They removed the outer and inner layers of banana trunks and measured the desired lengths using measuring tape. Using knives, they extracted banana sheaths and air dried them for two to three hours. After which, they measured the diameter and length of the banana fibers and coated the finished products with varnish. Finally, they placed the finished products (rope) into the testing machine to test the tensile strength.

CHAPTER IV

RESULTS AND DISCUSSION

Tensile Test Result

Manila hemp is made from fibers of the abaca plant.

Table 5.1 Minimum breaking strength for manila ropes

Rope Diameter		Minimum Breaking Strength	
(in)	(mm)	(lbf)	(kN)
3/16	5	405	1.8
1/4	6	540	2.4
5/16	8	900	4.0
3/8	10	1212	5.4
7/16	11	1575	7.0
1/2	12	2385	10.6
9/16	14	3105	13.8
5/8	16	3960	17.6
3/4	18	4860	21.6
13/16	20	5850	26.0
7/8	22	6930	30.8
1	24	8100	36.0
1 1/16	26	9450	42.0
1 1/8	28	10800	48.0
1 1/4	30	12150	54.0
1 3/8	32	13500	60.1
1 1/2	36	16650	74.1
1 5/8	40	20250	90.1
1 3/4	44	23850	110
2	48	27900	120

The **Table 5.1** Shows the minimum breaking strength of manila hemp.

The tensile strength test results of produced banana ropes with different diameters of banana fibers are presented in Table 5.2

Table 5.2

Diameter (mm)	Ultimate load (lbs.)	Average	Remarks
8mm (banana rope)	480	506 lbs.	FAIR
8 mm (banana rope)	520		
8mm (banana rope)	520		
10mm (banana rope)	600	600 lbs.	FAIR
10mm (banana rope)	560		
10mm (banana rope)	640		
12mm (banana rope)	680	706 lbs.	FAIR
12mm (banana rope)	760		
12mm (banana rope)	680		
8mm (synthetic rope)	1,160	1,160 lbs.	GOOD
10mm (synthetic rope)	1,760	1,760 lbs.	GOOD
12mm (synthetic rope)	1,920	1,920 lbs.	GOOD

Table 5.2 shows the tensile strength of produced ropes from banana fibers. The strength of banana ropes with 8 mm, 10 mm and 12 mm is found to be fair hence, they can only be used for tying and not for lifting heavy objects or materials.

ESTIMATED COST

Table 5.3 Estimate Cost of the rope

NO. OF ROPE	TYPE OF ROPE	COST (in pesos)
9 PCS	BANANA ROPE	34php
3 PCS.	SYNTHETIC ROPE	36php

The table above shows the comparison of prices between the produced banana rope and the synthetic ropes. Economically wise, it proves that the banana ropes are cheaper compared to the synthetic rope.

CHAPTER V

CONCLUSION AND RECOMMENDATION

CONCLUSION:

The researchers found out that the banana fiber is not possible or effective for lifting heavy objects because it did not reach the minimum breaking point of abaca rope which shows at table 5.1, but it can be used for tying light materials. Since bananas are abundant in the Philippines, their trunks can be used as ropes without requiring expensive materials.

RECOMMENDATION:

1. The minimum length of banana rope should be 0.757 meter to facilitate testing.
2. Conduct another study to compare the banana rope with abaca rope, instead of synthetic material as comparison to the fabricated.
3. Try to use the banana rope for slope protection.
4. In each specimen with different diameter, perform a durability test. (8mm, 10mm, 12mm diameter)
5. Test the banana rope one month before the schedule of the thesis defense
6. Try to put half of the samples in the water for at least one week before the testing. See the difference between the samples that are soaked in the water and the ones that are not soaked.

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Balakrishna, M. G. (2013). Physical and Chemical Properties of Banana Fibre Extracted from Commercial Banana Cultivars Grown in Tamilnadu State. *Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamilnadu, India*, 3.

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(Wikibooks, 2014)

(Lovett, 1996)

GLOSSARY OF TECHNICAL TERMS

Bolo - a large single-edged knife used in the Philippines.

Cellulose - an insoluble substance that is the main constituent of plant cell walls and of vegetable fibers such as cotton. It is a polysaccharide consisting of chains of glucose monomers.

Diameter - a straight line passing from side to side through the center of a body or figure, especially a circle or sphere.

Fiber - a thread or filament from which a vegetable tissue, mineral substance, or textile is formed.

Hemicellulose- a thread or filament from which a vegetable tissue, mineral substance, or textile is formed.

Knife - an instrument composed of a blade fixed into a handle, used for cutting or as a weapon.

Lignin - a complex organic polymer deposited in the cell walls of many plants, making them rigid and woody.

Pseudo stem - is the part of the banana plant that looks like a trunk. It is formed by the tightly packed overlapping leaf sheaths.

Rope - a produced product made of two strands of banana fibers twisted together to form a rope.

Specimen - loose granular substance, typically pale yellowish brown, resulting from the erosion of siliceous and other rocks and forming a major constituent of beaches, riverbeds, the seabed, and deserts.

Tensile Test Equipment Tensile testing is an important test used to determine the best type of material for a particular application. For this test, the material is molded to a standardized sample type and loaded into the machine's grips.

Vernier Caliper- linear measuring instrument consisting of a scaled rule with a projecting arm at one end, to which is attached a sliding Vernier with a projecting arm that forms a jaw with the other projecting arm.

APPENDIX A

ESTIMATED COST

TYPE OF ROPE	DIAMETER (mm)		COST	
BANANA FIBER	3-8 mm dia.	Varnish	34 php	
	3-10 mm dia.			
	3-12 mm dia.			
SYNTHETIC ROPE	1- 8mm dia.		9.25 php	Total
	1-10 mm dia.		12.50 php	36php
	1-12 mm dia		14.25 php	

APPENDIX B

Prepared Materials



REMOVED EACH LAYER OF BANANA TRUNK



EXTRACTION OF THE BANANA SHEATH



AIR DRYING



TWISTING THE BANANA FIBER



MEASURING THE DIAMETER OF BANANA FIBER



MEASURING THE LENGTH OF BANANA FIBER



BANANA ROPE



APPLYING THE VARNISH



FINISHED PRODUCT



DETERMNING THE TENSILE STRENGTH OF THE BANANA ROPE

Newton Pardo

CONSTRUCTION MATERIALS AND STRUCTURES LABORATORY
 Department of Civil Engineering
 College of Engineering
 University of the Philippines
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Lab. Report No. *146154*
 Sheet *1* of *1*

REPORT OF AXIAL TENSION TEST OF BOLT AND NUT

CLIENT: *CONCRETE - SINK HOLE*

PROJECT: *DETERMINATION OF STRENGTH OF CONCRETE*

SPECIMEN (X): *CONCRETE - SINK HOLE*

SAMPLE MARKING (Identification)	Diameter (mm)	YIELD POINT	ULTIMATE LOAD (lbs.)	Location of Failure / Break
8 (banana rope)			480	
8 (banana rope)			520	
8 (banana rope)			520	
10 (banana rope)			600	
10 (banana rope)			560	
10 (banana rope)			640	
12 (banana rope)			680	
12 (banana rope)			760	
12 (banana rope)			680	
8 (synthetic rope)			1,160	
10 (synthetic rope)			1,760	
12 (synthetic rope)			1,920	
2 (synthetic rope)			140	

NOTE: 1. Results are for test on samples pre-marked as listed, and as delivered to CMS-Lab.

Witnessed By: (Signature over Printed Name) *[Signature]*

Tested By: *[Signature]*

Date of Test: *8-23-18*

cmslab 18

Diameter (mm)	Ultimate Load	AVERAGE
8 (banana rope)	480	506
8 (banana rope)	520	
8 (banana rope)	520	
10 (banana rope)	600	600
10 (banana rope)	560	
10 (banana rope)	640	
12 (banana rope)	680	706
12 (banana rope)	760	
12 (banana rope)	680	
8 (synthetic rope)	1,160	1,160
10 (synthetic rope)	1,760	1,760
12 (synthetic rope)	1,920	1,920
2 (synthetic rope)	140	140

RESULT

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