



**BUSITEMA
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Pursuing Excellence

FACULTY OF ENGINEERING
DEPARTMENT OF GINNING AND TEXTILE ENGINEERING
A FINAL YEAR PROJECT REPORT

**IMPROVING THE STRENGTH OF PAPER FROM PECTINASE
TREATED BANANA FIBRES**

**BY
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final year project report submitted to the Department Of Ginning And Textile Engineering in partial fulfillment for the award of a Bachelor of Science Degree in Textile Engineering at Busitema University.

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APPROVAL

I TALEMWA BEN, hereby submit my final year project report for approval to my supervisors.

And declare that this research project report titled "Improving the strength of paper from Pectinase enzyme treated banana fibres" is my original work and has never been presented anywhere to any institution of higher learning or University before for any award

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ABSTRACT

Both fibre length and surface size have an impact on paper strength. Fiber length is used to measure pulp properties, tensile index of paper increases with fiber length.

Surface sizing promotes desired surface properties; creating a stronger surface, binding fibers, fillers to that surface, increases resistance and strength against water, oil and solvents which Improves positively the physical strength of the paper.

There is an increase in paper strength and the overall increase is highest in sample 9 (7 inches and 13% size) whose tensile strength is 64.0 *Nmlg* compared to the standard 33.38 *Nmlg*. Hence most suitable for low weight packaging

Changes in tensile, tear, burst strength and folding endurance were as a result of changes in fibre length and size percentage.

Contents

ACKNOWLEDGEMENT.....	1
APPROVAL.....	2
LIST OF ACRONYMS.....	6
CHAPTER ONE	7
1.0 INTRODUCTION.....	7
1.1 BACKGROUND.....	7
1.2 BANANA PRODUCTION	7
1.2.1 BANANA INTRODUCTION.....	7
1.2.2 BANANA PRODUCTION INTERNATIONALLY.....	8
1.2.3 BANANA PRODUCTION IN UGANDA.....	9
1.3 BANANA FIBRE PAPER.....	9
1.3.1 PAPER INTRODUCTION	9
1.3.2 BANANA FIBRE EXTRACTION.....	10
1.3.3 PULP AND PAPER MAKING.....	10
1.4 PROBLEM STATEMENT.....	10
1.5 OBJECTIVES OF THE STUDY.....	11
1.5.1 MAIN OBJECTIVE.....	11
1.5.2 SPECIFIC OBJECTIVES.....	11
1.6 SCOPE OF THE PROJECT	11
1.7 JUSTIFICATION	11
CHAPTER TWO	13
2.0 LITERATURE REVIEW	13
2.1 THE BANANA FIBRES AND HANDMADE PAPER.....	13
2.2 PECTINASE ENZYME	14
2.3 EFFORTS OF IMPROVING THE STRENGTH IN ENZYME TREATED BANANA PAPER.....	15
2.4 STARCH SURFACE SIZING	16
2.5 FIBRE LENGTH	17
CHAPTER THREE	18
3.0 METHODOLOGY	18
3.1 MATERIALS AND METHODS.....	18
3.1.1 MATERIALS AND EQUIPMENT.....	18
3.2. PAPER SAMPLE PRODUCTION.....	19

3.3 SAMPLE TESTS.....	26
3.3.1. TESTING PAPER TENSILE STRENGTH	26
3.3.2. TESTING PAPER BURST STRENGTH	26
3.3.3 TESTING PAPER TEAR STRENGTH.....	27
3.3.4. TESTING PAPER FOLDING ENDURANCE	28
3.3.5 ANOVA TESTS	28
CHAPTER FOUR	29
4.0 RESULTS AND DISCUSSIONS.....	29
4.1 RESULTS.....	29
4.2 DISCUSSION OF RESULTS	29
4.2.1 Tensile Strength Results.....	29
ANOVA RUN FOR TENSILE STRENGTH.....	35
CHAPTER FIVE	38
5.0 CHALLENGES, CONCLUSIONS AND RECOMMENDATIONS.....	38
5.1 CONCLUSION.....	38
5.2 CHALLENGES	38
5.3 RECOMMENDATIONS.....	38
REFERENCES:.....	40

LIST OF ACRONYMS

USA – United States of America

UCA – Ugandan Census for Agriculture

GSM – Grammes per Square Meter

MUF – Melamine Urea Formaldehyde

FAO – Food Agricultural Organization

BANU - Banana Association for Northern Uganda

UBC-TV – Uganda Broadcasting Television

AKD – Alkyl Ketene Dimer

ASD – Alkenyl Succinic Anhydride

pH – Potential Hydrogen

Kg/ha – kilogram me per hectare

Ha – Hectare

Mt – Million Tones

Agri-Forum – Agricultural Forum

KCCA – Kampala Capital City Authority

KACITA – Kampala City Traders Association

NEMA – National Environmental Management Authority

Nm/g – Newton meters per gram

mNm²/g – micro Newton square meter per gram

kPam²/g – kilo Pascals square meters per gram

No. – Number

Cm – centimeter

Mm – millimeter

CHAPTER ONE

1.0 INTRODUCTION

There are two ways to extract banana fiber, that is to say; either manually by hand or by mechanically through a decorticator machine. Therefore, two qualities, that is to say hand extracted and machine-extracted banana fiber, are available in the market. Machine-extracted fiber is the low-grade fiber (inadequately processed) and cheaper in cost while the hand-extracted fiber is good in quality with higher price. Hand-extracted fiber has been found suitable for making high-grade paper due to its high purity while due to the presence of adherent pith; the machine-extracted fiber produces inferior quality of the product. Although appreciable efforts have been made by various institutions like Krishi Vigyan Kendra and Khadi & Village Industries Commission (KVIC), Mumbai, India to develop improved versions of machines for fiber extraction, even the latest available machine (as of 2016) in the market is not able to take out the fiber in its purest form and most of pith remains attached to the extracted fiber. This pith creates problems during fibre utilization for making specialty handmade papers because it behaves as a dead load on the fiber thereby consuming lots of chemicals, resulting into poor quality of the product and raising concerns about environmental pollution. Therefore, a suitable technology is the need of the hour for improving the quality of machine extracted fiber so that it may become a good quality cellulosic fiber for making varieties of handmade paper as well as various other fibrous products, thereby promoting better utilization of this valuable bio resource. (Chauhan & A.K.Sharma, 2014)

Pectinase enzyme treatment under the optimized conditions is one of the technologies which has been used to improve the quality of machine extracted banana fibre which has enabled the handmade paper manufacturers to utilize the machine extracted banana fiber that is available at cheaper price to produce a good quality handmade paper. (Chauhan & A.K.Sharma, 2014)

1.1 BACKGROUND

1.2 BANANA PRODUCTION

1.2.1 BANANA INTRODUCTION

Banana locally known as "matooke" among the Baganda is a fibrous annual crop that produces a fruit that is harvested and thereafter the crop is discarded in the garden. With the beginning of the new millennium, people have placed a high emphasis on forest preservation and rational use of forestry and agricultural residues. There has been a growing interest of various industries in renewable plant materials. Apart from incineration as a renewable energy source, biomass is also

REFERENCES:

- Biricik, Y., Sonmez, S., & Ozden, O. (2011). Effects of surface sizing with starch on physical strength properties of paper. *Asian Journal of Chemistry*, 23(7), 3151–3154.
- Chauhan, S. (2016). Enzyme treatment in improving the quality of pseudo stem fiber of banana plant to use this bioresource for making ..., (October 2014).
- Chauhan, S., & A.K.Sharma. (2014). Enzyme treatment in improving the quality of pseudo stem fiber of banana plant to use this bioresource for making Handmade Paper. *International Journal of Fiber and Textile Research*, 4(3), 57–61.
- Food and Agriculture Organization of the United Nations (FAO). (2014). *Banana Market Review and Banana Statistics 2012-2013; Market and Policy Analyses of Raw Materials, Horticulture and Tropical (RAMHOT) Products Team FOOD. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS.*
- Glittenberg. (1993). Glittenberg.pdf.
- Godfrey, A. (2012). Handmade paper: a guide to its production and uses. *A Guide to Its Production and Uses*, 12(2), 54.
- Hallam, D. (2003). The World Banana Economy, 1985-2002. *Bananas and Plantains*.
https://doi.org/10.1007/978-94-011-0737-2_19
- Hjelt, T., Saharinen, E., Heinemann, S., Sirviö, J., & Technical, V. T. T. (n.d.). Pure effect of fiber length on paper strength.
- Hussain, I., & Tarar, O. M. (2014). Pulp and Paper Making by using Waste Banana Stem. *Journal of Modern Science and Technology*, 2(2), 36–40.
- Ozden, O. (1998). The Use of Starch in Paper Surface Coating. *The Use of Starch in Paper Surface Coating*, 101, 1998.