



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

**FACULTY OF ENGINEERING**

**PRODUCTION OF HANDMADE PAPER FROM SUGARCANE  
BAGASSE AND A MIXED GRADE OF WASTE PAPER.**

**Case study: Uganda Industrial Research Institute**

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Fulfilment of the Requirement for the Award of the Bachelor of Science in Textile Engineering*

## ABSTRACT

The production and consumption of paper for packaging has been highly encouraged and taken on in Uganda since 2007 when the government enacted a policy to ban the use of polythene bags. The policy was still reechoed in 2015. Though the policy wasn't successfully implemented it geared the use of paper packages as an alternative. Today the consumption of paper packages has greatly progressed, due to online shopping for example Jumia Company, Print Boda in Uganda and food orders from busy customers that rarely have time to rush to restaurants. However, the need to create better conservative and ecofriendly alternatives of manufacturing paper is required to reduce on the impact brought about by deforestation.

At present, mainly in densely populated regions with high paper consumption per capita, the paper industry is the exclusive user of recovered paper as a secondary raw material. Some paper and board grades can use exclusively recycled fibers. Some grades, for example liner, use blends of recycled and virgin fibers with various proportions of recycled fibers in the furnish depending on the paper or board grade. Furthermore, the demand of paper has been continuously increasing at a pace much faster than the availability of fibers from natural sources. Recycling of waste paper, after its intended use, has been found to be more economical and ecofriendly. (František Potucek et al, 2011)

Scarcity in forest-based raw materials has forced the paper industries to use inferior quality pulp produced from agricultural residues for papermaking. To improve the properties of the pulp, blending of good quality long fiber pulp is necessary. (Vishesh Pal et al, 2004)

In an attempt to improve the quality of recycled waste paper and evaluate the properties of package paper, bagasse was blended with the recycled waste paper fibers. This was done by blending bagasse with the mixed grade of waste paper in to five samples in ratios of 100:0, 80:20, 50:50, 20:80, 0:100 respectively. Strength characteristics such as tearing resistance, strength, burst strength and water resistance were tested and compared to each other. Inferior paper sample properties were observed when using 100% recycled waste paper fibers, which was the control sample. The results obtained showed that addition of 20% bagasse pulp to waste paper pulp did not significantly enhance the strength of the paper product. However, it was found that addition of 50 % or more of bagasse pulp to the mixed grade of waste paper pulp resulted in a substantial increase in the strength properties, except for the tear resistance strength. The

Results showed that flexible virgin bagasse fibers can be used as a Lignocellulose fiber for making packaging paper in combination with recycled paper fibers.

**DECLARATION**

I NAKAGOLO MARIA GORRET hereby declare to the best of my knowledge that this project is completely based on my own research work and it has never been submitted to any academic institution of higher learning for any academic award.

DATE .. 23<sup>rd</sup> May 2019 .....

SIGNATURE .....  .....

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**APPROVAL**

This research project report has been submitted to the Department of Textile and Ginning Engineering for examination with approval the following.

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## **DEDICATION**

I dedicate this report to my beloved parents, Mr. Lwaya Joseph, Mrs. Lwaya Betty, My sister Miss Mutesi Josephine and all friends who have seen me through my academic trying moments.

Contents	
<b>ABSTRACT</b> .....	i
<b>DECLARATION</b> .....	iii
<b>APPROVAL</b> .....	iv
<b>ACKNOWLEDGEMENT</b> .....	v
<b>DEDICATION</b> .....	vi
<b>List of figures</b> .....	ix
List of tables.....	ix
List of acronyms.....	ix
<b>CHAPTER ONE: INTRODUCTION</b> .....	1
<b>1.1 BACKGROUND</b> .....	1
<b>1.2 PROBLEM STATEMENT</b> .....	4
<b>1.3 OBJECTIVES</b> .....	4
<b>1.3.1 Main objective</b> .....	4
<b>1.3.2 Specific objectives</b> .....	4
<b>1.4 JUSTIFICATION</b> .....	5
<b>1.5 SCOPE OF THE STUDY</b> .....	5
<b>1.5.1 Conceptual scope</b> .....	5
<b>1.5.2 Geographical scope</b> .....	5
<b>1.5.3 Time scope</b> .....	5
<b>CHAPTER TWO: LITERATURE REVIEW</b> .....	6
<b>2.1 INTRODUCTION</b> .....	6
<b>2.2 BAGASSE</b> .....	6
<b>2.2.1 Advantages of bagasse features</b> .....	8
<b>2.2.2 Considerations in processing bagasse</b> .....	11
<b>2.3 PAPER RECYCLING</b> .....	12
<b>2.4 OTHER STUDIES ON BAGASSE FIBER, ITS BLENDS AND BLENDS OF VIRGIN PULP WITH RECYCLED PAPER PULP</b> .....	14
<b>CHAPTER THREE: METHODOLOGY</b> .....	16
<b>3.1 MATERIALS AND EQUIPMENTS</b> .....	16
<b>3.2 MATERIALS AND METHODS</b> .....	16



<b>3.2.1 Material preparation</b> .....	16
<b>3.2.2 Steps involved in paper making</b> .....	17
<b>3.2.2.1 Cooking</b> .....	17
<b>3.2.2.2 Pulp washing</b> .....	17
<b>3.2.2.4 Pulping</b> .....	18
<b>3.2.2.5 Pulp sizing:</b> .....	18
<b>3.2.2.6 Sheet formation</b> .....	18
<b>3.2.2.7 Drying:</b> .....	18
<b>3.2.2.8 Calendaring</b> .....	19
<b>3.3. PROPOSED PAPER TESTS CARRIED OUT</b> .....	19
<b>3.3.1 Gsm</b> .....	19
<b>3.3.2 Tearing resistance</b> .....	19
<b>3.3.3 Bursting strength</b> .....	20
<b>3.3.4 Water resistance</b> .....	20
<b>CHAPTER FOUR: RESULTS AND DISCUSSION</b> .....	21
This chapter clearly explains the results of the proposed paper tests that were carried out ..	21
<b>CHAPTER FIVE : CONCLUSIONS,CHALLENGES AND RECOMMENDATIONS</b> .....	27
<b>5.1 CONCLUSIONS</b> .....	27
<b>5.2 CHALLENGES</b> .....	28
<b>5.3 RECOMMENDATIONS</b> .....	28
<b>REFERENCE</b> .....	29

## List of figures

Figure 1 : World paper and paperboard production and consumption.....	3
Figure 2 : Annual production of sugarcane in Uganda ((factfish.com) .....	7
Figure 3 : Elemental components of bagasse by various authors (karp et al, 2013) .....	9
Figure 4: Structure of cellulose (Saheb and Jog, 1999).....	9
Figure 5: Structure of Hemicellulose (Brienzo et al , 2016).....	10
Figure 6: Influence of bagasse on tear resistance strength.....	23
Figure 7: Influence of bagasse on water resistance.....	25
Figure 8: Water resistance test and pulping process.....	32
Figure 9: Pulping process and pulp drying .....	33
Figure 10: Bagasse before and after cooking .....	33
Figure 11: Collection points; Kireka market and Mandela National Stadium .....	34
Figure 12: Weighing of the raw material and waste paper used .....	34

## List of tables

Table 1 : Materials and equipment used.....	16
Table 2: Different measures of weights of bagasse and mixed grade of waste paper .....	17
Table 4: Results of the proposed tests.....	21

## List of acronyms

Kg -kilograms

NSSC - Natural sulfite semi chemical

OCC -Old corrugated containers

OH -Hydroxyl

Wt -weight

# **CHAPTER ONE: INTRODUCTION**

## **1.1 BACKGROUND**

Paper is “matted or felted sheet or web of fibre formed on a fine screen from a water suspension. Paper may be produced from animal fibres, e.g., wool, fur, hair, silk; mineral fibres, e.g., asbestos; synthetic fibres, e.g., rayon or nylon; and other materials. Most paper, however, is produced from cellulosic plant fibres,” (Etherington and Roberts 2005, paper). Paper is generally formed by a network of cellulosic fibres (Schmied et al,2013).It is a versatile material with many uses, including writing , printing, packaging, cleaning , decorating, Book , toilet paper , Ruled paper ,carton egg box and a number of industrial and construction processes, magazines, legal or non-legal documentation, paper money Commercial paper. The versatility of paper is mainly due to the different additives that have for over the years have been added to the paper to make its application broad. Human consumption of paper is vast, with world paper production at 400 million tonnes per year (Wwf.panda.org, 2016)

The principles of paper making from pulp were laid down in A.D. 105, when Ts'ai Lun of China macerated the bark of mulberry trees (*Broussonetia papyrifera*), dipped a silk screen mold into the dilute macerate and on withdraw formed the first sheet of paper. More than 600 years earlier, pressed sheets from papyrus were widely used in Egypt. However these sheets could not be considered to be paper, since they were composed of strips cemented together in a random fashion. Papyrus was very important to the ancient Egyptians as it transformed Egyptian society in many ways. Not only was this ancient Egypt's greatest export but it revolutionized the way people kept valuable information. Once the technology of papyrus paper making was developed, it was kept a secret, allowing the Egyptians to have a monopoly on it. No substitute for papyrus paper could be found that was as durable and light weight until the development of the pulped paper by the Arabs in the 8th century. Thereafter the process of making pulp paper was far easier but the paper was not as durable as papyrus paper.

Waste has been one of the raw materials that has been added to the production of paper in various plants and industries. The waste is obviously solid including agricultural residues, (Yehia Fahmy et al, 2017) industrial waste (Sotoodehnia Poopak, et al 2012), garbage (Nelson, Eric, 2002; Paper from Garbage.), waste paper (Jerry Aue, Kevin Grabner, Alan Button,). This definitely leads to

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