

**BUSITEMA UNIVERSITY**  
**FACULTY ENGINEERING**  
**DEPARTMENT OF TEXTILE AND GINNING ENGINEERING**

**FINAL YEAR PROJECT REPORT**

**BIOACTIVE AND UV PROTECTION FINISH OF WOVEN COTTON  
FABRICS USING DYE EXTRACTS FROM SELECTED INDEGENEOUS  
PLANTS.**

**BY**



**OUMA ISIMA YUSUF**  
**BU/UG/2013/141**

*A final year project report submitted to the department of textile and ginning  
engineering as a partial fulfillment of the requirements  
for the award of bachelor of science degree in textile engineering*

**MAY 2017**

**DECLARATION**

I OUMA ISIMA YUSUF of Registration Number BU/UG/2013/141 hereby declare that this project report is my original work except where explicit citation has been made and it has not been presented to any institution of higher learning for any academic award

Sign ..... 

Date ..... 25<sup>th</sup> - May - 2017 .....



## APPROVAL

This is to certify that the project proposal under the title “BIOACTIVE AND UV PROTECTION FINISH OF WOVEN COTTON FABRICS USING DYE EXTRACTS FROM SELECTED INDEGENEOUS PLANTS” has been done under my supervision and is now ready for examination.

### 1. MR. LOUM JANANI

Sign ..... 

Date ..... 28/5/2017 .....

### 2. MADAM NAMUGA CATHERINE (Mrs.)

Sign.....

Date.....

## **ACKNOWLEDGEMENT**

As the cocoon of silkworm or even the caterpillar that is wonderfully transformed through a pupa to an adult butterfly, so has this dream that started small and simple finally metamorphosed into this fantastic project through the active support and encouragement of various personalities.

Special thanks to my supervisors MR. LOUM JANAN and Mrs. NAMUGA CATHERINE who have contributed much towards the accomplishment of this project through guidelines and financial support. Actually this work has been because of continuous consultation to them and their concern. Thanks very much my dear supervisors.

I highly appreciate the contribution of my beloved dad, mum and relatives towards my academics. Great thanks go to MR. OKONGO STEPHEN for his great support towards my education and courage.

I continue to thank my good lecturers who have equipped me with the knowledge that has helped to come up with such a project and have improved my engineering aspects and qualities especially MR. ALEX MUSINGUNZI who helped me identify Prof. AARON WANYAMA for plant identification.

Last but not least, I don't forget my dear classmates. Thanks for the cooperation and team work.

May the good Lord bless and reward you all abundantly. Above all I thank the almighty God for the gift life, knowledge wisdom and understanding.

## TABLE OF CONTENTS

DECLARATION .....	i
APPROVAL .....	ii
ACKNOWLEDGEMENT .....	iii
TABLE OF CONTENTS.....	iv
LIST OF TABLES .....	vii
TABLE OF FIGURES .....	viii
LIST OF ACRONYMS .....	ix
CHAPTER ONE .....	1
1 INTRODUCTION .....	1
1.1 BACKGROUND:.....	1
1.2 PROBLEM STATEMENT .....	4
1.3 OBJECTIVES OF THE STUDY .....	5
1.3.1 Main objective: .....	5
1.3.2 Specific objectives .....	5
1.4 SCOPE OF THE STUDY .....	6
1.5 JUSTIFICATION.....	7
CHAPTER II:.....	8
2 LITERATURE REVIEW .....	8
2.1 PROFILE OF PLANTS .....	8
2.1.1 Morinda Lucida.....	8
2.1.2 Ricinus Communis.....	10
2.2 ULTRA-VIOLET (UV) ABSORPTION .....	14
2.2.1 UV Radiation .....	14
2.2.2 UV Exposure and Human skin .....	14
2.2.3 UV radiation and absorption.....	16
2.3 Bioactivity .....	17
2.3.1 Human biota.....	17

2.3.2	The skin flora (skin microbiota) .....	18
2.3.3	Types of the skin micro biota.....	18
2.4	Staphylococci aerus and Escherichia Cole.....	21
CHAPTER III:	.....	22
3	MATERIALS AND METHODOLOGY.....	22
3.1	DYE EXTRUCTION FROM NATURAL PLANTS .....	22
3.1.1	Dye extraction from Morinda Lucida .....	22
3.1.2	Dye extraction from Ricinus c. and Areeta.I. ....	23
3.2	APPLICATION OF THE DYE EXTRACTS ON WOVEN COTTON.....	23
3.2.1	Washing. ....	23
3.2.2	Mordanting.....	23
3.2.3	Dyeing cotton fabric with Copper sulphate as a mordant.....	24
3.2.4	Dyeing cotton fabric with Alum as a mordant.....	24
3.3	PREPARING DYE SAMPLES FOR UV-ABSORBENCY TESTING.....	25
3.3.1	UV protection factor (UPF) .....	25
3.3.2	Extraction of dye from dyed fabrics .....	26
3.3.3	10S UV-VIS Spectrophotometer .....	26
3.4	PREPARATION OF SAMPLES FOR BIOACTIVITY TEST .....	27
3.4.1	Labeling of fabrics dyed using different mordants .....	27
3.4.2	Preparation of Cotton Fabric Bio-discs.....	28
3.4.3	Media preparation .....	28
3.4.4	Preparation of Test microorganisms .....	29
3.4.5	Qualitative assessment of bioactivity by Agar diffusion method ( <i>AATCC 147</i> ):...	29
CHAPTER FOUR:	.....	30
4	RESULTS AND DISCUSSION.....	30
4.1	RESULTS.....	30
4.1.1	UV – absorbency test results.....	30
4.1.2	Bioactivity Test Results .....	35
4.2	DISCUSSION .....	38
4.2.1	UV-ABSORBENCY TESTS.....	38

4.2.2	BIOACTIVITY TESTS.....	40
CHAPTER FIVE .....		41
5	CHALLENGES, CONCLUSIONS AND RECOMMENDATIONS.....	41
5.1	CHALLENGES.....	41
5.2	CONCLUSIONS.....	41
5.3	RECOMMENDATIONS .....	42
REFERENCES .....		43
APPENDIX.....		44

**LIST OF TABLES**

Table 1; Grades and classification of UPF ..... 25  
Table 2: Dyed fabrics for bioactivity test ..... 27  
Table 3: labels of dyed fabrics ..... 28  
Table 4: Results for Bioactivity of cotton discs against E. coli ..... 36  
Table 5: Results for Bioactivity of cotton discs against S. aureus ..... 36



## ABSTRACT

The main objective of the study was to investigate the UV absorbency of dyestuffs extracted from plain woven cotton and originally dyed with natural colourants from plants *Ricinus Coumunis*, *Areeta Indica* and *Morinda Lucida* and analysing antimicrobial bioactivity of dyed woven cotton fabrics. Unlike 1CA, 2CA and 3CA cotton fabric that showed activity against *E. coli* and *S.aureus*, 1CR, 2CR and 3CR cotton fabric has effect on the normal flora and hence can suitably be used for clothing purposes.

In reference to literature, the most dangerous UV-light is radiated at a range wavelength of 280-320nm, called UV-B. hence *Areeta.I.* shows a best absorbency of UV light at the most dangerous UVrange. *Ricinus.C.* has a good absorbency of up to IOA at 230nm and 30Snm in a wavelength range of 280-400 while applied in silk unlike on cotton where it showed up to an absorbency of only 2.769A, *Morinda.L.* does better on silk with an absorbency of IOA at 295nm but showed a poor absorbency while on cotton.

## TABLE OF FIGURES

Figure 1: Morinda Lucida .....	10
Figure 2 : Morinda Lucida .....	10
Figure 3: Ricinus Couminus (Caster bean) .....	13
Figure 4: Effect of UV light on different types of skin (source: <a href="http://www.autexrj.org/No1-2007/0192.pdf">http://www.autexrj.org/No1-2007/0192.pdf</a> ) .....	15
Figure 5: The erythema spectrum, .....	17
Figure 6: Morinda lucida stem backs dye extraction .....	22
Figure 7: Appearance of dyed fabrics. ....	24
Figure 8: GENESYS 10S UV-Vis spectrophotometer. ....	27
Figure 9: UV Absorbency of Ricinus Coumunis dye extracts from a dyed cotton fabric .....	31
Figure 10: UV Absorbency of Areeta. Indica dye extracts from a dyed cotton fabric .....	31
Figure 11: Dye extracted from cotton dyed with Ricinus Coumunis. ....	32
Figure 12: UV Absorbency of Miranda Lucida dye extracts from a dyed cotton fabric .....	32
Figure 13: UV Absorbency of Areeta Indica dye extracts from a dyed silk fabric .....	33
Figure 14: UV Absorbency of Miranda Lucida dye extracts from a dyed cotton fabric .....	34
Figure 15: UV Absorbency of Rcinus Communis dye extracts from a dyed silk fabric .....	34
Figure 16: UV Absorbency of Areeta Indica dye extracts from a dyed silk fabric .....	35

## **LIST OF ACRONYMS**

NYTIL-Southern range Nyanza limited

ASTM – American Standards of testing materials

UPF – UV protection function

BHI -Brain Heart Infusion

UV- Ultra Violet

## **CHAPTER ONE**

### **1 INTRODUCTION**

#### **1.1 BACKGROUND:**

Although dyes abound in the natural environment, they can also be formed in different ways and used in different applications depending on their manufacturing process. Dyes can be formed by using chemicals like acids or extracted from earth and mineral sources. Natural dyes can be obtained even from our own backyards and used to colour fabric and other household items. These include various parts of plants such as flowers, roots, and nuts which can be processed to obtain many colours. Natural dyes produce vibrant colours, Creating A Palette That Is Compatible And Blend With Each Other.

Natural dyes of various colours can be obtained from many local plants in Africa and that dyes can be extracted from barks of trees, leaves, roots, seeds, fruits, flowers, or the young shoots. ([Adu-Akwaboa 1994:129](#))

Similarly, plants in the environment can be exploited to achieve natural colors of various shades to color natural fibres and textiles by means of dyeing, printing or painting. Harris mentions that the roots of some species of the madder plant which could be grown practically everywhere were used from the earliest times to produce a whole range of reds. ([Harris \(1995\)](#)).

The literature indicates that until the 19th century, all dyes were derived from vegetable or more rarely animal or mineral sources. By the early part of the last century, only a small percentage of textile dyes were extracted from plants.

Natural dyes generally require a mordant, which are metallic salts of aluminum, iron, chromium, copper and others, for ensuring the reasonable fastness of the colour to sunlight and washing.

## REFERENCES

- Ashis KS, Aagaewal P (2009). Applications of natural dyes on textiles. *Indian J. Fibre textile Res.* 34:384-399
- Agarwal Radhika, Pruthi Neelam and Singh Saroj Jeet S, 2007. Effect of Mordants on Printing with Marigold Flowers dye, *Natural Product Radiance.*, 6 (4): 306-309.
- Deo HT, Desai BK (1999). Dyeing of cotton and Jute with tea as a natural dye. *Colouration technol.* 115:7-8
- Debasish Das, Sankar Ray Maulik and Subhash Chandra Bhattacharya, 2008. *Indian Journal of Fibre & Textile Research*, 33:163-170 .
- Devi AS, Sumathy BS and Katyayini VKLT, 2006. *Trailing Eclipta – A Natural Green Colour for Textiles, Natural Dyes Scope and Challenges* (ed. M. Daniel) Scientific Publication (India) Jodhpur, 103-112.
- Kota Chaitanya Sravanthi and Manthri Sarvani, 2011. Antibacterial Activity of *Ricinus Communis* Leaf Extracts, *International Journal of Pharmaceutical Sciences and Research* , 2(5): 1259-1261
- Mossa JS, Al-Yahya MA, Al-Meshal IA, 1987. *Traditional Medicinal plants of Saudi Arabia.*, Riyadh: King Saud University Press.
- Gokhale SB, Tatiya AU, Bakiwal SR, Fursule RA (2004). Natural dye yielding plants in India. *Natural product Radiance* 3(4):228-234
- Samanta AK, Agarwal P(2009). Application of natural dyes on textiles. Review article *Indian J. Fibre Text Res.* 3:384-399.
- Wanyama PAG, Kiremire BT, Murum JES, Kamoga O (2011). Textile dyeing and phytochemical characterization of crude plant extracts derived from selected dye yielding plants in Uganda. *Int J. Nat. Prod. Res.* 1(2)-31