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

**ENHANCING COLOR CHARACTERISTICS OF DYED COTTON AND POLYESTER-  
COTTON BLEND FABRICS WITH THE USE OF ZINC OXIDE NANO PARTICLES**

**BY**

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**BU/UP/2015/607**

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**A FINAL YEAR PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF  
TEXTILE AND GINNING ENGINEERING OF BUSITEMA UNIVERSITY IN PARTIAL  
FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE BACHELOR  
OF SCIENCE IN TEXTILE ENGINEERING**

## **ABSTRACT**

In this study, color characteristics of the dyed cotton and polyester-cotton fabrics were enhanced by the use of Zinc oxide nano particles to solve the problem of fading.

Pieces of cotton and polyester-cotton blend fabrics were scoured, dyed separately using synthetic dyes (vat, reactive and disperse dyes) and natural dyes (extracted from stem barks of *Albizia Coriaria*, *Morinda Lucida* and *Harungana Madagascariensis*) following standard procedures. After dyeing, others were functionalized with Zinc oxide nano particle emulsion.

Fastness properties (light, wash and rub fastness) and color strength (K/S) values of the dyed, dyed and functionalized cotton and polyester-cotton fabrics were separately determined. ZnO nano particle functionalized fabrics registered better grades of light, wash and rub fastness than the unfunctionalised fabrics. Functionalized fabrics (cotton and PC fabrics) dyed with synthetic dyes (vat, disperse-vat, reactive, disperse-reactive) registered very good to excellent (5-6) grades of light fastness than those dyed with natural dyes, good to very good (4-5) grades of wash fastness and good (4), moderate to good (3-4) of dry and wet rub fastness.

ZnO nano particles also increased color strength values of the dyed fabrics.

**Key words:** ZnO nano particles, cotton and polyester-cotton blend fabrics, color fastness, synthetic and natural dyes, color strength (K/S) values

**DECLARATION**

I **ACEGER SILVER** declare that the work presented in my final year project is as a result of my own research and has never been submitted to any institution of higher learning for any award whatsoever.

Signature.....

Date.....*11th. Jan. 2021*.....



**APPROVAL**

This final year project on enhancement of color characteristics of dyed cotton and polyester cotton blend fabrics with the use of zinc oxide Nano particles was under the supervision of;

**Mr. Loum Janani**

Signature ..... 

Date ..... 8/07/2021

## **DEDICATION**

I would like to dedicate this report to myself, my beloved family especially **my mum, my sisters** and my friends for their support in my journey to success.

## **ACKNOWLEDGEMENT**

I thank the Almighty God for the fact that He has brought me, the gift of life, protection and His provision to me during and throughout the writing of this project report.

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Lastly, I extend my deepest thanks to my family and my friends who helped me throughout this project report.

May the good Lord reward you all!

## **LIST OF ACRONYMS**

NT: Nanotechnology

ZnO: Zinc oxide

NPs: Nano particles

U.V: Ultra Violet

GSM: Grams per square meter

PC: Polyester-Cotton

SiO<sub>2</sub>: Silicon dioxide

NNI: National Nanotechnology Initiative

UIRI: Uganda Industrial Research Institute

NYTIL: Southern Range Nyanza Limited

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## **Chapter one**

### **Introduction**

#### **1.1 Background**

Color plays an important role in the selection of textile products by the consumer. The human eye can detect small color differences in textile products and hence color application by the textile manufacturer must be very uniformly done. Color is applied on textile substrates by either dyeing or printing.

Dyeing is a process of applying coloring matter directly on fiber, yarn or fabric without any additives or it's the overall coloration of a textile substrate while printing is delocalized dyeing. A dye is a colored substance used to impart permanent color to other substances.(Valnice & Zanoni, 2016) or Dyestuffs are colored organic molecules with substantivity for a textile substrate. Substantivity is the ability of a dyestuff to adsorb into a substrate from solution such that as the dyeing proceeds, the concentration of the dye in the fiber increases while the concentration of the dye in solution decreases. Textile dyes are classified into two that is natural dyes and synthetic dyes. Natural dyes are derived from plants and animals while synthetic dyes are manufactured from organic molecules.

Crude natural dyes used in this research were from *Morinda Lucida*, *Albizia Coriaria* and *H. Madagascariensis* stem barks. These crude natural dyes were obtained by first air drying the stem barks of the trees, crushing using a mortar and pestle and dissolving in distilled water. Synthetic dyes used were basic, disperse and vat dyes.

Textile finishing has always led to introduction of new technical properties, which are useful in diversified end uses. Technological diversification in finishing decides the performance domain of fabrics and renders it special functional properties. Ever since the introduction of

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