BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF GINNING AND TEXTILE ENGINEERING

MULTI RESPONSE OPTIMIZATION OF YARN STRENGTH, IMPERFECTIONS AND YARN EVENNESS FOR ROTOR SPUN YARN

BY

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ABSTRACT

In this study, a multiple response optimization model based on response surface methodology was developed to determine the best rotor speed and yarn twist level for optimum rotor yarn strength and unevenness and imperfections. Cotton yarn of 30 tex, was produced on rotor spinning machine with different twist levels (i.e. 500, 550, 600 and 700 tpm) at different rotor speeds (i.e. 70000, 75,000, 80000, 90000 and 100000 rpm). Yarn quality characteristics were determined for all the experiments. Based on the results, a multiple response optimization model was developed using response surface regression on MINITAB® 17 statistical tool.

DECLARATION

I hereby declare that the information contained in this report is entirely my own work and has not been submitted as an exercise from the assessment at this or any other university.

NAME	**SIGNATURE**
NANTUMBWE DOROTHY	.....

APPROVAL

This project was planned for and monitored by the Department of Textile and Ginning Engineering under the Faculty of Engineering of Busitema University under the supervision Dr. Nibikora Ildephonse

Sign: .....

Date: .....

DEDICATION

This report is dedicated to Mr. and Mrs. Nsereko Joseph and Mr. Kawuma Joseph; my fallen heroes who believed in me. I know you're looking down at me and smiling.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Rotor Spinning is a well-established yarn producing technology that has been used for more than forty years to process a wide scope of fibers worldwide (Padmanabhan, 1989). The productivity of yarn formation has increased 3-5 times by open-end spinning as compared to ring spinning system. Direct winding of the spun yarn to form a cheese of 3-5 kg is an additional benefit. The qualitative properties of open-end yarn are much better than carded short staple cotton with the exception of lower mean strength (Wirth, 1975). As far as economics is concerned, open-end spinning does not need the roving and winding machine and as such, less machinery involved in the yarn production process. Because of this, the profit margin is higher as compared to ring spinning system with other bonus advantages of less space and labour requirements (Bulent, 2003). In addition, almost 2.5 % less waste is generated for all yarn counts in rotor spinning as compared to ring spinning (Kampen, 1970).

Rotor spinning gives a new boom to the cotton processing. Yarn produced is more uniform, fuller, aerated and regular in strength (Nawaz et. al., 2003). Rotor spun yarns also exhibit more evenness, less count variation and imperfections, because of elimination of drafting waves in the spinning preparatory process. Furthermore, rotor spun yarns exhibit higher elasticity as compared to ring spun yarn (Jackowski et. al., 2002). Additionally, yarn breakage rate in rotor spinning is lower which results in improved production as well as quality of the yarn. However, rotor spun yarns are weaker as compared to ring spun yarns at equivalent twist levels due to their structural differences. Therefore higher twist levels are usually used for rotor yarns in order to achieve strength equivalent to that of the ring yarn. Moreover, rotor yarns are somewhat harsher than ring yarns due to high twist levels and structural difference (Farooq et. al., 2012).

In spite of that, the application range and flexibility of rotor spinning technology are its most important aspects. Considering the range of processed materials and final products, one can conclude that rotor spinning is the most universal technology. Thanks to its high productivity, and good yarn quality, the range of yarn counts spun using different raw materials is very high.

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