

Effect on physical properties of grey fabric using ring spun and compact spun yarn



Project Supervisor

Dr. Nabeel Amin

Project Co-Supervisor

Dr Sarwar Rana

Submitted By

Akif Zubair	060820068
Mazhar Iqbal Malik	050620055
Muhammad Sulaman Mushtaq	050620122

*Department of Textile Engineering
University of Management and Technology*

We dedicate our project to the employees and workers who are suffering from low facilities and wages, but putting high efforts for the survival of textile industry.

Acknowledgement

Firstly, we are very thankful to Allah Almighty for giving us a precious chance to work on this project.

Secondly, it is a pleasure to thank those who made this project possible, the honorable our project supervisor *Dr Nabeel Amin* and Co-Supervisor *Dr Sarwar Rana* for helping us in the selection of a useful topic for textile industry and giving us their opinions and helps us in this project. We are also thankful to *Mr Hammad Mohsin* for sharing his important opinions in the completion of this project.

We have special thanks to *Mr.S.M.Qutab* for helping us in the manufacturing of samples and sharing his views in the project completion.

We are very grateful to the “*SHAFI TEXCEL*” and “*INTERLOOP LIMITED LABORTARY*” with the reference of *Mr. S.M. Qutab* and *Dr Nabeel Amin*.

AKIF ZUBAIR
SULAMAN MUSHTAQ
MAZHAR IQBAL

Abstract

This project is related to the difference between the properties of fabric produced by using the same type of fibre (cotton). The yarn used for fabric is made using different techniques of yarn manufacturing i.e. ring spinning and compact spinning and apply different test methods to check its properties.

In this part of our project, we discuss the basics of cottons and its properties and the spinning and weaving methods and the tests which we will apply on these fabric samples.

CHAPTER NO 1

1.1 Introduction

Effect on Physical properties of grey fabric using ring spun and compact spun yarn. This topic is related to the textile weaving sector. This project concern with the properties of grey woven fabric, to check the properties of fabric from conventional ring spun yarn and compact spun yarn by applying different tests, while the count of yarn and fabric structure is same.

1.2 Objectives

The main objective of the project is to produce two types of fabric pieces made of cotton yarn of same count; one is to weave with ring spun yarn and other with compact spun yarn. Where the structure of fabric will remains the same for both types of yarns in weaving. The physical properties of the fabric sample would be based on single weave i.e. 1/1. The tests include:

- Pilling test
- Absorbency test

1.3 LITERATURE REVIEW

“Compact spinning produces a new yarn structure, as the edge fibers are incorporated into the yarn due to the elimination of the spinning triangle, so that the harmful effects of the spinning triangle on yarn characteristics are eliminated. The compact yarns possess less hairiness, better strength, better uniformity and lower values of thick & thin places and neps compared to the conventional ring-spun yarns”.¹

“The properties and structural parameters of compact and conventional ring yarns produced at five different twist levels were compared. A modified version of the tracer fiber technique. To explore yarn structure. Results obtained from these analyses showed that the high tenacity values of compact yarns can be attributed to the higher rate and amplitude of fiber migration in these yarns compared to those in conventional ring yarns. Another important finding was the superiority of compact yarns in terms of tensile properties is less noticeable at higher twist levels and in 50/50 polyester/cotton blend”.²

“Various makers of the compact spinning systems like Suessen, Rieter and Zinser have claimed advantages associated with compact spinning over ring spinning. The objective of this thesis is to validate the authenticity of the advantages popularly associated with compact spinning, in comparison to ring spinning”.³

¹ (Pinar Çelik, Hüseyin Kadoğlu. Ege University, Department of Textile Engineering 35100 Bornova, Izmir, Turkey, E-mail:pcelik@textile.ege.edu.tr)

² (J.Textile Inst., 43, T60–T66, 1952) combined with the Image Analysis Application Version 3.0 (B.A.R.N. Engineering)

³ (RAJANEY, POOJA JASWANT. Analysis of Compact Spun Yarns and Ring Spun Yarns. (Under the direction of Dr. Timothy G. Clapp).

1.4 Cotton

Cotton is a natural cellulosic fiber; it is the white fibrous substance covering seeds harvested from cotton plants.

Cotton fibers are divided into two categories:

- Mature Cotton
- Immature Cotton

1.4.1 History of Cotton fiber

The word “cotton” is derived from the Arabic word “qutun” or “kutan”. As the cotton fiber is obtained from plant it is classified as natural cellulosic fiber. About 5000 years ago the cotton was cultivated in India, Pakistan and Mexico. In fourteen century, the cotton was only grown in the Mediterranean countries after that the cotton was transferred to the spinning mills in the Western Europe. In 1641 when “Industrial Revolution” came in Lancashire, England, at that time cotton was used very well there. In 1793 a man named Eli-Whitney made first ginning machine. In England the first cotton mill was constructed in 1736.^{4 5}

1.4.2 Types of cotton with respect to Regions

Different types and kinds of cotton are commercially grown in various parts of the world. The basic characteristics of types of cotton may vary. This variation in different cotton fiber occurs due to the growing conditions including soil, climate, fertilizers etc.

The quality of various cotton fibers is determined and depends on:

- Color or the degree of whiteness
- Length or the staple
- Fineness of fiber

⁴ Textile science 2nd edition By E.P.G. Ghol & L.D. Vilensky

⁵ A Practical guide to fiber science by N.S Kaplan

1.4.3 Major Kinds of Cotton

Different types of cotton are often identified by the names of the regions or the countries where it is produced. Some of the most popular types of cotton are:

1.4.3.1 American Pima

This popular type of cotton is grown in Texas, New Mexico, Arizona and Southern California. . The fiber is fine, strong, silky, lustrous and creamy white in color. The cotton type is widely used for different kinds of apparel and home furnishing fabrics.

1.4.3.2 Egyptian Cotton

This type of cotton fibers are light brown in color, fine, strong and widely sold all over the world. It is used in applications where fine and strong yarns are needed. The cotton is often used for apparel, home furnishing and surgical purposes. Egyptian cotton is often used for manufacturing bed sheets, cushion covers etc.

1.4.3.3 Asiatic Cotton

This type of fine quality cotton is produced in countries like India, China and Pakistan.

1.4.3.4 Upland Cotton

This type of cotton is widely grown in different regions of America. It is often used wholly or as a component of blend with manmade fibers, for use in different industries.⁶

1.4.4 Length of cotton fibers with respect to Regions

In these types of cotton length is vary. In Egyptian cotton length is from “1 to 2.5 inches”. In American cotton length is from “1 to 1.5 inches” and in Asiatic cotton length is from “3 to 3.5 inches”.

⁶ www.articlealley.com

Table: 1.1 Growth of cotton in different countries ⁷
(Fig in '000' Metric tons)

Countries	2003-04	2004-05	2005-06	2006-07
United states	3975	5062	5201	4018
Brazil	1309	1299	1048	1524
Egypt	198	292	202	212
China	4870	6324	5770	7183
Australia	348	658	589	274
Bangladesh	15	13	14	14
India	3009	4121	4148	4760
Pakistan	1734	2482	2089	2091

Table: 1.2 Leading producing countries-
National cotton council of America-Ranking [6]
(Fig in million bales)

Top Ten Cotton Producer (2007)	480 pound per bale
China	25.3
India	20.5
United States	19.2
Pakistan	11.7
Brazil	7.2
Uzbekistan	5.5
Turkey	3.2
Greece	1.4
Turkmenistan	1.3
Syria	1.2

⁷ www.wikipedia.org

1.5 FIBER MORPHOLOGY

Fiber morphology consists of two major parts:

- Macro structure
- Micro structure

1.5.1 Macro structure

In macro-structure we observe the following categories:

- Length
- Color
- Fineness
- Luster

1.5.1.1 Length

As we have seen, fiber length was the initial property used to assess cotton quality and its suitability for certain end uses. The length of the fibers of cotton ranges from 10mm-65mm depending upon the quality of the fibers. Lengths of the fibers are very important factors in the spinning process of yarn. Strength is also varying with the variations in the length of the fibers. Long cotton fibers are easy to spin into smoother and stronger yarns. In result, it is more comfortable, more durable, more attractive fabrics and garments.

Fiber lengths on individual seeds can be determined while the fibers are still attached to the seeds, by hand stapling or by photo-electric measurement after ginning. Traditionally, staple length have been measured and reported to the nearest 32nd of an inch or to the nearest millimeters.

The length of cotton fiber differs with their regions of cultivation. Such as: Egyptian cotton has fiber length of 1-2.5 inches, American cotton has length of 1-1.5 inches and Asian cotton has fiber length 3-3.5 inches.⁸

⁸ Textile science 2nd edition By E.P.G. Ghol & L.D. Vilensky

1.5.1.2 Color

Fiber color is most directly linked to growth environment. Color measurements are also correlated with over all fiber quality so that (reflective, high RD), creamy-white fibers are more mature and of higher quality than the dull, grey or yellowish fibers associated with field weathering and generally lower fibers quality. Although up-land cotton fibers are naturally white to creamy-white, pre-harvested exposure to weathering and microbial action can cause fibers to darken and to lose brightness.

Color is determined by using Nickerson-Hunter Colorimeter. This gives the values of RD (light or dark) and +b (yellowness).⁹

1.5.1.3 Fineness

Fiber fineness is an important quality characteristic which plays a vital part in determining the spinning values of cotton. If the same count of yarn is spun from two varieties of cotton, the yarn spun from the variety having finer fibers will have a larger number of fibers in its cross-section and hence it will be more even and strong than that spun from the single variety of cotton fibers. Its fineness ranges from 11-22 micro-meters.¹⁰

1.5.1.4 Luster

There is no or minimum luster in the raw cotton fiber. But in Sea-island and Egyptian are the two types of cotton that have very little luster.¹¹

1.5.2 Microscopic Appearance

Microscopic appearance of the cotton is viewed in two ways:

- Longitudinal
- Cross-sectional

⁹ A Practical guide to fiber science by N.S Kaplan

¹⁰ A Practical guide to fiber science by N.S Kaplan

¹¹ Textile science 2nd edition By E.P.G. Ghol & L.D. Vilensky

1.5.2.1 Longitudinal

Under a microscope cotton fiber looks like a twisted ribbon and twisted tube. Due to these Twisted or convolutions we can identify the cotton fiber. They frequently alternate in direction of rotation. The main part of the fiber or $\frac{3}{4}$ length of the fiber having convolutions,

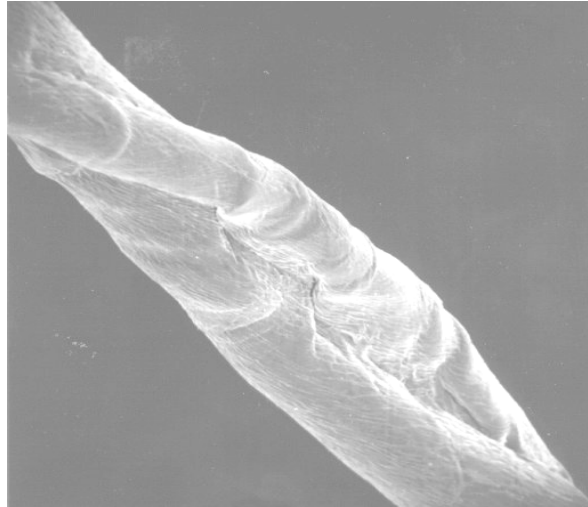


Figure: 2.1 microscopic view of cotton fiber

remaining end is straight. Convolutions are made after the cotton ball burst. The convolution angle of the twist is calculated by the formula

$$\theta = \tan^{-1} (2W/l) \text{----- Equ (1)}$$

In the case of convolutions the fibers are tend to roll onto themselves. The twist thickness increases with the age. The convolutions are not present during initial growth but are formed after boll opening. Fiber widths between the long twists are slightly higher than those between the short twists, but these differences diminish with fiber development.

Convolutions generation is intimately related to the internal structure and secondary-wall thickness.^{12 13 14}

¹² Textile science 2nd edition By E.P.G. Ghol & L.D. Vilensky

¹³ A Practical guide to fiber science by N.S Kaplan

¹⁴ Cotton Fibers BY Amarjit S. Basra

1.5.2.2 Cross-sectional

Cross sectional analysis of cotton fibers provides direct, accurate measurements on fiber fineness and maturity, which are often regarded as the reference data for validating or calibrating other indirect measurements of these important cotton properties.

A cotton cross sectional contains measurable information directly related to the maturity of the fiber. The success of a cross section method using image analysis largely relies on two techniques: fiber cross sectioning and image segmentation. Cross sectioning is the most important step in obtaining analyzable images of fibers. In the grinding, a bundle of fiber embedded in a polymer resin and hardener mixture was hardened, grinded and then polished, and the surface containing fiber cross sections was imaged on a microscope using reflected light.

There are different ways of cutting a thin piece of fiber perpendicular to the long axes. A quick embedding method especially for cotton fibers was established by the researchers at the USDA Southern Regional Research Center (SRRC).¹⁵

1.5.3 Micro Structure

There are four layers in the structure of cotton fiber:

- Cuticle
- Primary cell wall
- Secondary cell wall
- Lumen

1.5.3.1 Cuticle

The very inner side layer is called cuticle. This is made of waxy layer. In this layer only a very few molecules are thick. This layer protects the others layers from chemicals and other

¹⁵ Abstract from "IMAGE ANALYSIS FOR COTTON FIBERS (Part II: Cross Sectional Measurement)
B.Xu and Y.Huang (The University of Texas at Austin)