

A Comparative Study on Cotton - Jute
Blended Fabric Using Reactive Dye

BY

V. B. Rekha

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE
AND HIGHER EDUCATION FOR WOMEN (DEEMED UNIVERSITY) COIMBATORE - 641 043
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN FAMILY AND COMMUNITY SCIENCE

MAY 1995

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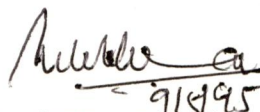
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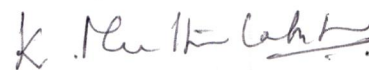
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Introduction

I INTRODUCTION

The growing awareness and increasing momentum generated for saving the environment from ecological disaster had prompted the movement for return to nature. This has led to a significant swing from synthetic textiles to natural textiles.

Fibrous materials are found in nearly all plant life but some plants have proved to be important sources of textile fibres for the manufacture of yarn, cord and fabrics. These plant fibres consists largely of cellulose as natural fibers. The natural cellulose fibres commonly encountered in consumer goods include cotton, linen, jute, ramie and hemp. Many of these fibres are used to some degree in all parts of the world depending on availability, cost, appearance and comfort.

Cotton is the backbone of the world textile trade and is one of the widely used major textile fibre possessing ideal properties than any other fibre. It has been of service to mankind for so long that its versatility is almost unlimited from utilitarean to high fashion and new uses constantly being discovered. This unique combination of properties has made cotton a standard for great masses of the people. The statement that

"cotton is the king of fibres" still hold value inspite of the new discoveries of natural and man made fibres. Jerde (1992).

Thus the people's taste for cotton, the natural fibre has its own importance. But due to the inability to meet the growing demands of increasing population, deforestation and urbanisation has reduced the land available for cotton cultivation and its supply. An alternative is to use cotton blended fabrics. Cotton can most suitably be blended with jute which is cheap and available in abundance so that certain of the desired properties of cotton, that jute may lack will contribute to the general characteristics of the blended yarn or fabric.

The major objectives of blending of jute with other fibres are to improve the functional properties, to overcome certain inherent deficiencies, to impart additional favourable technical properties, and to improve process performance of jute fibre. The blending of jute fibre with natural fibres which are finer and have definite length influence the spinnability as well as productivity. Chaudhuri (1991).

On the horizon of Indian textiles a new glow of

the "golden fibre" is emerging, says Sivaramakriahna (1993). Jute is a bast fibre obtained from the inner bark of the corchorus plant. It is produced in greater amounts than any other fiber with the exception of cotton. The fibre obtained economic importance during the latter part of the 18th century, however, it had been used earlier as 'sack cloth'. Saptharishi (1994).

In a world where concern for the degradable environment is growing everyday, jute has emerged as a natural alternative to widely used synthetic, non biodegradable fibres, especially in the textile industry. However, these new areas of application for this cash crop are a comparatively recent phenomenon and hold a very small share in India's jute industry, but the validity of the direction in which jute should move in the coming year is crystal clear. Saptharishi(1993).

Textile view takes a look at the radical new efforts to change the image of jute and promote it as a high fashion fibre not only for furnishings but also all areas of apparel. The fabric development in a real sense, is not the weaving or fabric production, but the innumerable ways and means of transforming the fibre into yarn, into an ordinary cloth and to a beautiful fabric which will readily catch the eyes of a common man and here lies the

real art and challenge of textile technologist.

In India, modern technology has created the possibilities for spinning an intimate blend of jute and cotton. Especially in south, with their long textile heritage in the cotton industry, treats jute in a way that enables them to process it on cotton machinery. After cutting the two meter long fibres into the average cotton staple length of 1.5 inch, the fibres are mixed thoroughly and an intimate blend yarn is spun out of the required cotton - jute portion. Saptharishi (1994).

Thus the age old jute fibre is being rediscovered. It is no longer going to be a raw material for the traditional packing, sacking and backing. The versatile potential of jute is getting explored. The result of research and experimental innovation has indicated that every aspect of human living can be supported by jute. Sharma (1993). Recently significant development have taken place in evolving new uses of jute in specific areas like jute household textiles, jute reinforced plastics, jute fabrics/yarn based handicrafts, paper, paper pulp and automobile panels. Saptharishi (1994).

Understanding the immense potential of jute fibre in its value added applications, Government of India with the assistance of United Nations Development Programme is

implementing a massive five year National Jute Programme to promote a new class of diversified jute Industry mainly to produce value-added diversified products in both organised and decentralised sectors. Under this programme development of necessary technology for the commercial production of value added products are being undertaken by various research institutions throughout the country. promotion of entrepreneurs and development of required human resources for the commercial production of such value-added items are undertaken by educational institutions also. BTRA(1994).

Hence the investigator has made an attempt on a comparative study of cotton-jute blended fabrics with the following objectives.

To compare:

1. Two different proportion of cotton-jute blended fabric with same yarn count.
2. Cotton-jute blended fabric with different yarn count.
3. The effect of reactive dye between different blend ratio and different yarn count and
4. The effect of varying reactive dye concentration on different blend ratio with different yarn count.

Review of Literature

II REVIEW OF LITERATURE

The literature pertaining to the study of cotton-jute blended fabric is reviewed under the following headings:

- A. Origin and History of cotton and jute
 - B. Role of cotton and jute industry in India's Economy
 - C. Need for cotton - jute blended yarn
 - D. Processing of cotton - jute blended yarn
 - E. Characteristics, properties and uses of cotton, jute and cotton-jute blended products
 - F. Dyes suitable for cotton - jute blended fabrics
- A. Origin and History of cotton and jute:

Almost since the dawn of history, man has been familiar with the use of fibre, both vegetable and animal fibres have played quite an important role in not only covering the body for clothing purposes, but also being of several other uses in every day life. In due course of time, fibres have considerably activated their uses and established an important role for themselves in the economic life of people, opines Doraiswamy (1994).

Natural fibres are facing stiff competition in the fibre market following the introduction of man made fibres. But natural fibers are still holding their commercial status by virtue of some special character

properties which are lacking in manmade fibres. Therefore cotton fibre is still considered as king of fibres, says Murthy (1987).

The traditional varieties of cotton cultivated in this country in the past belonged to the species of *Gossypium Arboreum* and *Gossypium Herbaceum*, called generally as desi cotton. The varieties belonging to these species have inherently low yield and are shorter and coarser than varieties belonging to *Gossypium Hirsutum* or American upland types. Cotton belonging to *Gossypium Barbadense* have extremely long and fine fibres and are grown mostly in Egypt and Sudan, suggests Murthy (1987).

According to Joseph (1980) the origin of cotton is unknown. Archaeologists have contributed valuable information concerning the fibres early use, but there is a dearth of evidence to indicate, when or where cotton first grew. Data suggesting that cotton was grown in Egypt about 12,000 B.C. remain inconclusive, however most authorities agree that cotton was produced in India about 3000 BC and that India was the principle country in which cotton was widely utilized before 2500 B.C. Murthy (1987) says that according to historians, India was the first country to grow cotton and weave cotton fabric. The word cotton derives from the Arabic word quoton or qutun, which means a plant found in conquered lands, relates Joseph (1980).

Saptharishi (1994) suggests that jute is internationally recognised name of bast fibre obtained from the stalks of plants of the genus 'corchorus' of the 'Tiliaceace family', Corchorous is a genus about 40 species of annual herbs distributed throughout the tropics. About eight species occur in India, of which two are of commercial importance i.e. c. capsularis and c. Olitorius.

Many years before the beginning of the christian Era, it was recorded in 'Manu', an ancient sanskrit socio-regions Code, that a particular kind of fine cloth made out of bark and named 'Patta' was used by the people of India, opines Chellamani (1994). The first use of jute fibre in India is reported to have been in the early 18th century. By the late 19th century the cheapness and excellence of jute cloth as a packaging material were well established, says Kothari (1992). It was due to the trading enterprises of the 'East India Company' that the possibilities of jute both as a fibre as well as cloth became known to the world, stresses Doraiswamy (1994).

B. Role of cotton and Jute Industry in India's economy

The cotton textile Industry is the major industry to develop among the modern Indian Industries. It is the base on which the pyramid of the industrial sector of all the country has been built, remarks Kothari (1992).

Cotton is world wide the most popular fibre forming 4% of the total consumption. Cotton is cultivated over about 75 lakh hactares in our country. Since the average land holding is small, it is estimated that about 45 to 50 lakh persons are engaged in cotton cultivation. Besides a large number of persons get supplementary employment for seasonal operations like harvesting, commits Achwal (1992) Cotton as an economically important commodity has been dealt with by highlighting its role as a foreign exchange earner, its present importance through by products and the production and consumption situation of cotton as a raw material for textile industry, claims Sundaram (1990). The production of cotton increased significantly by 19.2%, from 9.71 million bales to 11.58 million bales in 1993 and the trends in the total production of cloth increased by about 1.7 percent, states Kothari (1994).

The jute industry is one of the oldest in India and has played a pivotal role in the country's economy. It would be no exaggeration if we mention that jute has contributed to a large measure in the economy of the eastern region of the country. Besides being agro-based, it is also labour intensive and a source of livelihood to a large number of people in various ways. It has also contributed considerably towards building up valuable

foreign exchange for the country, besides generating a sizable revenue by way of various taxes and levies, reveals Doraiswamy (1994). There are nearly 70 jute mills in India with over 43,000 looms. As the world's largest producer of jute, India's production reached 1.3 million tons in 1993. The jute economy supports 4 million farmer families and 2,40,000 workers in factories, apart from 1,50,000 workers in other jute related activities. India is the largest producer of jute goods with the largest area, 12.5 lakh hectares under cultivation, opines Kothari (1994).

C. Need for cotton - jute blended yarn:

Utilisation of jute yarn in combination with other textile yarns is going to create impact in a highly competitive textile yarn market particularly when fluctuations in the supply, availability and price of cotton yarns have become order of the day, suggests Doraiswamy (1994). The purpose of blending of two or more types of fibres is 2 folds, one is the economic and the other is the yarn characteristics, says Chaudhuri and Das (1991).

Prasad (1993) points out that jute is rather a rigid coarse fibre with linear density ranging from 12 to 50 denier. As compared to cotton fibre, jute fibre is

thicker by 8 to 30 times. Because of this, higher count yarns could not be made from 100% jute fibres. Without making higher count yarns really worthwhile, acceptable value added products could not be made from 100% jute fibres. Hence for producing value added products jute fibre is to be necessarily mixed with cotton and then spun into yarn. These were known as cotton-jute blended yarns.

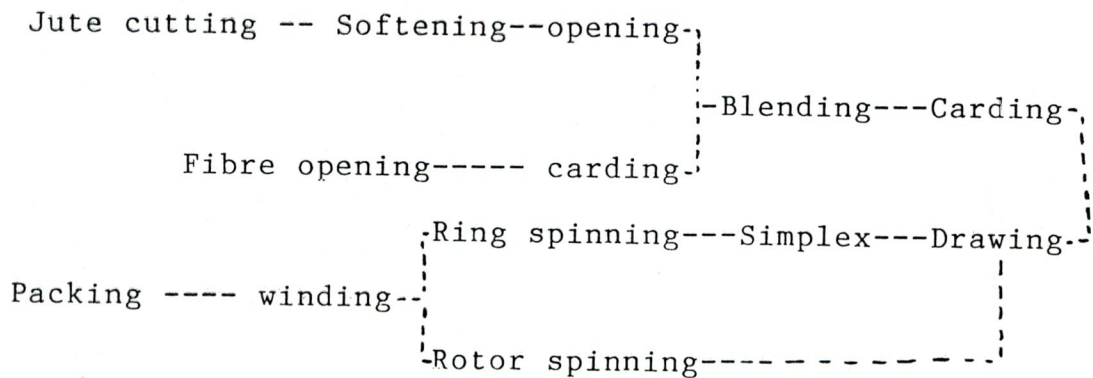
Blending of jute with other fibres imparts an unique or special characteristic of jute effect to the resultant product, reveals Banerjee et al (1994).

Objectives of blending of cotton and jute fibres:

- 1) The intermixing of fibres will overcome certain inherent deficiencies of all jute products in regard to relative coarseness, brittleness and harshness in feel, appearance, wrinkling behaviour and inextensibility.
- 2) Facilitate improved spinning performance owing to increased number of fibres at the yarn cross section.
- 3) Improved weaving performance.
- 4) Reduced cost of the end product.
- 5) Impart aesthetic value to the end product such as better eye appeal, soft feel, improved resiliency, drape, washability, durability and reduced fibre shedding, points out Selt (1989).

D. Processing of cotton - jute blended yarn:

Process flow chart for cotton-jute blends



The jute fibre is cut to staple lengths using a cutting machine and treated with emulsion (oil, water and emulsifying agent) or enzymes, to make them soft to improve the inter fibre cohesion and processability. They are then opened in the one or two toothed openers, blended with opened cotton and made into scutcher laps. These laps (cotton - jute blended) are then processed through the card in the cotton processing system and spun into yarns of count 6's to 10's, with desired blend ratio, in the ring and rotar spinners with slight modification in the card, speed and settings in the machines at different process stages, enumerates Gupta et al (1992).

E. Characteristics, properties and used of cotton, jute and cotton-jute blended products:

Cotton has remained the dominant raw material in our country, not only due to its easy, domestic

availability but because of a variety of other factors, says Mehta (1986). The cotton fibre is one of the purest forms of cellulose, of which it contains between 88 and 96 percent. The non-cellulosic impurities include, naturally occurring organic compounds such as wax, pectins, proteins and colouring matter, suggests Green Wood (1993). The cotton fibre has the ability to absorb a great deal of moisture, making it a good fabric to wear in hot weathers commits Storey (1978). The tensile property of cotton is greater when wet than when dry, remarks Encyclopaedia of Textiles (1992). Alkalies do little damage to cotton, where as they are more suseptible to damage by strong mineral acid than by organic acids, claims Cowan and Jungerman (1980). Careful bleaching will resist the chemical attack of bleaches to the fibre surface polymers of cotton, reveals Gohl and Vilensky (1987). Cotton fibre is pure white, highly absorbent, tasteless and odourless, very smooth and soft, non irritant and cool to touch, stresses Rao (1987).

Cotton is the most versatile and widely used textile fibre possessing more ideal properties than any other fibres. This is widely used natural fibre for clothing, sheets, hand kerchiefs and bandages are ideally made from cotton, opines Holland (1985).

According to Jerde (1992) cotton is one of the world's major textile fibers. It is also one of the most versatile, being used either alone or in many blends for a seemingly infinite variety of apparel, household and industrial products.

Jute, the golden fibre is an annually renewable natural resource which makes no demand on the world's scarce energy resources. Hence, jute contributes lasting solutions to the universal problems of pollution in these environmentally conscious times, stresses Bondopadhyay (1993).

Jute is a strong ligno cellulosic fibre with 58-63% cellulose, 21-24 % hemicellulose, and 12 - 14 % lignin as the major constituents, says Ganguly and Chanda (1994). The fibre strand is composed of numerous individual filaments that in turn consist of overlapping fibre cells joined by entrusting substances, claims Mukerjee (1993). Jute fibre has got many advantages in that it is a naturally available cheap fibre and annually renewable. It is an eco - friendly, bio - degradable fibre with high strength and low extensibility, suggests Saptharishi (1994).

Jute fibre possess some favourable technical properties like, silky (golden) lustre, high tensile

strength and bulk, good dyability, fire retardency, sound and heat insulation property, antistatic property, dimensional stability and low thermal conductivity, opines Balasubramanian and Desai (1994). It has also inherent drawbacks such as bittleness, harshness to feel, hairiness, rugged appearance, wrinkle characteristic, inextensibility, inwashability and fibre shedding, claims Doraiswamy (1994).

As jute contains a high amount of lignin, the light fastness is very poor. Wet strength and abrasion resistance are also poor, enumerates Pondey et al (1993). The major drawback of jute is that the bleached jute turns yellow on exposure to sunlight, remarks Achwal (1993). When the jute fibres are treated with alkali, non-cellulosic materials dissolve, making the fibre regular which give rise to a better quality yarn for use in diversified product, points out Sikdar et al (1993).

Traditionally, jute is used for the manufacture of sacks, gunny bags, cords and covering material, suggests Achwal and Sinkar (1993). After the earth summit and the strong condemnation of plastics and biodegradables, the prospects for jute industry are looking up. Jute being a natural biodegradable and environmental friendly fibre, has a distinct advantage over synthetics, other advantages is their natural breathing qualities, remarks Mukerjee (1993).

Kothari (1993) opines that jute is still used for packing, wrapping and the manufacture of cloth backing for tufted carpet to some extent. However, there is a growing demand of jute yarn of a finer quality for weaving, at the buyer's end to meet the demand of specialised end uses like wall covering and woven carpets. This fine quality yarn is also used in the manufacture of foot wear, bags and travel coats, which have a large market overseas. The heavier yarn is used for binding purposes on explosives and as a kind of bedding for underground cables, opines Saptharishi (1995). According to BTRA (1994) cotton-jute blended yarns and products can be used in the following ways.

- 1) Yarns - knitting yarn
 - Face yarn for tufted carpet
 - Export yarn
- 2) Jute blended and union fabric-
 - Furnishing fabrics
 - Upholstery Fabrics
 - Apparel Fabrics
 - Fashion Fabrics
- 3) Fancy products - Hand / shoulder bags
 - Soft Luggages
 - House decorative/Handicraft products
 - Fabric for chairs

4) Utility Products - Wall Hangings

- Table Mats
- Table covers
- Shopping bags
- shawls
- Blankets
- Sofa covers
- Carpets

F. Dyes suitable for cotton - jute blended fabrics:

Dyeing may also be called as finishing process, it colours the fabric and so adds beauty to it, suggests Deulker (1988). Dyeing is cheaper in loose form but it is safer to dye in piece form as far as blend or union fabrics are concerned. Piece dyeing is the easiest and also the least expensive method for adding colour, says Joseph (1980).

Dyeing of jute and jute blends can be selected on the basis of the ease of application, reasonable fastness, characteristics, brightness and lustre of the shade and cost effectiveness. Careful selection of dyes are important, because dyes which are fast to cotton or wool are not fast to jute fibre due to the presence of lignin in jute, remarks Sivaramakrishnan (1993).

Studies on dyestuffs on jute reveal that jute can be dyed with all classes of dyes which are conventionally applicable to cotton and other cellulosic fibres. For example, direct, reactive, vat, azoic and pigment. In practice, only direct, reactive dyes have found application on jute on account of their being reasonably cheap and being easy to apply, points out Bhagwat (1991).

Dyeing of jute with direct and reactive dyes is carried out similar to the process adopted for dyeing cellulosic fibres. The interesting features of jute is that its overall performance in terms of dyeing time, exhaustion, washing and rubbing fastness in a shade better than cotton when dyed with direct and reactive colours. This is mainly due to the presence of a mild alkalie in the dye bath, which contributes to a later swelling of the jute fibres, claims Achwal (1933).

According to Bagchi and Saha (1992), reactive dye are preferred to direct dyes because they possess better colour fastness properties than direct dyes, other advantages are increase in productivity, cost reduction, simplification of process, reduction in processing time, processing is eco-friendly and gives cleaner effluent because of neutral PH and lower amount of chemicals used in dyeing process.

The ability of the reactive dyes to react chemically with the cellulosic material and to become attached to it by a covalent bond differentiate this class of dyes from others. This unique feature is the cause for their excellent washing fastness Nkconye and Olawande(1993). The ability of a reactive dye to react with a textile fibre is derived from the presence of a group called the 'reactive group in the dye which reacts with suitable groups in the fibre, enumerates Muralindharav et al (1994).

Experimental Procedure

III. EXPERIMENTAL PROCEDURE

The procedure adopted for the study is given under the following headings:

- A. Selection of fabric
 - 1. Selection of yarn
 - 2. Selection of count and blend ratio
- B. Selection of dye, colour and shade
- C. Equipment used for dyeing
- D. Choice of pre-treatment
 - 1. Desizing the fabric
 - 2. Scouring the fabric
- E. Selection of the dyeing method
- F. Procedure for dyeing the fabric
- G. After - treatment
- H. Evaluation
 - 1. Visual inspection
 - 2. Laboratory tests
 - a. Fabric thickness
 - b. Fabric Weight
 - c. Abrasion Resistance
 - d. Bursting Strength
 - e. Drapability
 - f. Wettability and Absorbency Tests
 - g. Colour Fastness Tests
 - 3. Statistical Analysis

A. Selection of fabric

According to Sivaramakrishna (1993) blended yarn are the pillars for product development, cotton-jute blended fabric has occupied a unique place in the field of textile, because of its wide range of use to produce a number of developed value added products. Cotton-jute blended fabrics are not only economical but also has desirable characteristic of stiffness, drape and fabric crispness. Doraiswamy and Chellamani (1993).

Therefore the investigator selected three types of cotton - Jute blended fabrics with plain weave of two meters each. Fifty cms from each sample was kept aside as original for laboratory purposes. The details of the selected blended fabrics are given in Appendix-I.

1. selection of yarn:

The yarns selected for the cotton - jute blended fabrics has cotton as warp and cotton - jute blended yarn as weft. Cotton is more popular than jute in the field of clothing and furnishings, this may be due to properties like, good absorbency, comfort and strength. Jute lacks these properties. But from the point of view of economy, jute is cheaper than cotton. With this view, an attempt has been made to produce a cotton - jute blended fabric.

2. Selection of count and blend ratio:

According to Wingate (1988) the count of yarn is the numerical designation given to it to indicate its size and is the relationship of length to weight.

Blended yarns is a strand composed of two or more different kinds of fibres in an intimate mixture so that the ultimate value of the fabric can be enhanced by the joint and positive qualities of both as the components of the blend.

The investigator selected cotton - jute blended fabrics with the following yarn count and blend ratio and named as sample A, B and C.

Sample A: Warp 16^S cotton, weft 10^S cotton-jute (70/30)

Sample B: Warp 30^S cotton, weft 10^S cotton-jute (70/30)

Sample c: Warp 16^S cotton, weft 10^S cotton-jute (60/40)

B. Selection of dye, colour and shade

Dye

The type of dyestuff used for dyeing any particular fabric depends on the nature of the fabric and the fastness qualities required in the finished goods. The criteria for dyestuff selection would include its shade, dyeing rate, degree of exhaustion and water solubility. The two most important factors to be considered are the dyeing rate and exhaustion which in turn are controlled by time, temperature,

salt, liquor ratio, dye bath volume, dye concentration and the inherent compatability of the dye stuff and fibre type. An equillibrium is usually reached within forty five minutes. At that point extra time is allowed for the dye to develop that is come to a uniform colour over the textile. Shenai (1973).

Studies on dye stuffs on jute reveal that jute can be dyed with all classes of dyes which are conventionally applicable to cotton and other cellulosic fibres. Cotton jute blended fabric can be dyed with direct, reactive and vat dyes. To get fastness properties reactive dye is best recommended. Betrabet (1994).

Dyeing at room temperature permits saving in the cost of dyeing and avoids unevenness in dyeing that may arise from temperature variation. Prayag (1990). Hence the commercially available cold brand reactive dye was selected to dye the selected blended fabrics.

Colour

The investigator has selected orange M₂R colour from reactive dye stuff in view of its aesthetic value, especially among the women folk and its technical advantage as to its fastness to prolonged wear and tear.

Shade

Kulkarni et al (1978) pointed out that the shades of the dyeing is expressed in a percentage of weight of dye to weight of fabric. The material to liquor ratio is also a unique quantity. This represents the weight of the dye bath liquor, in other words the percentage of shade and amount of material, the amount of dyestuff and the material to liquor ratio which reflect the concentration of the dye bath.

The general preference to categorise colour substracts are light, medium and dark in the field of colouration of the material.

Hence the investigator selected 2 percent, 4 percent and 6 percent shades. It may be noted that the depth of shade in terms of light, medium and dark based on the visual perception is carried out in day to day life. Hence the categorisation relates to the amount of colour applied to the substrate, scientifically as depth standard is related to the amount of colour consumed, method of application and type of substrate. Shah et al (1988).

C. Equipment used for dyeing

Neol Dyren forth and Hoster (1975) suggests the following equipment for dyeing. Hand jigger machine, physical balance, glass measures, rubber gloves and plastic

buckets were the equipment used to dye the samples along with dyes and chemicals.

D. Choice of Pre - treatment

1. Desizing the fabric

Desizing is the first wet process where the sizing ingredients used during weaving of a fabric are removed. An effective sizing is important to weaving, efficient removal of the sizes from grey fabric is equally important for further wet process. Dixon (1988).

Among the various methods of desizing, enzymatic treatment is the most popular and widely applied in industries. Hence enzymatic treatment was given to the samples. The detailed procedure for enzymatic treatment was given in appendix-IV. After desizing the materials were rinsed thoroughly in cold water and dried well.

2. Scouring the fabric

Since the impurities present in the woven material might hinder the absorption of dye, it is essential that the grey cloth is subjected to scouring.

The samples were scoured by using the procedure suggested by Tatersal (1975). The detailed procedure was given in appendix-IV.

E. Selection of the dyeing method

The Hand Jigger machine is a simple efficient machine in which dye stuffs can be applied on materials of varying weight, length and width. Shenai (1973). In the Jigger the cloth is kept moving back and forth throughout, till the desired shade is obtained. In Jigger dyeing, material runs evenly without overlapping of selvage. This is an important advantage in Jigger dyeing. Peter (1975).

Therefore hand jigger method was selected for dyeing the cotton - jute blended fabric.

F. Procedure for dyeing the fabric.

Each of the samples A, B and C were cut into three equal parts and named as A₁, A₂, A₃, B₁, B₂, B₃, C₁, C₂, and C₃ respectively. All the samples were dyed with reactive dye orange colour (M₂R) cold brand, with the following percentage of shades.

A₁, B₁ and C₁ were given 2% shade

A₂, B₂ and C₂ were given 4% shade

A₃, B₃ and C₃ were given 6% shade

Dyeing procedure is given in detail in appendix-V and the dyed samples in appendix - II.

G. After-treatment

Shenai (1984) remarks that after-treating bath

containing a detergent at a suitable temperature is able to remove and keep in suspension, the unwanted dye particles in the bath. This treatment has to be carried out at the boiling temperature to achieve full development of the fastness properties, especially light and washing fastness of the dyed samples.

As suggested by SITRA, the dyed samples were boiled in 2g/l soap solution for 30 minutes. After this the materials were rinsed thoroughly in cold water and dried.

H. Evaluation

1. Visual Inspection

In order to evaluate the dyed samples, a panel of 20 post graduate students of Textiles and Clothing and Family and Community Science, were selected as judges from Avinashilingam Deemed University, Coimbatore. A rating scale was prepared as shown in Appendix-III. The dyed samples were displayed for easy evaluation. The prepared rating scale was given to the selected judges and they were requested to evaluate the samples. The data were collected, consolidated and the result is presented under the chapter Result and Discussion.

2. Laboratory tests

The original and the dyed materials were tested by taking the sample pieces from the same relative portions

of all the materials for their respective laboratory tests.

a. Fabric Thickness

The thickness of a Textile material is the distance between two parallel surface, while exerting a specified pressure on the material. ASTM standards (1983).

The Hungarian thickness tester (Plate - I) was used to determine the thickness of the original and the dyed materials. It has a broad anvil upon which a presser foot is pressed by a spring. The sample was placed on the anvil and the presser foot was lowered on to the sample by releasing the raising lever very slowly. The dial reading in millimetres was noted down. The same procedure was carried out at twelve different places of the same material. Then the mean thickness was calculated and recorded for each material separately.

b. Fabric Weight

Booth (1986) points out that the fabric weight is generally expressed in one of the three ways. Ounces per square yard, ounces per linear yard for standard widths and yards per pound for given widths.

The Eureka cloth quadrant Balance (Plate - II) was used to determine the fabric weight directly. It had a graduated scale in ounces per square yard. A template was used to cut the sample and the sample was suspended on the

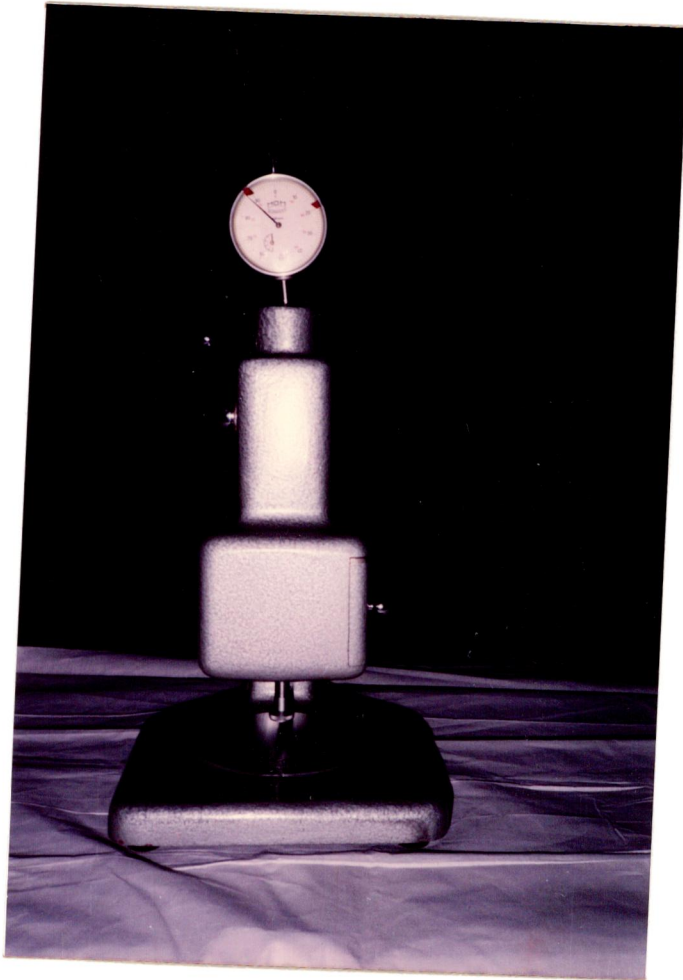


PLATE I
HUNGARIAN THICKNESS TESTER

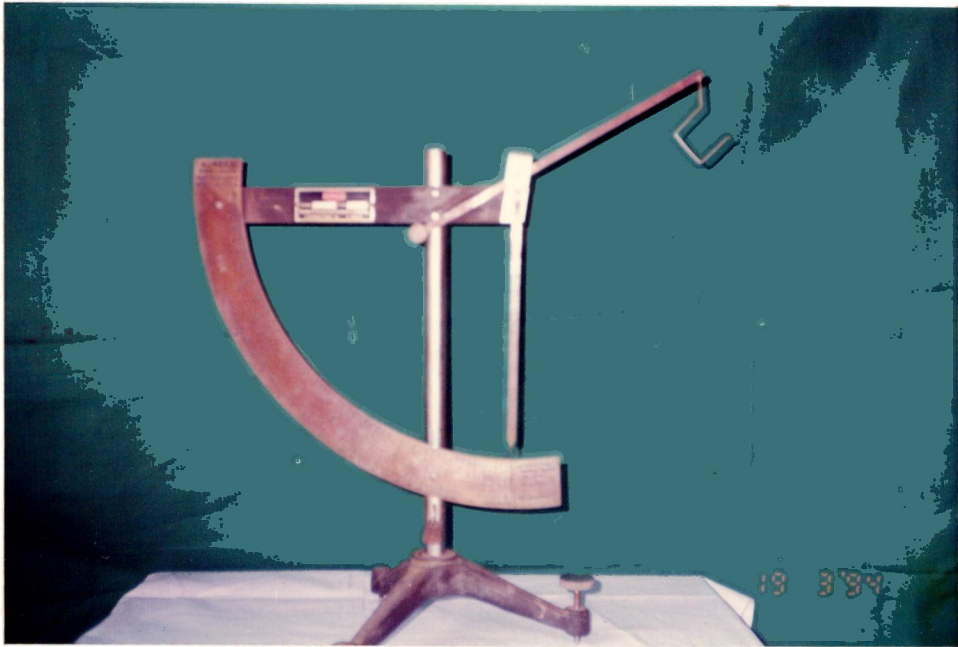


PLATE II
EUREKA CLOTH QUADRANT
BALANCE

hook of the balance and the reading was recorded. The mean value of ten samples from the original and the dyed materials were calculated and recorded separately.

C. Abrasion Resistance

Abrasion Resistance is the ability of a fabric to withstand loss of appearance, utility, pile or surface through the destructive action of surface wear and rubbing. Wingate (1988).

The Eureka Materials Abrasion Resistance Tester (Plate-III) was used to determine the abrasion resistance of the samples. Universal Carborundum (Fine J-298 KV) was used as an abradent. Eight samples were cut from different places of the same material using a template. The weight of each sample was found out. Then it was mounted on the sample holder and was given a multidirectional movement and rubbed against the abrasive paper. The number of rubs needed to rupture the sample was determined as 30. After abrasion, final weight was noted. The loss of weight of the sample due to abrasion was calculated. The readings were taken for each of the original and dyed samples and their mean value was calculated and recorded.

d. Bursting Strength

Wingate (1988) states that Bursting Strength is the ability of a material to resist breaking by pressure applied to it, specifically the force necessary to rupture a fabric

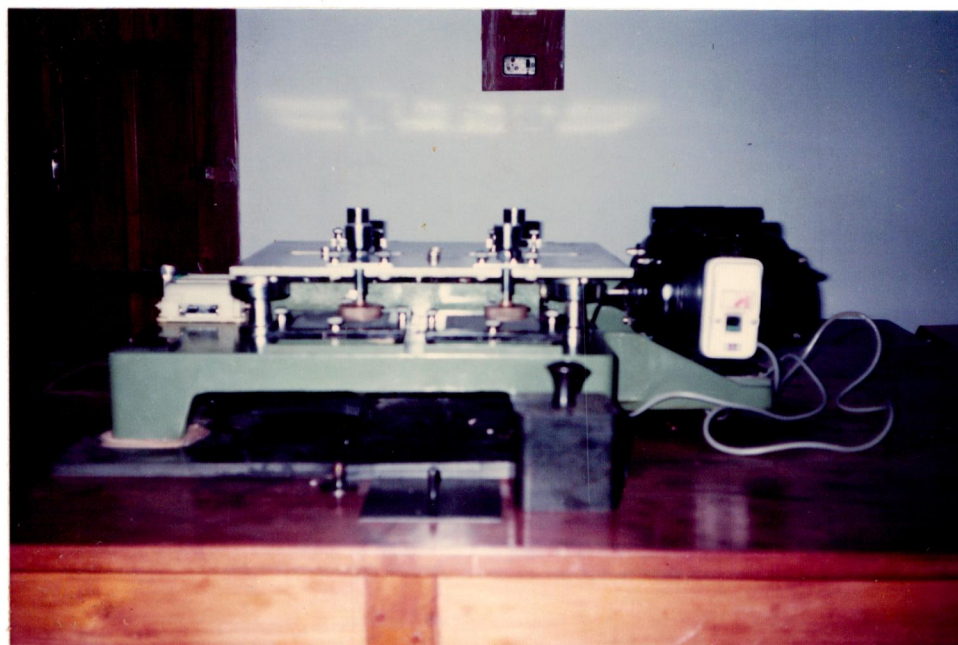


PLATE III
EUREKA MARTINDALE ABRASION
RESISTANCE TESTER



PLATE IV
EUREKA BURSTING STRENGTH
TESTER

by distending it with a force applied at right angles to the plane of fabric under specified condition.

The Eureka Bursting Strength Tester (Plate - IV) was used. It consisted of a disc holding a rubber diaphragm and a ring clamp mechanism for mounting the sample. The internal diameter of the sample was 3cm, the dial was calibrated in both pounds/square inch and kg/cm^2 . The load necessary to burst the fabric by means of the diaphragm gave the bursting strength. The mechanism was stopped immediately after the sample got ruptured. The dial reading was noted. The test was repeated eight times for the originals and the dyed samples and their mean value was found out and recorded.

e. Drapability

Wingate (1988) refers drape as a character of fabric indicative of flexibility and suppleness. Used with reference to the way fabric falls when hung or arranged in different position. Draping quality is expressed as drape coefficient which theoretically varies between 0 and 100.

The Eureka Drape Tester was used (Plate - V). When the light was on, the image was formed on top of the glass cover. The samples were cut using a round template which was 24 cms in diameter. Using this, two brown papers were also cut.



PLATE V
EUREKA DRAPE TESTER

The material was drapped on the plateform and the image was drawn on the brown paper. The weight of the brown paper initially and finally after cutting to the image was recorded. The co-efficient percentage was found using the formula :
$$\frac{M_2}{M_1} \times 100$$

Where, M_1 = Initial weight of the paper

M_2 = Weight of the paper after cutting

f. Wettability and Absorbency Tests

Since the time taken to absorb a drop of water by the sized original was found to be unwettable, the pre-treated materials were considered as original for the Drop, sinking and Capillary Rise tests.

(i) Drop Test

The ability of a fabric to take up moisture is determined as absorbency and wettability as the time taken in seconds for a drop of water to sink into the fabric. Skinkle (1972).

A burette filled with distilled water was clamped in a stand. The sample was mounted in an embroidery frame and placed at the base of the stand (Plate-VI). The height between the sample and burette nozzle was kept constant. The nozzle of the burette was opened to allow a drop of water to fall on to the sample. The stop watch was started simultaneously and it was stopped when the drop of water

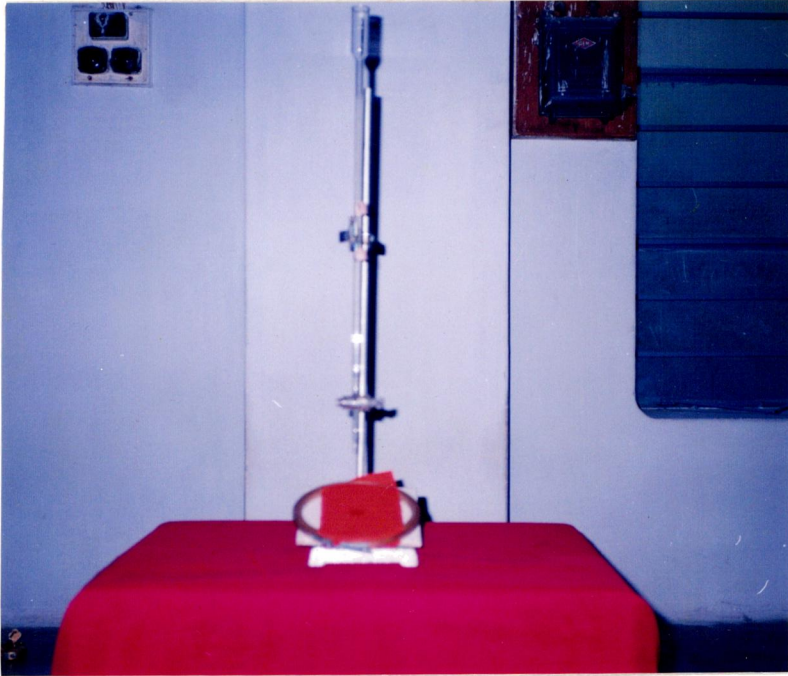


PLATE VI
DROP TEST

fully sank into the material. The time taken for this was noted. The same procedure was repeated for 10 times for the original and dyed materials and their mean was recorded separately.

(ii) Sinking Test

Sinking time is a single test which helps to measure the Wettability of a fabric. Booth (1986). As suggested by Skinkle (1972) eight samples were cut into 5cm x 5 cm square from the original and the dyed materials. A 1000 ml beaker was taken and filled with distilled water (Plate-VII). The sample was dropped on the water from a standard height and the time required for the sample to sink was noted. The stop watch was started when the fabric struck the surface of water and stopped when the last corner sank below the water surface. This was repeated for eight samples of the originals and the dyed materials and the mean calculated and recorded separately.

(iii) Capillary Rise Test

Sinkle (1972) points out that the capillary travel method measures the rapidity of absorption. As suggested by him five samples were cut into 20 cms length and 3 cms width from the originals and the dyed materials. One end of the sample strip was pasted to a glass rod and at the other end 10gm weight was placed to keep the sample straight. Both ends of the glass rod was placed on heavy



PLATE VII
SINKING TEST

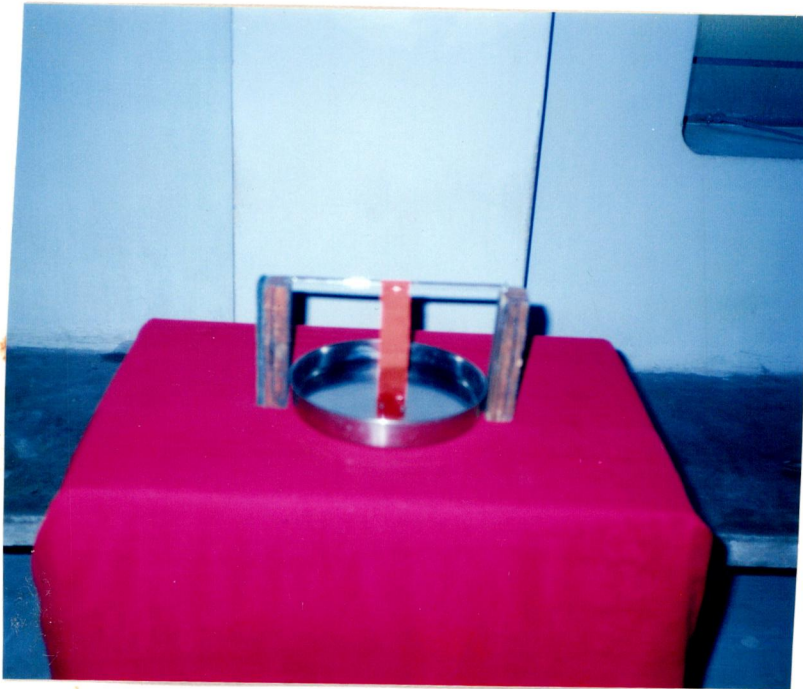


PLATE VIII
CAPILLARY RISE TEST

wooden blocks. At the weighted end, 3 cms of the sample was allowed to immerse in a tray of distilled water as shown in (Plate-VIII). The rise of the water level in the strip was measured after 5 minutes for the original and dyed materials, their mean calculated and recorded separately.

g. Colour Fastness Tests

The outstanding properties of the dyed materials is the fastness of its shade, declares Trotman (1984). When a dye is present on a fabric it is expected to have certain fastness properties, adds Shenai (1983). Colourfastness in Textile materials is the ability of fabric to retain its original colour or to resist transfer of colour, opines Wingate (1988).

The American Association of Textile Chemicals and Colourists (AATCC) have established standard terminology for rating colour fastness properties of fabric to different test methods and also for evaluating colour staining and transfer in fabrics. The investigator followed the AATCC grey scales for the assessment of colour change, colour transfer and staining. Appendix-VI.

i) Sunlight

Lyle (1976) points out that colour fastness to light is expected from all fabrics but is most important in

home decorative fabrics. The majority of colours become lighter in hue when exposed to light, where as some become darker in hue.

A sample piece of 8" x 2" was taken from each of the dyed materials. The samples were divided into 8 parts by marking at a distance of two inches in the larger side marked upto eight. Each sample was covered with black paper to prevent the samples from direct sunlight. The first portion was exposed to direct sunlight for eight hours, while the other seven parts were kept away from direct sunlight. For the successive seven days the other portions were exposed accordingly along with first portion. As a result the first portion got seven days exposure and the last portion one day exposure to sunlight. The changes in colour of the dyed samples were compared with the original and accordingly the specimen's were rated with the grey scale.

ii) Dry and wet crocking

Crocking is defined as the colour fastness from one colour textile material to another by rubbing says Wingate and Mohler (1970).

Samira Crockmeter (Plate-IX) was used for ascertaining the fastness of dyed textiles to wet and dry crocking. Each of the dyed samples were cut to a size of 10" x 8" and mounted on to the rubbing finger with a ring.

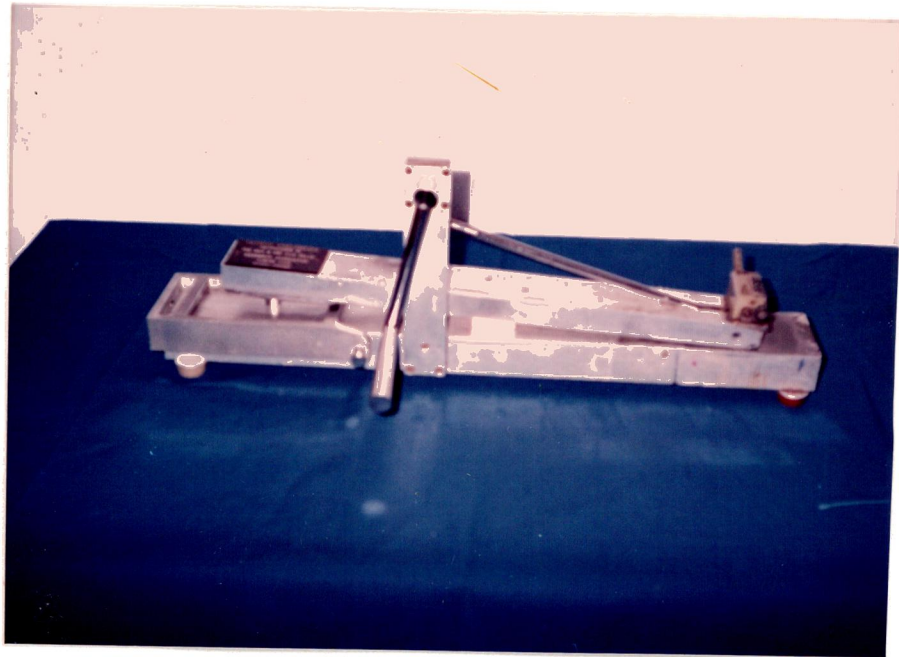


PLATE IX
SAMIRA CROCKMETER

Each sample was given ten rubs, after the number of rubs were standardised. The colour transferred from the dyed sample to the white material was assessed using grey scale.

A damp white material was used for wet crocking. But the procedure adopted was same as that of dry crocking.

iii) Dry and Wet pressing

The National Bureau of Standards suggested a test to determine colour fastness to dry and wet pressing.

As suggested by Wingate (1988) a dyed sample of 2"x4" size was sandwiched with a white material for both dry and wet pressing. Then, the dyed samples were pressed with a hot iron for 15 seconds. The samples under dry and wet condition were assessed for colour change and staining using the grey scale.

iv) Colour fastness to Washing

Textile Hand Book (1966) states that all fabrics must withstand cleansing, colour fastness to washing and dry cleaning. The test samples of 3" x 3" size were cut from the dyed materials. Each sample was sandwiched between the undyed cloth which has been desized well.

Soap solution of about 5gms/litre was prepared. Each of the test samples were soaked in the soap solution separately for about half an hour. After that the test samples were removed, rinsed in cold water thoroughly, squeezed well and dried.

The colour change and staining of the samples were assessed in comparison with the grey scale.

3. Statistical Analysis

The results of the laboratory tests were analysed statistically and suitably estimated.

The difference between the three selected cotton-jute blended fabrics in the grey form and the dyed form were individually analysed statistically using student 't' test to learn whether the difference was significant or not.

Similarly the difference between the dyed samples using different percentage of shades of the selected cotton-jute blended fabrics were also checked for significance both within the samples and also between samples A and B and samples A and C.

According to Gupta (1991) 't' test is based on 't' distribution and are commonly called students t-distribution. The 't' distribution is used when the sample size is 30 or less and the population standard deviation is unknown. A model of the 't' test is presented in Appedix-VII.

Results and Discussion

IV RESULTS AND DISCUSSION

The results of the study are discussed under the following headings:

A. Visual Inspection

B. Laboratory Tests

A. Visual Inspection

The details of the panel ratings include the general appearance, evenness in dyeing, colour, texture and lustre of the dyed materials. These are given in Table I.

TABLE - I
VISUAL INSPECTION OF DYED SAMPLES

S.No.	Samples	APPEARANCE			EVENESS			COLOUR			TEXTURE			LUSTRE		
		Good %	Fair %	Poor %	Even %	Slightly Even %	Uneven %	Very Bright %	Bright %	Dull %	Slightly Rough %	Rough %	Very Rough %	Lustre %	Semi Lustre %	Dull %
1.	A ₁	35	40	25	100	-	-	5	30	65	15	55	30	5	40	55
2.	A ₂	80	20	-	100	-	-	10	90	-	40	45	15	25	50	25
3.	A ₃	85	15	-	100	-	-	65	35	-	50	35	15	60	30	10
4.	B ₁	5	60	35	100	-	-	5	30	65	20	65	15	-	35	65
5.	B ₂	70	20	10	100	-	-	5	90	5	40	55	5	15	65	20
6.	B ₃	65	35	-	100	-	-	70	30	-	65	35	-	45	50	5
7.	C ₁	20	60	20	100	-	-	10	25	65	40	45	15	10	25	65
8.	C ₂	55	45	-	100	-	-	10	85	5	60	40	-	30	55	15
9.	C ₃	75	25	-	100	-	-	75	25	-	70	30	-	60	30	10

Regarding general appearance, sample A₃ was rated as good by 85 percent of the judges and samples C₃ and B₂ were rated as good by 75 and 70 per cent of the judges respectively.

Considering evenness, all the samples were rated as even by 100 per cent of the judges.

As regards brilliancy of colour, 90 per cent of the judges rated samples A₂ and B₂ as bright, while C₂ and C₃ were rated as bright and very bright by 85 and 75 per cent of the judges respectively.

With respect to texture, samples C₃ and C₂ were rated as slightly rough by 70 and 60 per cent of the judges respectively, where as sample B₁ was rated as rough by 65 per cent of the judges.

Considering lustre, sample B₂ was considered semi-lustrous and B₁ as dull by 65 per cent of the judges. Samples A₃ and C₃ were considered lustre by 60 per cent of the judges.

B. Laboratory tests

The tests included the following aspects:

1. Fabric Thickness
2. Fabric Weight
3. Abrasion Resistance
4. Bursting Strength
5. Drapability
6. Wettability and Absorbency Tests
 - a. Drop Test
 - b. Sinking Test
 - c. Capillary Rise Test
7. Colour Fastness Tests
 - a. Sunlight
 - b. Wet and Dry Crocking
 - c. Wet and Dry Pressing
 - d. Washing

1. Fabric Thickness:

The fabric thickness of original and dyed samples are shown in Table II and in Figure I.

TABLE - II FABRIC THICKNESS

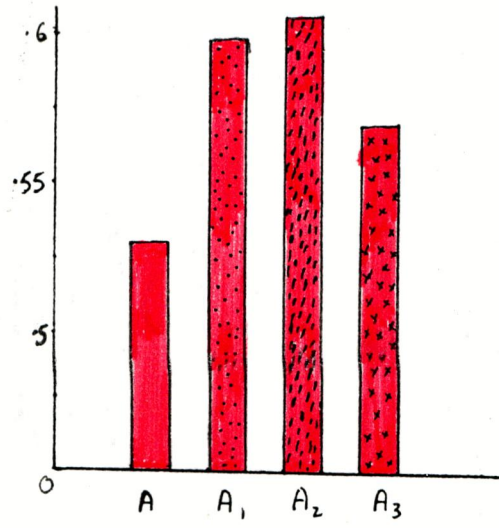
S.No.	Samples	Mean Fabric Thickness in mm	Gain over original	% gain over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	0.533	-	-	A Vs A ₁	5.797**	A ₁ Vs A ₂	0.895	A ₁ Vs B ₁	4.759**
2	A ₁	0.600	0.067	12.57	A Vs A ₂	8.095**	A ₁ Vs A ₃	2.101	A ₂ Vs B ₂	4.233**
3	A ₂	0.612	0.079	14.82	A Vs A ₃	7.380**	A ₂ Vs A ₃	3.401**	A ₃ Vs B ₃	5.087**
4	A ₃	0.577	0.044	8.26	B Vs B ₁	7.185**	B ₁ Vs B ₂	1.969	A ₁ Vs C ₁	0.583
5	B	0.467	-	-	B Vs B ₂	10.096**	B ₁ Vs B ₃	0.362	A ₂ Vs C ₂	0.037
6	B ₁	0.538	0.071	15.20	B Vs B ₃	7.850**	B ₂ Vs B ₃	2.562*	A ₃ Vs C ₃	1.583
7	B ₂	0.561	0.094	20.13	C Vs C ₁	2.780*	C ₁ Vs C ₂	0.699		
8	B ₃	0.534	0.067	14.35	C Vs C ₂	1.863	C ₁ Vs C ₃	0.313		
9	C	0.562	-	-	C Vs C ₃	2.549*	C ₂ Vs C ₃	0.818		
10	C ₁	0.593	0.031	5.52						
11	C ₂	0.611	0.049	8.72						
12	C ₃	0.590	0.028	4.98						

* Significant at 5% level

** Significant at 1% and 5% level

FIGURE-1

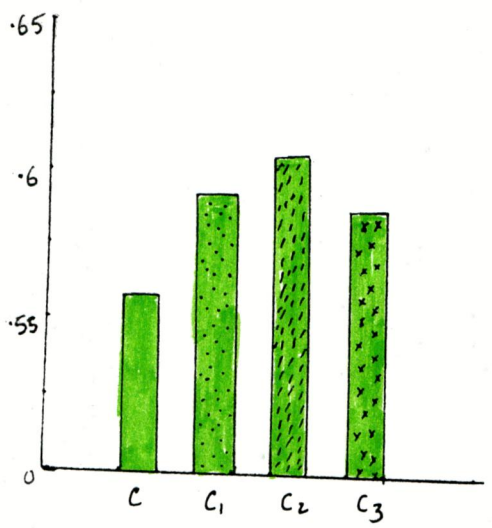
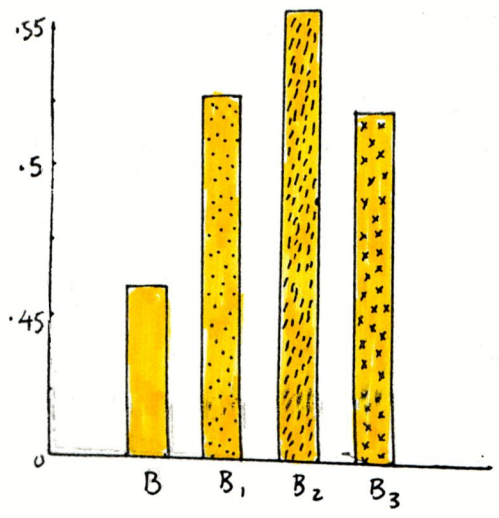
FABRIC THICKNESS OF ORIGINAL AND DYED SAMPLE



Scale : x axis $\frac{1}{2}$ cm = 1 sample
 y axis 2 cm = .05 unit

KEY

- Original
- Dyed at 2% level
- Dyed at 4% level
- Dyed at 6% level
- Sample A
- Sample B
- Sample C



FABRIC THICKNESS OF DYED SAMPLES COMPARED
BETWEEN COUNTS AND BLEND RATIOS

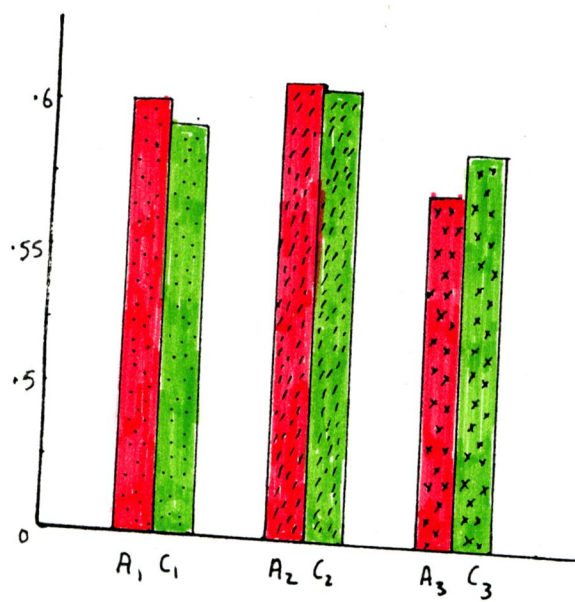
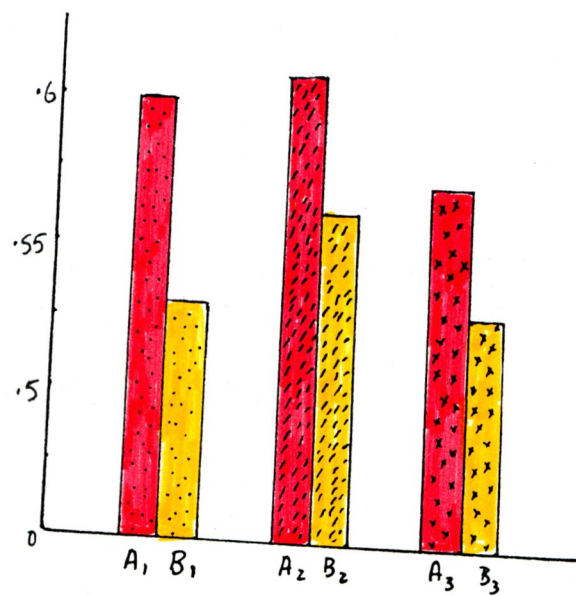


Table II shows the thickness of the original and dyed samples. The greater the mean value, the more is the thickness of the sample. From Table II, it was obvious that all the dyed samples showed higher mean value than their respective originals.

Among the dyed samples, the percentage of gain over original is higher for samples A_2 , B_2 and C_2 .

The statistical analysis proved the following facts:

1. No significant difference was found in samples C Vs C_2 , among the dyed samples compared with their respective originals.

2. There was significant difference only for samples A_2 Vs A_3 and B_2 Vs B_3 when compared with their respective dye shades.

3. Among the dyed samples compared with blend ratio, there was no significant difference, where as the dyed samples compared with yarn count showed significant difference.

2. Fabric Weight:

The fabric weight of original and dyed samples are presented in Table III and Figure II.

TABLE - III

FABRIC WEIGHT

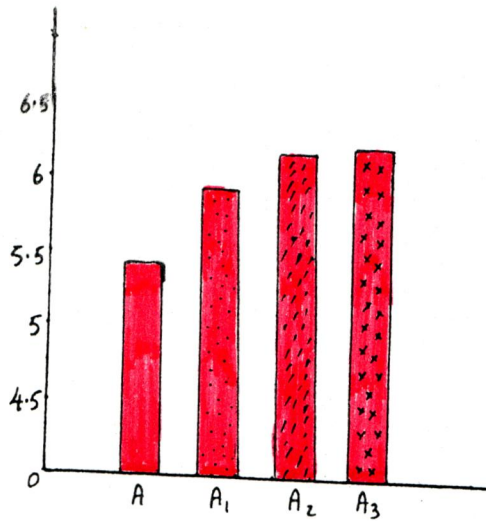
S.No.	Samples	Mean Fabric weight OZ/Sq yard	Gain over original	% gain over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	5.450	-	-	A Vs A ₁	9.345**	A ₁ Vs A ₂	1.777	A ₁ Vs B ₁	12.497**
2	A ₁	5.985	0.535	9.82	A Vs A ₂	5.766**	A ₁ Vs A ₃	4.124**	A ₂ Vs B ₂	8.263**
3	A ₂	6.225	0.775	14.22	A Vs A ₃	12.396**	A ₂ Vs A ₃	0.287	A ₃ Vs B ₃	14.076**
4	A ₃	6.265	0.815	14.95	B Vs B ₁	4.328**	B ₁ Vs B ₂	3.358**	A ₁ Vs C ₁	9.243**
5	B	4.015	-	-	B Vs B ₂	11.064**	B ₁ Vs B ₃	6.833**	A ₂ Vs C ₂	3.007*
6	B ₁	4.510	0.495	12.33	B Vs B ₃	25.701**	B ₂ Vs B ₃	3.803**	A ₃ Vs C ₃	2.587*
7	B ₂	4.970	0.955	23.79	C Vs C ₁	2.783*	C ₁ Vs C ₂	2.803*		
8	B ₃	5.315	1.300	32.38	C Vs C ₂	4.564**	C ₁ Vs C ₃	5.306**		
9	C	5.125	-	-	C Vs C ₃	7.694**	C ₂ Vs C ₃	1.624		
10	C ₁	5.300	0.175	3.41						
11	C ₂	5.690	0.565	11.02						
12	C ₃	5.955	0.830	16.20						

* Significant at 5% level

** Significant at 1% and 5% level

FIGURE-11

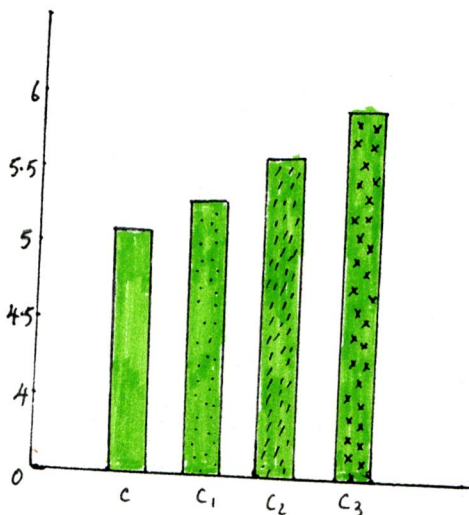
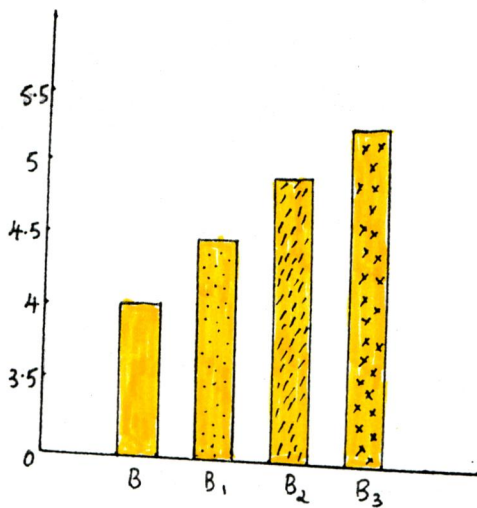
FABRIC WEIGHT OF ORIGINAL AND DYED SAMPLE



Scale : x axis $\frac{1}{2}$ cm = 1 Sample
 y axis 1 cm = 0.5 unit

KEY

- Original
- Dyed at 2% level
- Dyed at 4% level
- Dyed at 6% level
- Sample A
- Sample B
- Sample C



FABRIC WEIGHT OF DYED SAMPLES COMPARED
BETWEEN COUNTS AND BLEND RATIOS

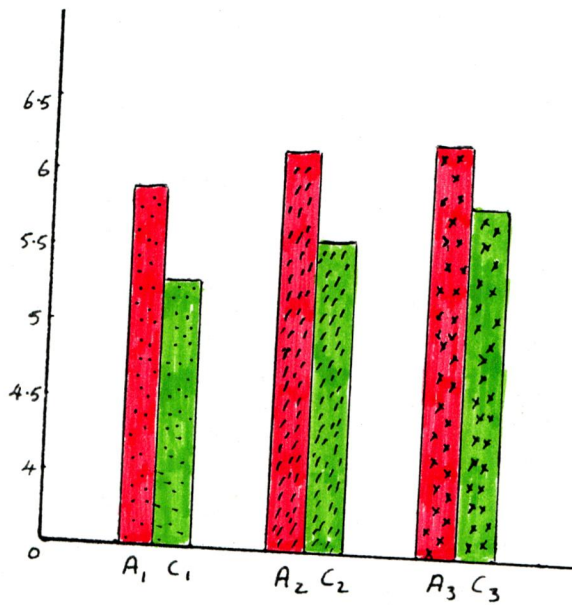
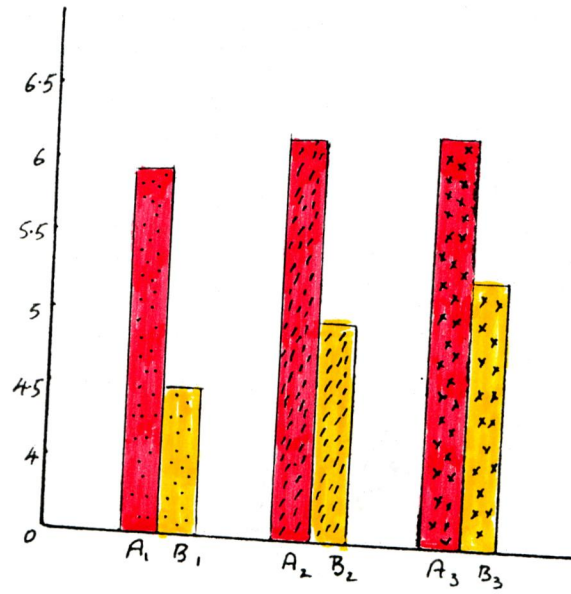


Table III shows the weight of the original and dyed samples. The more the mean value the more is the weight of the sample. From Table III, it was clearly evident that all the dyed samples showed higher mean value than the original.

Among the dyed samples, the percentage gain over original is high for samples A_3 , B_3 and C_3 .

On analysing statistically the following facts were proved:

1. All the dyed samples compared with their respective originals showed highly significant difference.

2. Among the dyed samples compared with their respective dye shades, only sample A_1 Vs A_2 , A_2 Vs A_3 and C_2 Vs C_3 showed no significant difference.

3. There was significant difference between the dyed samples compared with the counts and blend ratios.

3. Abrasion Resistance:

The Abrasion Resistance of original and the dyed samples are presented in Table IV and Figure III.

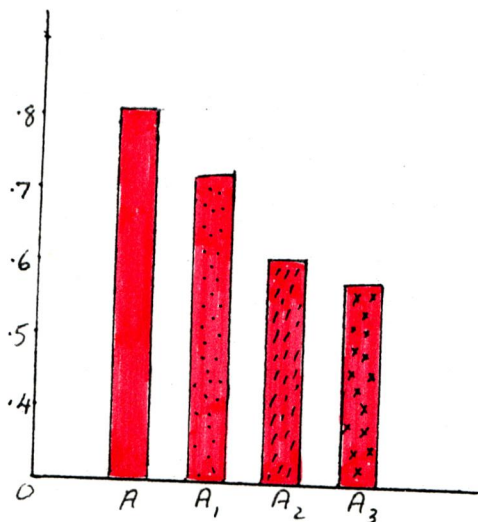
TABLE - IV ABRASION RESISTANCE

S.No.	Samples	Mean Difference in mg	Loss over original	% Loss over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	0.8125	-	-	A Vs A ₁	0.804	A ₁ Vs A ₂	1.066	A ₁ Vs B ₁	4.126**
2	A ₁	0.7250	0.0875	10.77	A Vs A ₂	2.772*	A ₁ Vs A ₃	1.245	A ₂ Vs B ₂	7.906**
3	A ₂	0.6125	0.2000	24.62	A Vs A ₃	2.672*	A ₂ Vs A ₃	0.313	A ₃ Vs B ₃	5.570**
4	A ₃	0.5875	0.2250	27.69	B Vs B ₁	1.488	B ₁ Vs B ₂	0.200	A ₁ Vs C ₁	1.042
5	B	1.3125	-	-	B Vs B ₂	1.628	B ₁ Vs B ₃	0.439	A ₂ Vs C ₂	2.573*
6	B ₁	1.1500	0.1625	12.38	B Vs B ₃	1.635	B ₂ Vs B ₃	0.300	A ₃ Vs C ₃	1.457
7	B ₂	1.1375	0.1750	13.33	C Vs C ₁	0.981	C ₁ Vs C ₂	0.929		
8	B ₃	1.1125	0.2000	15.24	C Vs C ₂	2.177	C ₁ Vs C ₃	1.513		
9	C	0.9125	-	-	C Vs C ₃	2.522*	C ₂ Vs C ₃	0.886		
10	C ₁	0.8375	0.0750	8.22						
11	C ₂	0.7750	0.1375	15.07						
12	C ₃	0.7125	0.2000	21.92						

* Significant at 5% level

** Significant at 1% and 5% level

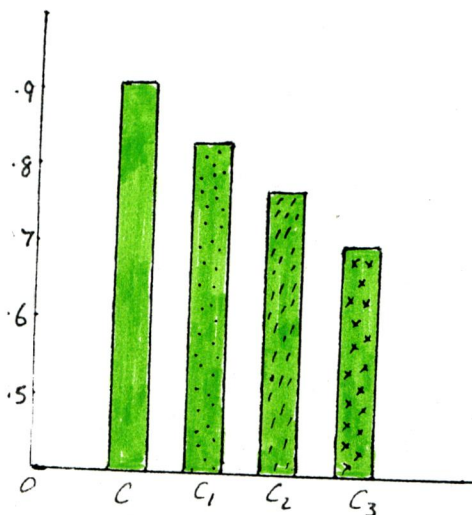
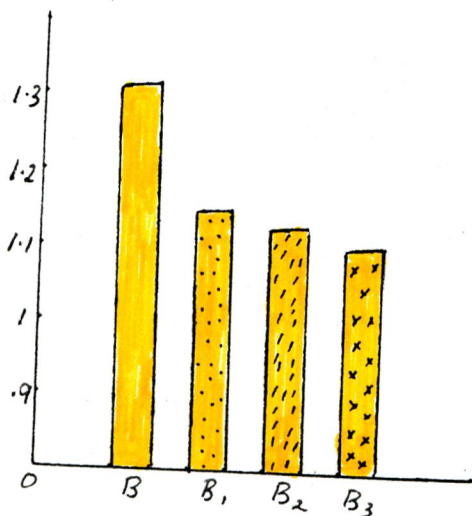
FIGURE-111
 ABRASION RESISTANCE OF ORIGINAL AND DYED SAMPLE



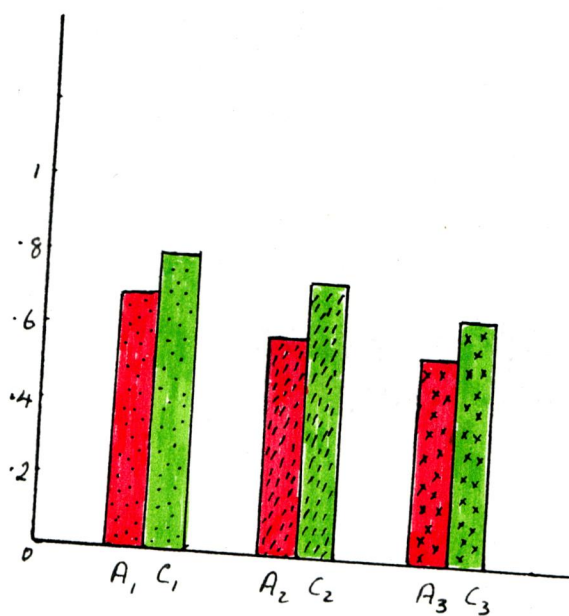
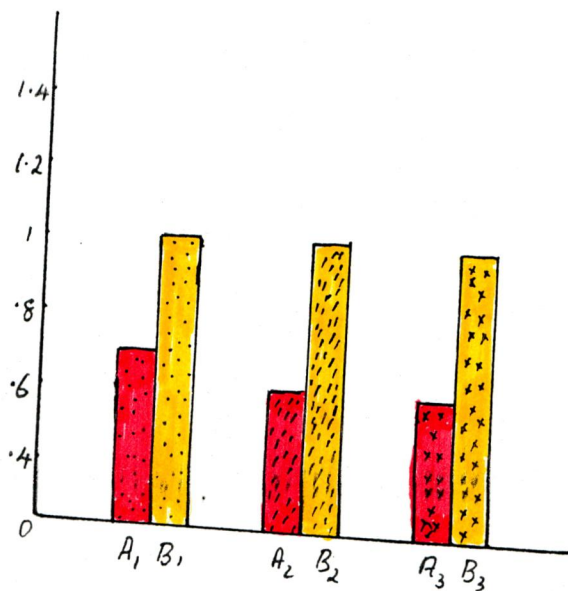
KEY

- - Original
- ▤ - Dyed at 2% level
- ▥ - Dyed at 4% level
- ▦ - Dyed at 6% level

- - Sample A
- - Sample B
- - Sample C



ABRASION RESISTANCE OF DYED SAMPLES COMPARED
BETWEEN COUNTS AND BLEND RATIOS



The above Table depicts the weight loss of the dyed samples due to abrasion. Table IV shows the abrasion resistance of the samples. The greater the loss in weight, the lesser is the resistance to friction.

From Table IV, it was clearly evident that among the dyed samples, the percentage of loss of original is maximum in the case of A₃, B₃ and C₃.

The statistical analysis proved the following facts

1. Among the dyed samples compared with their respective originals, only samples A Vs A₂, A Vs A₃ and C Vs C₃ showed significant difference.

2. All the dyed samples compared with their respective dye shades showed no significant difference.

3. Considering the comparison of the dyed samples with counts, significant difference was found where as in the comparison of blend ratio, except samples A₂ Vs C₂, all the rest of the samples showed no significant difference.

4. Bursting Strength:

The bursting strength of original and dyed samples are presented in Table V and Figure IV.

TABLE - V BURSTING STRENGTH

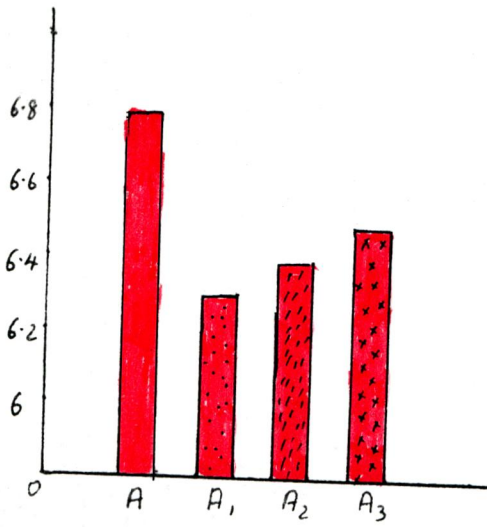
S.No.	Samples	Mean strength in kg/cm ²	Loss over original	% Loss over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	6.79	-	-	A Vs A ₁	2.015	A ₁ Vs A ₂	0.400	A ₁ Vs B ₁	2.766*
2	A ₁	6.33	0.46	6.77	A Vs A ₂	2.273*	A ₁ Vs A ₃	0.765	A ₂ Vs B ₂	3.499**
3	A ₂	6.42	0.37	5.45	A Vs A ₃	0.989	A ₂ Vs A ₃	0.544	A ₃ Vs B ₃	2.965*
4	A ₃	6.55	0.24	3.53	B Vs B ₁	4.248**	B ₁ Vs B ₂	0.337	A ₁ Vs C ₁	2.288**
5	B	6.52	-	-	B Vs B ₂	3.454**	B ₁ Vs B ₃	0.697	A ₂ Vs C ₂	3.324**
6	B ₁	5.72	0.80	12.27	B Vs B ₃	3.491**	B ₂ Vs B ₃	0.266	A ₃ Vs C ₃	2.311*
7	B ₂	5.78	0.74	11.35	C Vs C ₁	1.806	C ₁ Vs C ₂	1.140		
8	B ₃	5.81	0.69	10.58	C Vs C ₂	1.210	C ₁ Vs C ₃	1.399		
9	C	6.24	-	-	C Vs C ₃	0.941	C ₂ Vs C ₃	0.453		
10	C ₁	5.72	0.52	8.33						
11	C ₂	5.95	0.29	4.65						
12	C ₃	6.01	0.23	3.69						

* Significant at 5% level

** Significant at 1% and 5% level

FIGURE-IV

BURSTING STRENGTH OF ORIGINAL AND DYED SAMPLE

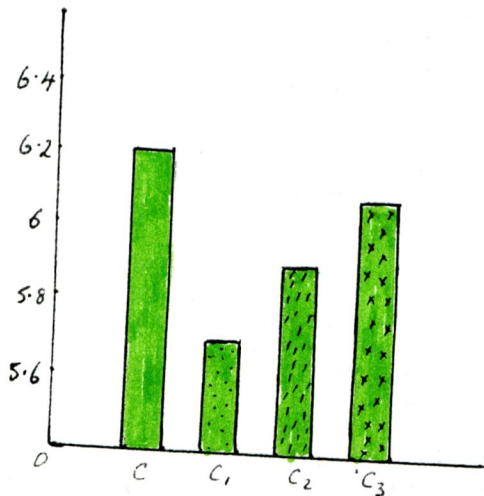
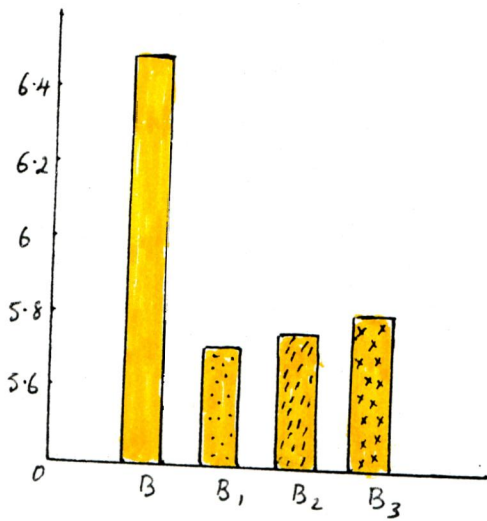


Scale : x axis $\frac{1}{2}$ cm = 1 sample
 y axis 1 cm = 0.2 unit

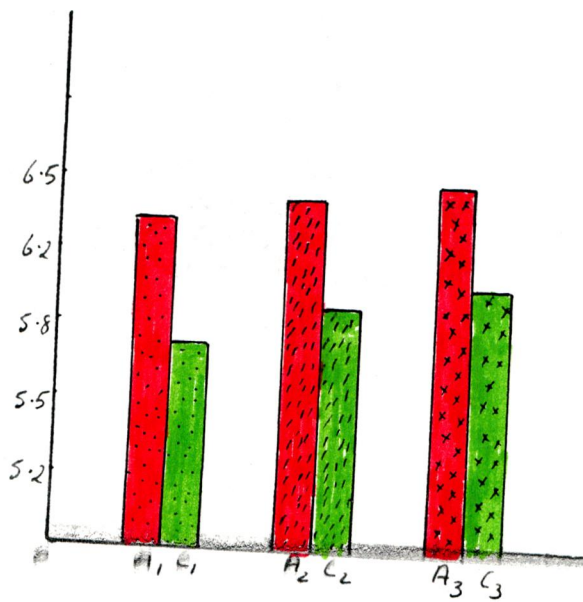
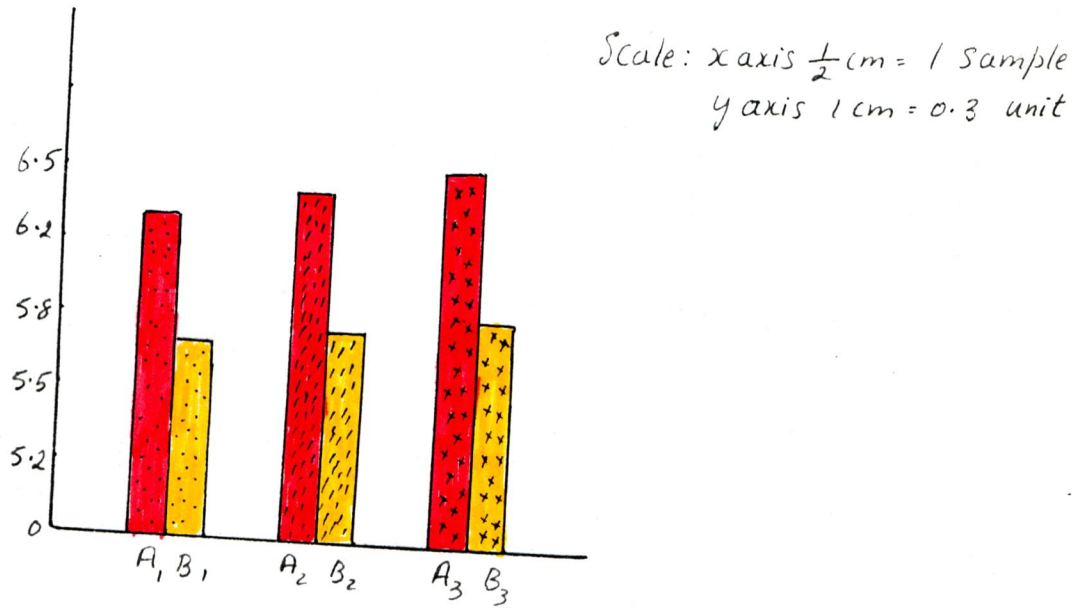
KEY

- Original
- Dyed at 2% level
- Dyed at 4% level
- Dyed at 6% level

- Sample A
- Sample B
- Sample C



BURSTING STRENGTH OF DYED SAMPLES COMPARED
BETWEEN COUNTS AND BLEND RATIOS



The above Table illustrates, the following strength of the original and dyed samples. The higher the mean value, the greater is the strength of the sample. From Table V, it was clearly evident that all the dyed samples showed lower mean value than their respective originals.

Among the dyed samples, the percentage of loss over original is highest in case of samples A_1 , B_1 and C_1 .

On analysing statistically the following facts were proved :

1. When all the dyed samples were compared with their respective originals, there was significant difference between samples A Vs A_2 , B Vs B_1 , B Vs B_2 and B Vs B_3 .

2. There was no significant difference found with their respective dyed samples compared between dye shades.

3. Significant difference was found among the dyed samples compared between counts and blend ratios.

5. Drapability:

The drape co-efficient of the original and dyed samples is presented in Table VI and Figure V.

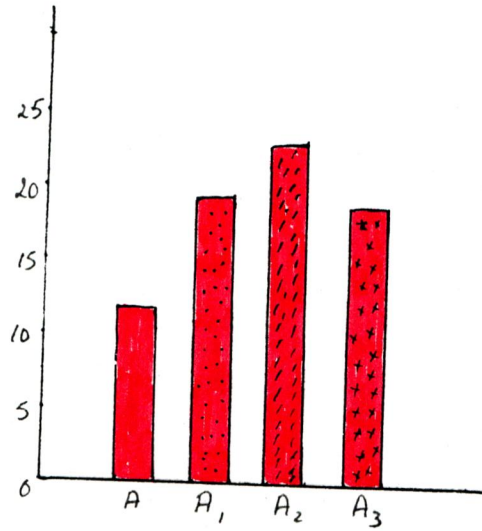
TABLE - VI DRAPABILITY

S.No.	Samples	Mean co-efficient %	Gain over original	% Gain over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	11.844	-	-	A Vs A ₁	24.61*	A ₁ Vs A ₂	8.885	A ₁ Vs B ₁	36.34*
2	A ₁	19.134	7.290	61.55	A Vs A ₂	24.97*	A ₁ Vs A ₃	0.189	A ₂ Vs B ₂	8.642
3	A ₂	22.673	10.829	91.43	A Vs A ₃	17.72*	A ₂ Vs A ₃	7.414	A ₃ Vs B ₃	7.768
4	A ₃	19.066	7.222	60.98	B Vs B ₁	65.59**	B ₁ Vs B ₂	3.493	A ₁ Vs C ₁	10.72
5	B	15.9215	-	-	B Vs B ₂	67.03**	B ₁ Vs B ₃	2.177	A ₂ Vs C ₂	1.220
6	B ₁	23.3165	10.395	65.29	B Vs B ₃	13.33*	B ₂ Vs B ₃	1.515	A ₃ Vs C ₃	8.419
7	B ₂	25.8605	9.939	62.43	C Vs C ₁	28.98*	C ₁ Vs C ₂	4.543		
8	B ₃	24.840	8.9185	60.02	C Vs C ₂	322.5**	C ₁ Vs C ₃	5.920		
9	C	8.343	-	-	C Vs C ₃	81.19**	C ₂ Vs C ₃	5.786		
10	C ₁	25.858	17.515	209.94						
11	C ₂	23.117	14.774	177.08						
12	C ₃	22.150	13.807	165.49						

* Significant at 5% level

** Significant at 1% and 5% level

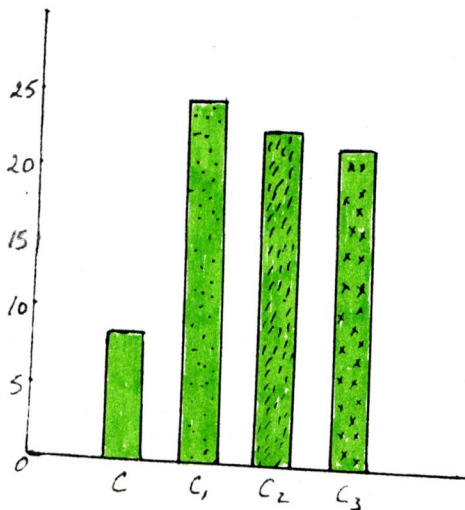
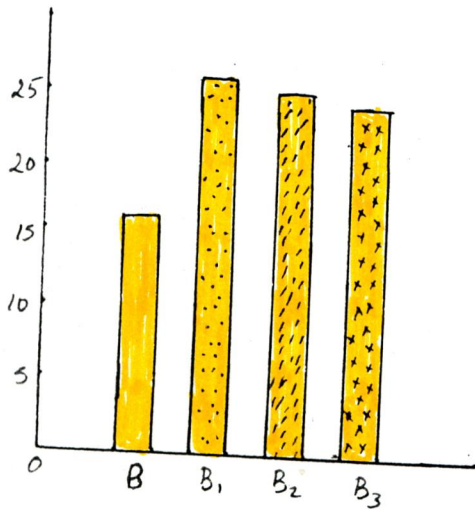
FIGURE - V
 DRAPABILITY OF ORIGINAL AND DYED SAMPLE



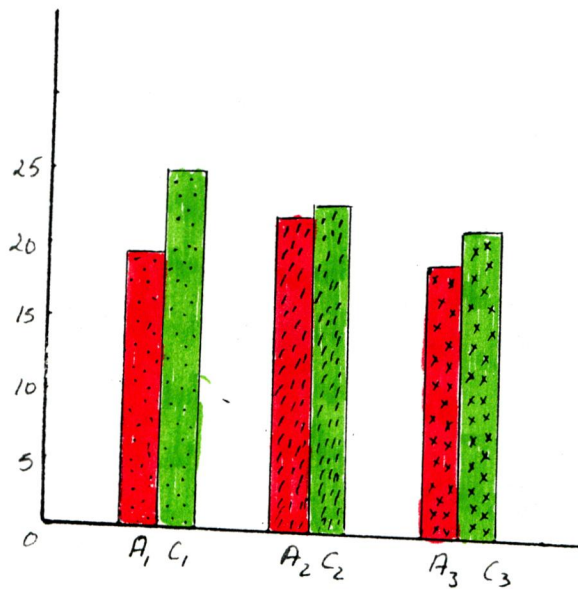
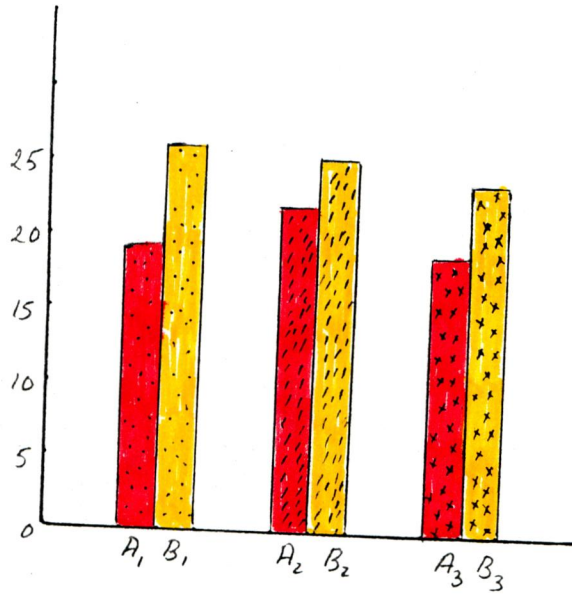
Scale : x axis $\frac{1}{2}$ cm = 1 Sample
 y axis 1 cm = 5 units

KEY

- Original
- Dyed at 2% level
- Dyed at 4% level
- Dyed at 6% level
- Sample A
- Sample B
- Sample C



DRAPABILITY OF DYED SAMPLES COMPARED
BETWEEN COUNTS AND BLEND RATIOS



The above Table shows the drape co-efficient of the original and dyed samples. From Table VI it was clear that the drape co-efficient of all the dyed samples is greater than their respective originals.

Among the dyed samples the percentage of gain over original is maximum for samples A_2 , B_1 and C_1 .

The statistical analysis proved the following facts:

1. There was significant difference with dyed samples compared with their respective originals.
2. No significant difference was found among the dyed samples with their respective dye shades.
3. Samples A_1 Vs B_1 only showed significant difference among the dyed samples compared with the counts, where as the blend ratio showed no significant difference.

6. Wettability and Absorbency Tests:

a. Drop Test:

The Drop test of the samples pre-treated originals and dyed in different concentrations are presented in Table VII and Figure VI.

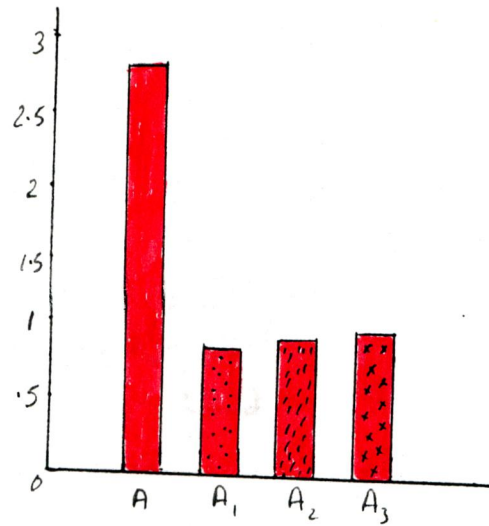
TABLE - VII DROP TEST

S.No.	Samples	Mean value in seconds	Loss over original	% Loss over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	2.80	-	-	A Vs A ₁	46.98 ^{**}	A ₁ Vs A ₂	0.207	A ₁ Vs B ₁	6.775 ^{**}
2	A ₁	0.89	1.91	68.21	A Vs A ₂	48.22 ^{**}	A ₁ Vs A ₃	1.228	A ₂ Vs B ₂	7.633 ^{**}
3	A ₂	0.90	1.90	67.86	A Vs A ₃	36.93 ^{**}	A ₂ Vs A ₃	1.069	A ₃ Vs B ₃	5.758 ^{**}
4	A ₃	0.96	1.84	65.71	B Vs B ₁	42.84 ^{**}	B ₁ Vs B ₂	0.264	A ₁ Vs C ₁	2.763 [*]
5	B	2.98	-	-	B Vs B ₂	47.56 ^{**}	B ₁ Vs B ₃	1.348	A ₂ Vs C ₂	2.885 [*]
6	B ₁	1.20	1.78	59.73	B Vs B ₃	47.23 ^{**}	B ₂ Vs B ₃	1.240	A ₃ Vs C ₃	3.346 ^{**}
7	B ₂	1.21	1.77	59.40	C Vs C ₁	51.09 ^{**}	C ₁ Vs C ₂	0.277		
8	B ₃	1.25	1.73	58.05	C Vs C ₂	51.87 ^{**}	C ₁ Vs C ₃	0.573		
9	C	2.71	-	-	C Vs C ₃	52.87 ^{**}	C ₂ Vs C ₃	0.293		
10	C ₁	0.77	1.94	71.59						
11	C ₂	0.78	1.93	71.22						
12	C ₃	0.79	1.92	70.85						

† Significant at 5% level

** Significant at 1% and 5% level

FIGURE-VI
DROP TEST OF ORIGINAL AND DYED SAMPLE

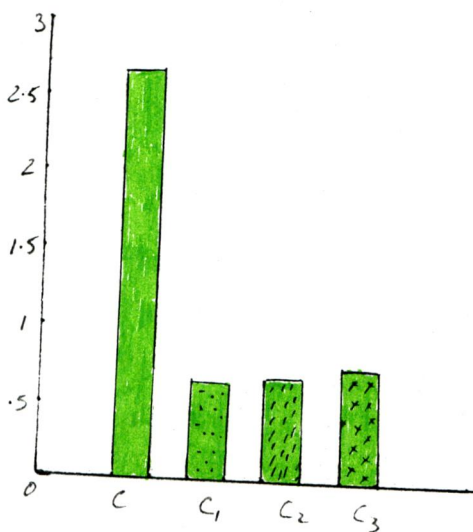
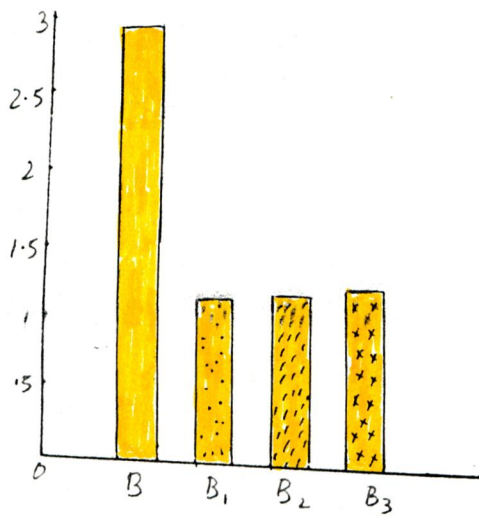


Scale: x axis $\frac{1}{2}$ cm = 1 Sample
y axis 1 cm = 0.5 unit

KEY

- - Original
- ▤ - Dyed at 2% level
- ▥ - Dyed at 4% level
- ▧ - Dyed at 6% level

- - Sample A
- - Sample B
- - Sample C



DROP TEST OF DYED SAMPLES COMPARED
BETWEEN COUNTS AND BLEND RATIOS

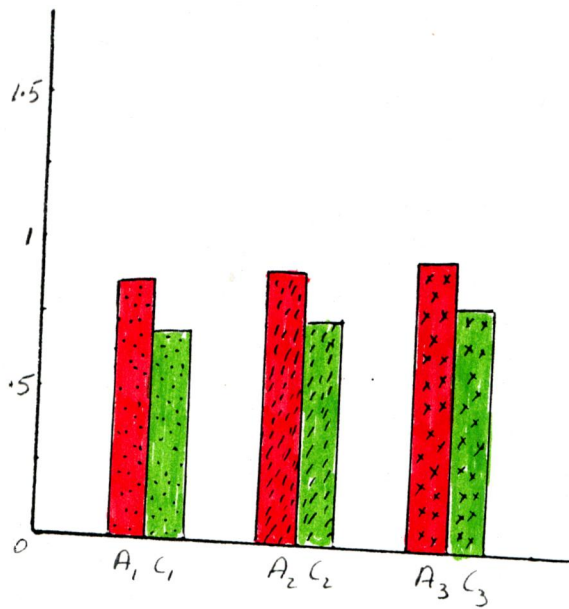
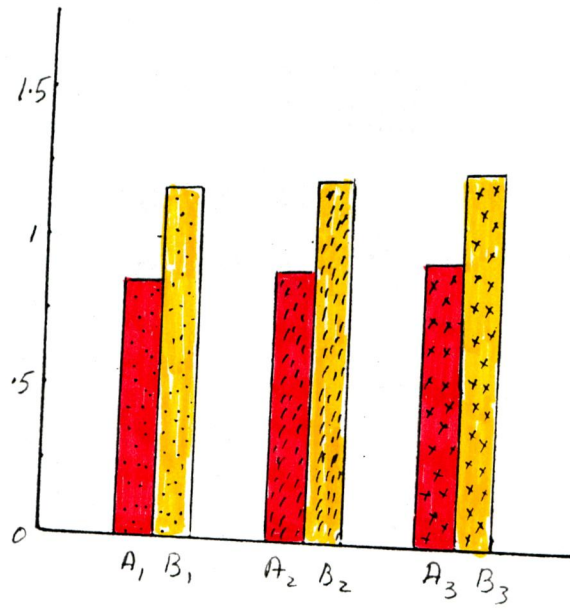


Table VII shows the results of drop test of the samples desized, scoured and dyed in different shades. The lower the mean value, the quicker is the absorbency of the sample. From Table VII it was clearly evident that all the dyed samples showed a mean value lower than their respective originals.

Among the dyed samples, the percentage loss over original was higher in case of samples A₁, B₁ and C₁.

On analysing statistically the following facts were proved:

1. There was highly significant difference between all the dyed samples compared with their respective originals.
2. There was no significant difference among the dyed samples with their dye shades.
3. Considering the comparison of counts and blend ratios, all the samples showed significant different.

b. Sinking Test:

The sinking time of the samples pretreated originals and dyed in different concentrations are presented in Table VIII and Figure VII.

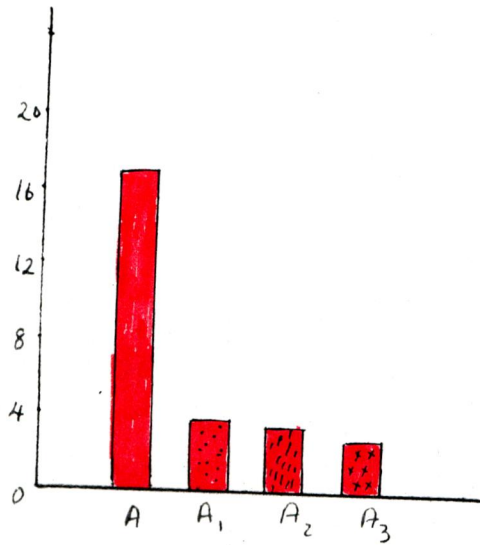
TABLE - VIII SINKING TEST

S.No.	Samples	Mean value in seconds	Loss over original	% Loss over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	17.33	-	-	A Vs A ₁	73.12 ^{**}	A ₁ Vs A ₂	0.126	A ₁ Vs B ₁	4.578 ^{**}
2	A ₁	3.80	13.53	78.07	A Vs A ₂	71.18 ^{**}	A ₁ Vs A ₃	2.455	A ₂ Vs B ₂	7.053 ^{**}
3	A ₂	3.77	13.56	78.22	A Vs A ₃	113.8 ^{**}	A ₂ Vs A ₃	2.230	A ₃ Vs B ₃	8.159 ^{**}
4	A ₃	3.34	13.99	80.73	B Vs B ₁	47.23 ^{**}	B ₁ Vs B ₂	0.234	A ₁ Vs C ₁	0.792
5	B	14.20	-	-	B Vs B ₂	106.4 ^{**}	B ₁ Vs B ₃	0.357	A ₂ Vs C ₂	1.644
6	B ₁	2.47	11.73	82.57	B Vs B ₃	117.3 ^{**}	B ₂ Vs B ₃	0.254	A ₃ Vs C ₃	0.593
7	B ₂	2.41	11.79	83.03	B Vs C ₁	60.14 ^{**}	C ₁ Vs C ₂	1.110		
8	B ₃	2.38	11.82	83.24	C Vs C ₂	65.02 ^{**}	C ₁ Vs C ₃	2.064		
9	C	16.47	-	-	C Vs C ₃	64.76 ^{**}	C ₂ Vs C ₃	1.065		
10	C ₁	3.63	12.84	77.96						
11	C ₂	3.43	13.04	79.17						
12	C ₃	3.25	13.22	80.27						

* Significant at 5% level

** Significant at 1% and 5% level

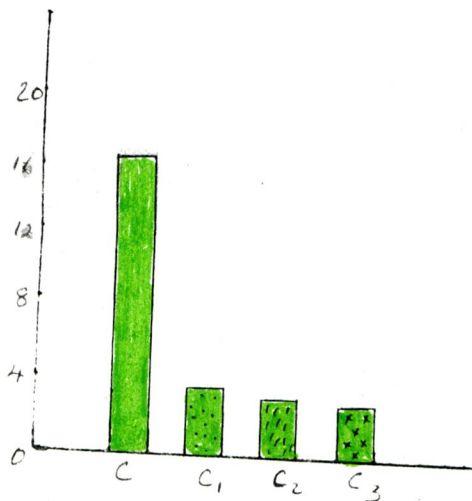
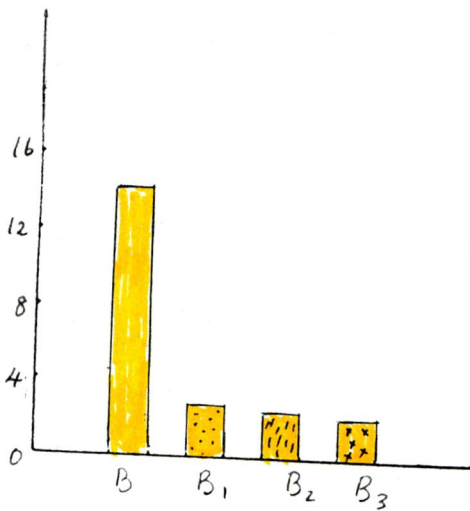
FIGURE - VII
SINKING TEST OF ORIGINAL AND DYED SAMPLE



Scale : x axis $\frac{1}{2}$ cm = 1 Sample
y axis 1cm = 4 units

KEY

- Original
- Dyed at 2% level
- Dyed at 4% level
- Dyed at 6% level
- Sample A
- Sample B
- Sample C



SINKING TEST OF DYED SAMPLES COMPARED
BETWEEN COUNTS AND BLEND RATIOS

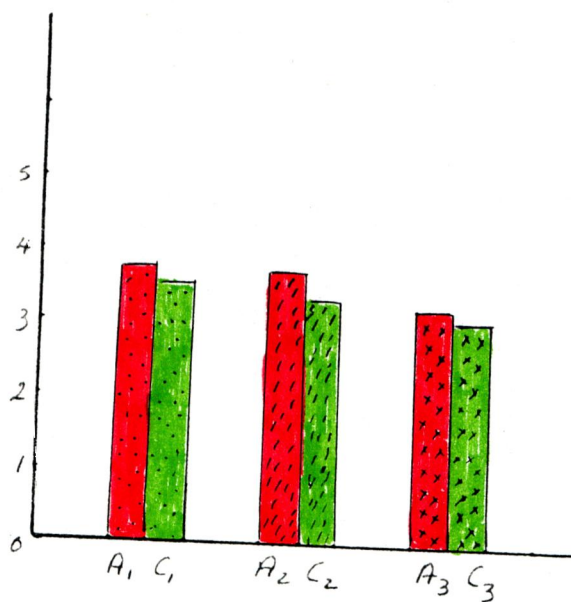
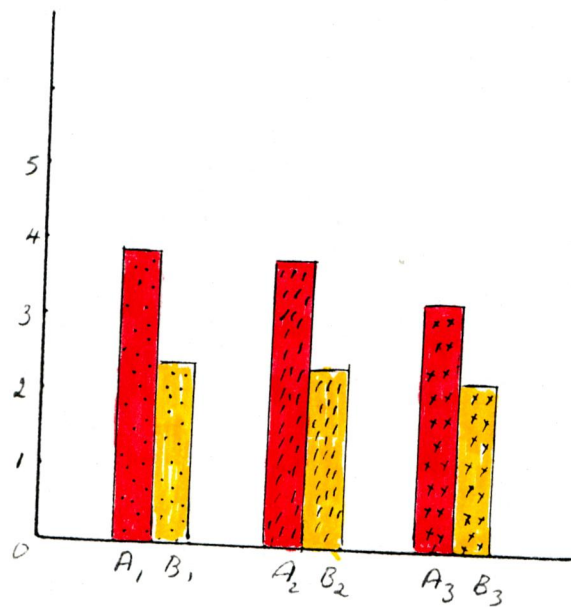


Table VIII determines the sinking time of the original and dyed samples. The lesser the mean value, the more is the wettability of the sample. From the Table it was clearly evident that there was marked difference between samples, when compared with their respective originals.

Among the dyed samples A_1 , B_1 and C_1 showed the minimum percentage, when compared with their respective dyed samples.

Statistical analysis proved the following facts:

1. All the dyed samples compared with their respective originals showed highly significant difference.
2. Sample A_1 Vs A_3 only showed significant difference between dyed sample compared with their dye shades.
3. No significant difference was found with the samples compared with blend ratios, where as significant difference was found when compared with the counts.

C. Capillary Rise Test:

The Capillary Rise of the samples pre-treated originals and dyed in different concentration are shown in Table IX and Figure VIII.

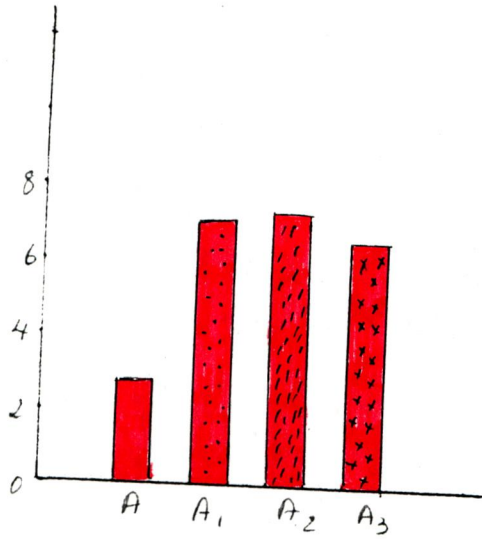
TABLE - IX CAPILLARY RISE TEST

S.No.	Samples	Mean value in cms	Gain over original	% Gain over original	Original compared with dyed samples	't' value	Dyed samples compared between dye shades	't' value	Dyed samples compared between different counts and blend ratios	't' value
1	A	2.88	-	-	A Vs A ₁	78.39 ^{**}	A ₁ Vs A ₂	0.448	A ₁ Vs B ₁	18.84 ^{**}
2	A ₁	7.02	4.14	143.75	A Vs A ₂	93.29 ^{**}	A ₁ Vs A ₃	5.830 ^{**}	A ₂ Vs B ₂	24.09 ^{**}
3	A ₂	7.04	4.16	144.44	A Vs A ₃	87.01 ^{**}	A ₂ Vs A ₃	8.122 ^{**}	A ₃ Vs B ₃	27.81 ^{**}
4	A ₃	6.76	3.88	134.72	B Vs B ₁	81.18 ^{**}	B ₁ Vs B ₂	3.512 [*]	A ₁ Vs C ₁	14.35 ^{**}
5	B	4.06	-	-	B Vs B ₂	77.38 ^{**}	B ₁ Vs B ₃	4.278 ^{**}	A ₂ Vs C ₂	0.590
6	B ₁	7.86	3.80	93.59	B Vs B ₃	70.82 ^{**}	B ₂ Vs B ₃	1.179	A ₃ Vs C ₃	10.27 ^{**}
7	B ₂	8.00	3.94	97.04	C Vs C ₁	102.70 ^{**}	C ₁ Vs C ₂	9.742 ^{**}		
8	B ₃	8.06	4.00	96.52	C Vs C ₂	53.38 ^{**}	C ₁ Vs C ₃	8.985 ^{**}		
9	C	3.08	-	-	C Vs C ₃	76.03 ^{**}	C ₂ Vs C ₃	3.210 [*]		
10	C ₁	7.66	4.58	148.70						
11	C ₂	7.00	3.92	127.27						
12	C ₃	7.24	4.16	135.06						

* Significant at 5% level

** Significant at 1% and 5% level

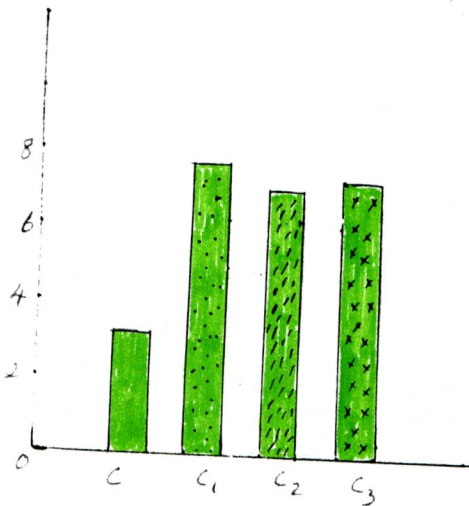
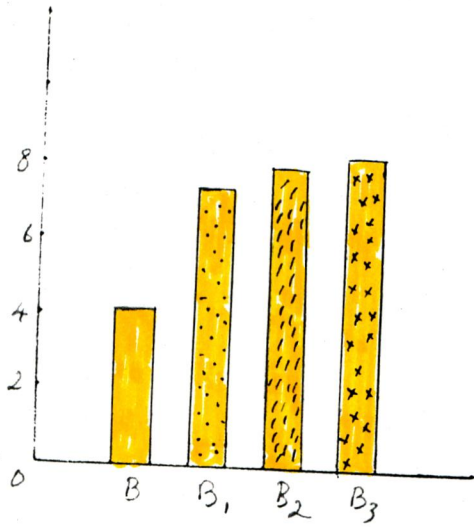
FIGURE-VIII
 CAPILLARY RISE TEST OF ORIGINAL AND DYED SAMPLE



Scale: x axis $\frac{1}{2}$ cm = 1 Sample
 y axis 1 cm = 2 units

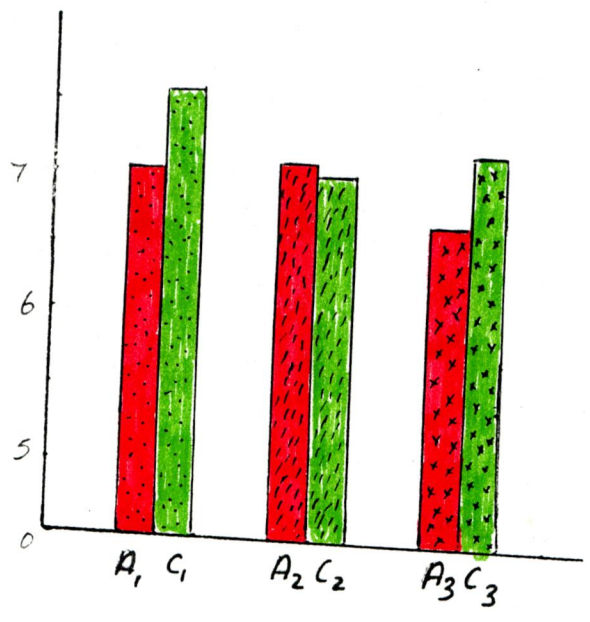
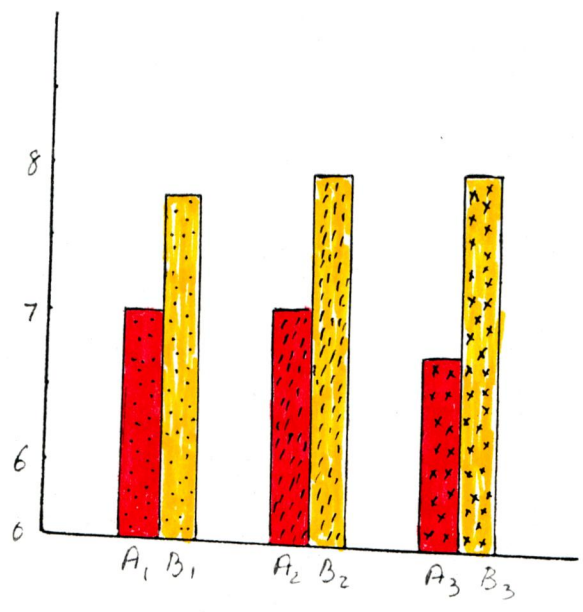
KEY

- Original
- Dyed at 2% level
- Dyed at 4% level
- Dyed at 6% level
- Sample A
- Sample B
- Sample C



CAPILLARY RISE TEST OF DYED SAMPLES COMPARED BETWEEN COUNTS AND BLEND RATIOS

Scale : x axis $\frac{1}{2}$ cm = 1 sample
y axis 1 cm = i unit



The above Table illustrates the capillary rise of the originals and dyed samples. The higher the mean value, greater is the absorbency of the sample.

A maximum gain in percentage was observed in the samples A_2 , B_3 and C_1 .

On analysing statistically the following facts were proved:

1. Highly significant difference was found among the dyed samples compared with their respective originals.
2. Among the dyed samples compared with their respective dye shades, except samples A_1 Vs A_2 and B_2 Vs B_3 rest of the samples showed significant difference.
3. Considering the comparison between counts, all the samples showed highly significant difference, while only A_2 Vs C_2 showed no significant difference between blend ratios.

7. Colour Fastness Tests:

The details of the colour fastness tests of the dyed samples are given in Table X.

TABLE - X

COLOUR FASTNESS OF DYED SAMPLES

S.No.Samples		Colour Fastness to sunlight	Colour Fastness to washing		Colour Fastness to crocking		Colour Fastness to pressing	
		Colour change	Colour change	Staining	Dry staining	Wet staining	Dry staining	Wet staining
1	A ₁	4	5	5	5	4	5	5
2	A ₂	4	5	5	5	3	5	4
3	A ₃	3	5	4	5	3	5	4
4	B ₁	4	5	5	5	4	5	5
5	B ₂	4	5	5	5	3	5	5
6	B ₃	3	5	4	5	4	5	5
7	C ₁	4	5	5	5	4	5	5
8	C ₂	3	5	4	5	3	5	5
9	C ₃	3	5	5	5	3	5	4

The above Table shows that in the sunlight test, except samples with 6 per cent shade, all other samples revealed good colour fastness property.

In the washing test, only samples with 6 per cent shade showed staining, where as the rest showed good colour fastness to washing.

Regarding crocking, samples dyed with 6 per cent shade showed staining in wet condition where as the rest showed good colour fastness to crocking.

In the pressing test, all the samples showed good colour fastness to dry pressing. But there was slight staining for dyed samples A and C, where as samples B showed good colour fastness even to wet pressing.

Hence it can be concluded that the colour fastness property of cotton-jute blended fabrics of different yarn count and blend ratio is more or less the same.

Summary and Conclusion

V SUMMARY AND CONCLUSION

Awareness for ecology has changed the outlook of many materials and jute fibre is one among them. Jute, a natural bast fibre was hitherto used to produce only packing materials like sacks and hessians. The advent of synthetic packing materials posed a great threat to its very survival. This and the awareness for ecology forced the technologists to look the jute fibre afresh. As a result, it was found that jute can be successfully used to produce a number of diversified value added products, by blending it with cotton.

Cotton-jute blended yarns with various blend ratio, over a wide range of counts can be spun according to the desired end use, like decorative and furnishing fabrics, upholsteries, floor coverings, mats, folio bags and shopping bags.

In this study, the investigator made an attempt on a comparative study of cotton-jute blended fabrics with the following objectives.

To compare :

1. Two different proportion of cotton-jute blended fabric with same yarn count.
2. Cotton-jute blended fabric with different yarn count.

3. The effect of reactive dye on different blend ratio and different yarn counts.

4. The effect of varying reactive dye concentration on different blend ratio and yarn counts.

Therefore the investigator selected three types of cotton-jute blended fabrics, two metres each, with cotton as warp and cotton-jute blended yarn as weft. With varying warp count's of 16^S and 30^S and blend ratios of 70/30 and 60/40.

Fifty cms of each sample was kept aside as originals and the rest were pre-treated. The samples were dyed with Reactive M_2R orange colour with 2 percent, 4 percent and 6 percent shades.

The findings of the study are listed below:

1. In visual inspection :

Among the dyed samples, sample C excelled others in all the aspects namely general appearance, evenness, colour, texture and lustre.

2. In laboratory tests :

The fabric thickness was influenced by dyeing, due to the swelling of the fibres, hence the dyed samples proved to be thicker than originals.

The weight of all the dyed samples were greater than the originals, this increase in weight may be due to increased number of yarns per square inch.

It was clear from the data that the abrasion resistance of the dyed samples was lesser than the originals which was due to the pre-treating process. The loss due to abrasion resistance was more for samples C than for A, because for every one percent addition of jute, the strength of the resultant yarn decreases.

The bursting strength of samples B and C was less than A, as samples B is finer than A and C consists of more percentage of jute.

The drape co-efficient of fabrics with higher count is better than that of lower counts, hence samples B has better drapability than A. And sample C has less drape than A, as the percentage of jute is more in C.

Regarding the wettability and absorbency tests, time taken for the absorption of one drop of water was less for samples C than A and in capillary rise test the absorption of water in 5 minutes is more for C than for A. This is due to the greater absorption property of jute, where as the sinking time is less for samples C than A, as jute is heavier.

Conclusion:

1. In all the tests significant difference was found between originals and dyed samples, except in the case of bursting strength.

2. No significant difference was found on comparison between 2 percent, 4 percent and 6 percent shades for samples A, B and C as well.

3. There was significant difference between dyed samples A and B, with yarn count 16^S and 30^S, respectively.

4. Considering the blend ratio, there was significant difference between the dyed samples A and C in all the tests, except for fabric thickness and sinking test.

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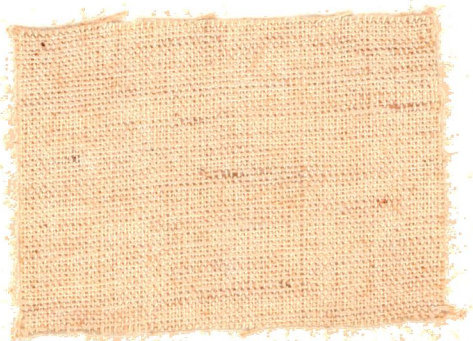
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Appendices

APPENDIX I
DETAILS OF THE SELECTED MATERIALS



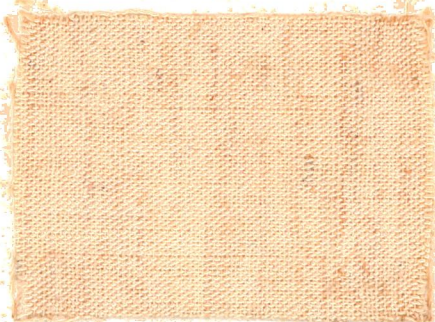
A

Warp - 100% Cotton with 16^S count
Weft - cotton-jute (70/30) with
10^S count
weave - plain



B

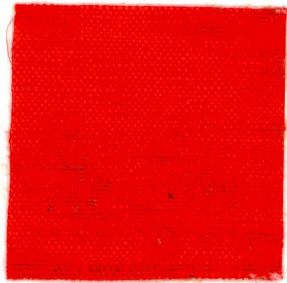
Warp - 100% cotton with 30^S count
Weft - cotton-jute (70/30) with
10^S count
weave - plain



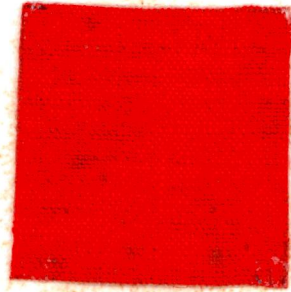
C

warp - 100% cotton with 16^S count
weft - cotton-jute (60/40) with
10^S count
weave - plain

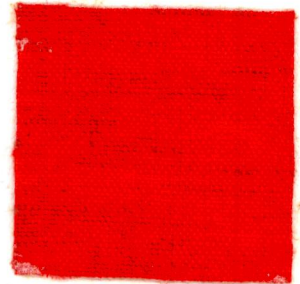
APPENDIX II
SAMPLES DYED WITH REACTIVE DYE
IN DIFFERENT CONCENTRATION



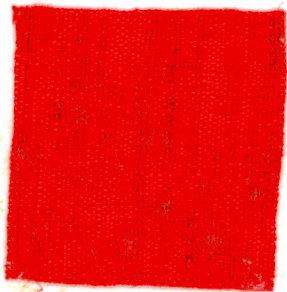
A₁



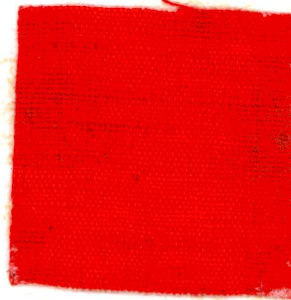
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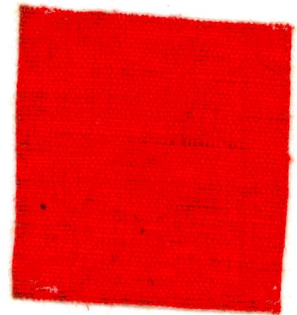
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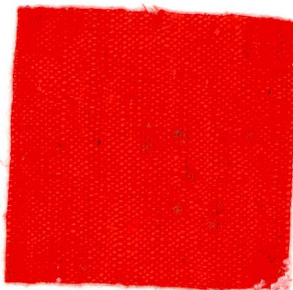
B₁



B₂



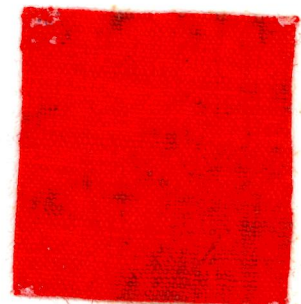
B₃



C₁



C₂



C₃

2% Shade

4% Shade

6% Shade

APPENDIX III

PROFORMA USED TO EVALUATE THE DYED SAMPLES

S.No.	Samples	APPEARANCE			EVENESS			COLOUR			TEXTURE			LUSTRE		
		Good	Fair	Poor	Even	Slightly Even	Uneven	Very Bright	Bright	Dull	Slightly Rough	Rough	Very Rough	Lustre	Semi Lustre	Dull

APPENDIX - IV

PROCEDURE FOR DESIZING AND SCOURING

Desizing:

Desizing was carried out following the procedure adopted by SITRA, given below:

Material to liquor ratio	- 1:20
Enzyme (Zymax)	- 10g/l
Common salt	- 10g/l
Wetting agent	- 0.1cc/l

The requisite amount of enzyme and common salt were taken in a beaker, to this few cc of warm water was added and mixed thoroughly. This was transferred to a tub containing requisite amount of water and stirred well. The materials were immersed into this solution and the temperature maintained at 70^oc by passing steam for 2 hours. The fabric was then given a hot and a cold wash several times to ensure thorough cleaning and dried.

SCOURING :

Scouring was carried out following the suggestion given by Taltersal (1975), at a liquor ratio of 1:20.

Sodium hydroxide	- 2.5 %
Soda ash	- 2.5 %
Liccapal D	-
P.V - Liquid	- 0.5 %

The materials were boiled for 30 minutes in the above solution, rinsed thoroughly in soft water and dried.

APPENDIX - V**DYEING PROCEDURE**

Dyeing was carried out following the procedure by SITRA given below:

Material to liquor	- 1:20
Dye stuff	- x%
Common salt	-40gm/l
Soda ash	- 20gm/l
Wetting agent	- 0.1 cc/l

Preparation of Dye Solution:

The dye solution was prepared by mixing required quantity of dye powder with water. The solution was stirred well till the dye dissolved completely. This solution was ready for use.

Dyeing in cold condition:

The sample was loaded to the jigger and wetted out. The prepared dye solution was poured and the jigger was operated for 10 minutes. The dye solution from the jigger was poured into a beaker, added the salt, mixed well and the solution was poured back in the jigger. It was operated for 15 minutes. The soda ash was added and the jigger operated for 20 minutes. The material was removed from the jigger and rinsed well in cold water, then boiled in soap solution for 30 minutes and rinsed further in cold water, dried and pressed well.

The same procedure was adopted for 2%, 4% and 6% shades.

APPENDIX - VI

DETAILS OF GREY SCALE RATING

The dyed samples were rated using the AATCC Grey scale to measure the extent of colour change and staining. The grey scale ratings envisaged the following standards of colourfastness to reactive dyes applied to the cotton-jute blended fabrics.

Number of rating	Inference regarding colour change
------------------	--------------------------------------

5	No change
4	Slightly changed
3	Noticeably changed
2	Considerably changed
1	Much changed

Inference regarding staining

5	No staining
4	Slightly stained
3	Noticeably stained
2	Considerably stained
1	Much stained

APPENDIX - VII

FORMULA USED FOR THE STATISTICAL ANALYSIS OF THE DATA OBTAINED IN THE STUDY

The statistical analysis for the laboratory tests were done by students 't' test

For testing the hypothesis of two independent random samples of size n_1 and n_2 with means x_1 and x_2 and standard deviation S_1 and S_2 the following statistic is followed:

$$t = \frac{x_1 - x_2}{S} \sqrt{\frac{n_1 \times n_2}{n_1 + n_2}}$$

Where,

x_1 = mean of the first sample

x_2 = mean of the second sample

n_1 = number of observations in the first sample

n_2 = number of observations in the second sample

S = Combined standard deviation

The value of S is calculated by the following formula:

$$S = \sqrt{\frac{(n_1 - 1) S_1^2 + (n_2 - 1) S_2^2}{n_1 + n_2 - 2}}$$

FOR EXAMPLE

FABRIC THICKNESS

S.No.	Samples	Mean thickness in mm	Gain over original	% gain over original	Dyed samples compared between dye shades	't' value
1	A ₁	0.600	0.067	12.57	A ₁ vs A ₂	0.8959
2	A ₂	0.612	0.079	14.82	A ₁ vs A ₃	2.101
3	A ₃	0.577	0.044	8.26	A ₂ vs A ₃	3.401**

** Highly significant

$$x_1 = 0.612, x_2 = 0.577$$

$$n_1 = 12, n_2 = 12$$

$$s_1 = 0.0316, s_2 = 0.0169$$

$$s = \sqrt{\frac{(12 - 1) \times (0.0316)^2 + (12 - 1) \times (0.0169)^2}{12 + 12 - 2}}$$

$$= 0.0252$$

$$\text{Therefore, } t = \frac{0.612 - 0.577}{0.0252} \times \sqrt{\frac{12 \times 12}{12 + 12}}$$

$$= 3.401$$