

A complete comparison between JUTTON & COTTON-increase jute dependency instead of cotton

Abstract

Jute producing sector is one in every of the oldest ancient manufacturing sectors of East Pakistan. As a lignocellulosic natural fibre jute possesses exhausting and harsh qualities that build it troublesome to provide attire and alternative fancy materials used in our daily life. Jute-Cotton mix is one in every of the doable choices to cut back the reliableness on the cotton. The aim of this work is to characterize the Jute-cotton alloyed material. During this work 100 gift cotton material is compared with a jute-cotton alloyed fabric. material samples like weave style, yarn count, material density, cowl issue, weight per unit space (g/m²), material strength, colouring performances like wash and rubbing fastness are evaluated. The reflection factor attempt to color strength K/S values of reactive colored material and basic dyed fabric samples were additionally studied. The experimental works are done at Dyeing laboratory and textile testing & quality control laboratory of Textile Engineering College, Noakhali.

Keywords: jute-cotton blended fabric, fabricdensity, cover factor, weight per unit area (g/m²)

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Introduction

Jute fibre is a natural bast fibre which is obtained from the bark of jute plant, consist of three main categories of chemical compounds named cellulose (58~63%), hemi-cellulose (20~24%) and lignin (12~15%), and some other small amount of constituents such as fats, pectin, aqueous extract. Jute fibre is consisting of small units of cellulose enclosed and attached together by lignin and hemi-cellulose (Pan et al., 1999). Jute fibre is not used to produce wearable product as it has some faults in regard to feel, drape, stiffness, wash ability coarseness and abrasion (Azad et al., 2009). At present, in jute sector, need of diversified jute been used and improved quality is rising for the use in various areas namely floor coverings, technical textiles, household textiles, handicrafts and so on. (Sengupta et al., 2012). Blending is a technique used to remove the poor characteristics of one fibre. It is a technique which is used to combine fibres that emphasizes the good qualities in the same time minimizes the poor qualities of the fibres. It also reduces the manufacturing cost of fabric production and makes it economical. Jute-cotton blended yarn is one of the examples of it (Bhardwaj et al., 2012). Blending jute with cotton fibre may be an acceptable the process of jute diversification by which value-added products can be produced. Jute fibres have several advantages like high tenacity, a lustrous golden appearance and good properties. Hence the techniques of softening and blending could as utilize to increase the quality of jute and can form a new class of jute-based fabrics which may have an expanding market within and outside the country (Shilpa et al., 2007).

In the present work, some characteristics of jute-cotton blended fabrics have been assessed. In comparison, characteristics of fabric which produced from JUTE-COTTON blended yarn is far better than characteristics of the fabric produced from single yarn. The blending of jute and cotton is done to develop comfortability, drape properties, wash fastness, dyeability many other properties of the fabric products. Any successful effort to blend cotton with jute fibre would be a break-

through in the field of textile.¹ The use of fabrics made from Jute-Cotton blended yarns would surely Strength our economy by cutting a part of the cost incurred for importing cotton and enhancing the value addition due to locally produced cheaper jute as a raw material (Ahmedullah et al., 2012).

Methods and materials

Preparation of fabrics

We considered one hundred percent plain (1:1) cotton fabric, which contains 105 Ends per inch and 75 Picks per inch. Where warp yarn is 54 Ne & weft yarn is 38 Ne.

In the same time, we considered a Jute-Cotton Blended fabric, which Contains 48 Ends per inch & 28 Picks per inch where warp yarn count is 15 Ne & weft yarn count is 30 Ne.

Strength evolution

The Force-Elongation results of the fabric samples were determined by Universal Tensile Strength Tester GESTER (GT-CO2) at 300mm/min test speed. The fabric samples were 15cmx10cm attached with the upper clamp and lower clamp and the samples were tested with the mentioned speed.

Weight per unit area

Gram per square meter (G.S.M) of both fabrics was calculated with the relationship,

$$G.S.M = \left[\frac{EPI}{Warp\ count(Ne)} + \frac{PPI}{Weft\ count(Ne)} \right] \times 23.50$$

Where EPI indicates Ends per inch and PPI indicates Picks per inch of the fabrics.

Fabric drape test

Drape co-efficient=(Total mass of the shaded area/total mass of paper ring) 100

The procedure was followed through (ISO 9073-9:2008)

Rubbing fastness

Rubbing color fastness defined as the power to continue first color of dyed fabrics when rubbing.

Dry rubbing test was carried out using the grayscale for staining under standard lighting, D65. One test is done to warp direction & another for weft direction.

Wet rubbing test carried out by wetted with water to 100% take up. Air dries the both cotton & jute-cotton blended test at the room temperature. For this it is also done to warp direction & another for weft direction.

Test is followed in (ISO 105X12; 1993; BS EN ISO 105X12; 1995) for both fabrics.

Pilling test

Pilling is a fabric surface characteristic caused by little pills of entangled fibre adjacent to the cloth surface and giving the garment haggish appearance. Under the impact of the rubbing action these unbound fibres develop into small circular bundles hang on to the fabric by a few unbroken fibres. Test is done through (ICI Pilling Box) (ISO 12945-1).

Cloth cover

The cloth cover may define as the fabric construction displaying to what boundary the warp and the weft yarns are clearly woven and become acquired from the below,

$$K_c = K_1 + K_2 - K_1 K_2 / 28$$

Where, K_c = Cloth cover

K_1 = Warp cover factor

K_2 = Weft cover factor

The fraction of space per inch of cloth covered by warp yarn is known as warp cover factor which was obtained as,

$$K = \frac{\text{Threads per inch}}{\sqrt{\text{Count}}} = \frac{n}{\sqrt{Ne}}$$

Similarly, the weft cover factor was calculated. The threads per inch n were counted with the help of thread counter.

Measurement of reflectance (%) and color strength (K/S)

Reflectance of any dyed fabric samples and Dyed fabrics color depth was analysed by measuring the K/S values of samples. Color measuring instrument called Spectrophotometer (Data color) determines the Reflectance (%) and Color depth (K/S) value of fabrics were measured & compared using a UV VIS-NIR reflective spectrometer (Spectra flash SF 600 X, USA), over the range of 400 to 700nm.

The equation which we get from Kubelka-Munk is following,

$$K/S = \left[\frac{1-R}{2R^2} \right]$$

Where, R=Reflectance

K=Absorbance

S=Scattering

Wash fastness

The colour fastness to wash of a dyed cloth is the measure of its counteraction in shade exchange, on publicity to a given organization or treatment. For both fabrics (ISO 105 C06) method was followed.

Results and discussions

Jute-cotton blended fabric & cotton fabric

Fabric samples details made from the jute-cotton blended fabric & cotton fabric have been plotted in the Table 1. Both jute-cotton blended fabric & cotton fabric are in plain weave structure, because normally woven fabrics are of plain structural pattern. The variations in the amount of threads per unit length of fabric is in related to the yarn count N_e , but the cover factors for both warp and weft and ensuing impact at the cloth became maintained nearly identical. The fabric sample A was represented with Jute-cotton blended fabric with ratio 1/1 plain structured, warp yarn count was 15 and weft yarn count was 30, total no. of warp yarn and weft yarn per inch were 48 and 28 respectively, the cover factor was 14.86 and weight per unit area was 97g/m². The fabric sample B was represented with hundred percent cotton fabric, 1/1 plain structured, warp yarn count was 54 and weft yarn count was 38, total no. of warp yarn and weft yarn per inch were 105 and 75 respectively, the cover factor was 20 and weight per unit area was 92g/m².

Table 1 Fabric construction of jute-cotton blended fabric & cotton fabric

Fabric Sample	Yarn composition	Weave design	Yarn count (Ne)	Threads per inch	Cover factor	Weight g/m ²
A	Jute-Cotton Blended Fabric	1/1 Plain	Warp 15	Ends 48	14.86	97
			Weft 30	Picks 28		
B	Cotton	1/1 Plain	Warp 54	Ends 105	20	92
			Weft 38	Picks 75		

Strength evolution

After completing the test of Force-Elongation of both samples in GESTER (GT-C02) at a speed of 300 mm/min we get the following results which presents the change of characteristics of the blended with the respect of hundred percent cotton fabric, plotted in Table 2.

Table 2 The change of characteristics of the blended with the respect of hundred percent cotton fabric

Sample	Elongation at break (%)	Breaking strength (N)	Tensile strength (N/mm ²)
Jute-Cotton blended fabric	9.49	433.565	4.886
100% Cotton fabric	6.4	258.485	4.507

Fabric rubbing test

From the Table 3 it is far seen that the dry rubbing fastness of sample A (Jute-Cotton blended fabric) was almost same with the sample B (100% Cotton fabric) with the value 4-5 and 5 respectively. The wet rubbing fastness is also for sample A (Jute-Cotton blended fabric) is similar to sample B (100% Cotton fabric). The values are 2 and 2-3 respectively. As the sample A (Jute-Cotton blended fabric) was dyed with basic & reactive dyes and the fabric of sample B (100% Cotton fabric) was dyed with reactive dyes. So, the rubbing fastness of sample A (Jute-Cotton blended fabric) is similar to the sample B (100% Cotton fabric) that we can say.

Table 3 Rubbing fastness test result of Jute-cotton blended fabric

Type of rubbing	Sample A	Sample B
Dry rubbing	4-5	5
	4	5
	4-5	5
	2	2-3
Wet rubbing	1-2	3
	2	2-3

Wash fastness

From the Table 4 it was found that dyes stained on the fibers of the multifiber fabric show the rating is almost same for both the fabrics. The sample A was dyed with reactive dye and the warp yarn of the sample B was dyed with indigo dyes. The staining on the di-acetate, cotton, nylon, polyester, acrylic, wool for sample A and B was found in good rating value 3 to 4 (Figure 1).

Table 4 Staining on the multifibre due to wash of different Jute-Cotton blended fabric

Multifibre	Cotton	Jutton
Di-acetate	2-3	2-3
Bleached Cotton	3-4	3
Polyamide	3	1
Polyester	5	5
Acrylic	4	4-5
Wool	2	1

Fabric drape test

Drape co-efficient for Jute-Cotton blended fabric = $(1.123/7.244)100=15.44\%$

Drape co-efficient for 100% Cotton fabric = $(3.015/7.244)100=41.62\%$

Wash Fastness

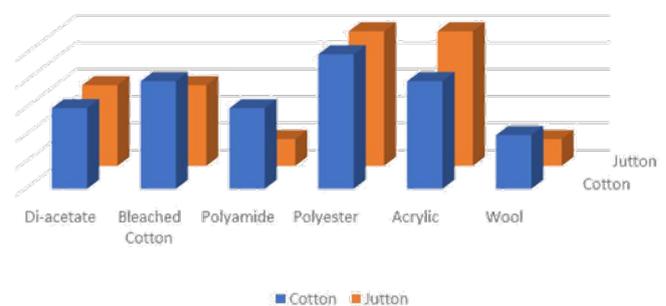


Figure 1 Wash fastness.

Pilling test

After 18000 cycle of running in the ICI pilling box. We found following result in 3:3 total 6 samples (Table 5) (Figure 3).

Table 5 Samples

Sample	Jute-Cotton blended fabrics rating	Cotton fabrics rating
Sample 01	4	5
Sample 02	4	5
Sample 03	4	5

Reflectance evaluations

Figure 3 shows the reflectance (%) of sample Cotton & sample Jutton. It is known that, when reflectance is more, absorbance is less. Reflectance (%) was measured in.

Pilling Test

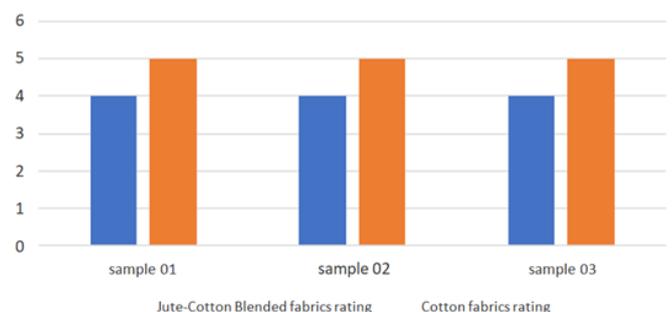


Figure 2 Pilling test.

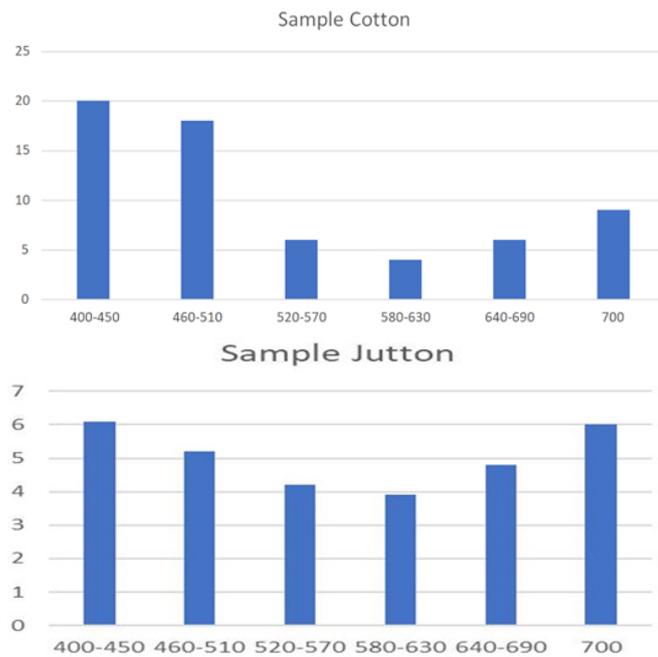


Figure 3 The reflectance (%) of sample Cotton & sample Jutton.

400-450, 460-510, 520-570, 580-630, 640-690 and 700nm wave lengths. For sample Cotton the reflectively % was 20, 18.36, 6.61, 4.0, 6.31 and 9.44 respectively. For sample Jutton, the reflectance % was 6.26, 5.57, 4.49, 3.91, 4.79, and 5.65 respectively.

K/S evaluation

Color strength of sample Cotton and sample Jute was measured

through K/S value and graphically represented in Figure 4. When the reflectance is more, absorbance is less. On the other hand, when reflectance is less; absorbance is more, indicates the more K/S value. K/S value was measured in 400-700nm wave lengths. For example, Cotton, the K/S value was lowest 1.6 at 450nm and highest value was 11.93 at 610nm, for sample Jute the K/S was minimum 7.01 at 430nm and maximum 12.35 at 630nm wave lengths.²⁻²¹

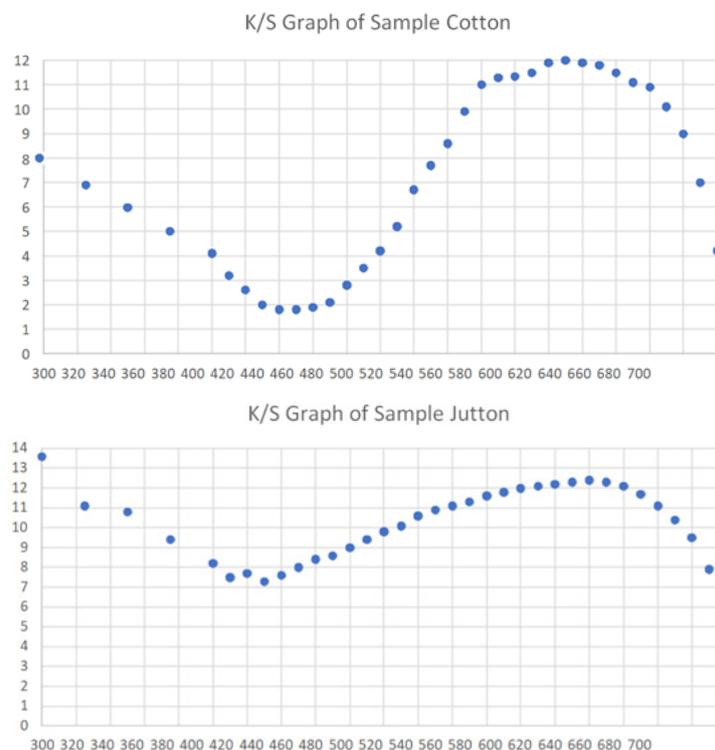


Figure 4 K/S graph of sample Cotton & sample Jutton.

Conclusion

The jute-cotton blended fabric which also called jutton and hundred percent cotton which was characterized on weave design, yarn count, fabric density, cover factor, weight per unit area (g/m²), fabric strength, dyeing performances such as wash and rubbing fastness, reflectance and color strength. The study reveals that, the characteristics of blended yarn fabric can be used as fully cotton fabric which may reduce the dependability on importable cotton fibre. Statistically all the major results are shown that jute-cotton blended fabric can be used instead of hundred percent cotton fabrics. On the whole, it may be said that, not only depending on the cotton fibre, but also jute-cotton blending may reduce the dependability on 100% cotton yarn. The use of fabrics made from Jute-Cotton blended yarns would surely strengthen our economy by cutting a part of the cost incurred for importing cotton and enhancing the value addition due to locally produced cheaper jute as a raw material, an opportunity to integrate the blended yarn into the production of jute-cotton denim and other heavy fabrics also.

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Conflicts of interest

The authors have no conflicts of interest regarding the publication of this paper.

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