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Original Research Article

Production of Fabrics with Etherified Jute Blended Yarns

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Abstract

Different fabrics were prepared by plain weaving with the blended yarns made of etherified jute fibre in the ratio of 50:50 with cotton, rayon and polyester. The physical properties of fabrics from blended yarns have been compared with those of cotton fabrics made with the same calculation 30 tex yarns. The mechanical properties of these fabrics were determined to monitor their serviceability in practical use and to ensure their suitability as jute blended cotton and synthetic fabrics. The softness and handling characteristics presented by the blending length and flexible firmness of the blended fabrics were much more comparable to that of the cotton fabrics with the indented fabric structure. The strength properties of etherified jute blended fabrics showed that the durability and serviceability of these fabrics was not much less than that of cotton fabrics due to any stress and deformation during use. It has also been observed that the blending of etherified jute with cotton, rayon, polyester or any other flexible fiber improves the draping properties of the fabrics made from it and in actual use these fabrics have almost the same bright look and firmness of cotton fabrics.

Keywords: Etherification, Blended Fabrics, Draping properties, Cloth Cover, Flexural Rigidity.

INTRODUCTION

Jute is the golden fiber of Bangladesh. It contains cellulose (58-63%) non-fibrous substances such as lignin (12-14%), hemicellulose (21-24%), pectin (0.2-0.5%) and waxy substance which is coated with fibril formation [1-3]. Therefore, jute as a textile fiber suffers from an underlying defect which of course limits the spinning of yarn for the production of coarse packing fabrics [4, 5]. Partial removal of non-cellulosic components of jute fiber to improve its properties has been of great interest recently [6, 7]. It has been reported that some chemical treatments improve the fiber properties of jute, modifying its physico-mechanical and physico-chemical properties [8, 9]. Furthermore, its mechanical properties indicate that the fiber is so strong and rigid that it is not suitable for making the fine and flexible yarns required for use in a variety of textiles as the fiber tends to close or close the fibers during spinning [10-12]. An alkaline solution of sodium hydroxide, ammonium hydroxide only partially dissolves hemi-cellulose and swells the fiber without improving the softness of the fiber whereas a solution of chlorite-removed lignin only makes the fiber harder [13, 14]. On the other hand, when jute fibers are etherified with N-butyl chloride with sodium hydroxide at temperatures up to 30^0C at normal pressure, both lignin and hemicellulose are partially removed, resulting in quantitative, structural, and dimensional changes of these internal components of the fiber [15, 16]. It changes the physical and mechanical properties of jute fiber depending on the etherified treatment. Jute fibers were modified by etherified method under different conditions and the specimens of these fibers were preserved in their properties as textile fibers and their physical and mechanical properties were improved. Fabric samples in plain weaving was made by mixing cotton, rayon and polyester with blended yarns made of etherified jute fiber in different proportions. The physical properties of the fabrics were determined to monitor their serviceability in practical use and to ensure their suitability in practice as jute blended cotton and synthetic fabrics [17, 18]. The softness and handling characteristics presented by the blending length and flexible firmness of the blended fabrics were comparable to cotton fabrics with a

uniform fabric structure. It has been noticed that the blending of etherified jute with cotton, rayon and polyester or any other flexible fiber has improved the draping properties of the fabrics made from it and in actual use these fabrics have almost the same bright look and firmness. The present work has been undertaken for the manufacture of fabrics from a mixture of cotton, rayon, and polyester with etherified jute yarn and for diversified use of jute in the textile sectors.

MATERIALS AND METHODS

MATERIALS

Corchorus capsularies were collected from the experimental plot of Bangladesh Jute Research Institute and retted under fresh water for 18 days. The fibers are separated and dried in the sun. As a result fiber was used as a fibrous raw material for making blended yarns and fabrics. Sodium hydroxide, sodium carbonate and N-butyl chloride were used as obtained.

Preparation of fabrics

Three different specimens of cloth about 10 meter long and 1 meter wide were made by weaving in the general power loom of Jute and Textile Product Development Center of Bangladesh Jute Research Institute, Dhaka. The weaving was carried out with blended yarns made of etherified jute fibers in different combinations with cotton, rayon and polyester respectively. The set of warp and weft yarns followed the one up and one down principle in weaving plain or square fabrics.

Cloth cover

The cloth cover describes the fabric construction showing to what extent the warp and the weft yarns are closely woven and was obtained from the relationship.

$K_c = (K_1+K_2 - K_1K_2/28)$

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:

$$K = \frac{thread\ per\ inch}{\sqrt{Count}} = \frac{n}{\sqrt{N}}$$

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

Stiffness and flexural rigidity

A strip of cloth (6 x1) inch was cut to the size of the template of the tester was slide into the direction parallel to its length, so that its end was projected form the edge of the horizontal platform of the tester.

The length of the overhang cloth was measured when the tip of the test specimen was depressed under its own weight to the point where the lines joining the tip of the horizontal platform made an angle of 41.5 degree with horizontal plane. The bending length, C was determined by the following equation:

$$C = \frac{L}{2}$$

Where,
L = the overhang fabric length.

The flexural rigidity (G), which is a measure of stiffness associated with handle of cloth was determined from the following relationship.

$G=WC^3 \times 10^3$ mg/cm = mNmm

Where,
C= bending length
W= cloth weight (gm) per square cm.
N= Newton

Draping properties

Drape may be broadly defined as the ability of a fabric to give a graceful appearance in use. The warp and weft way characteristics of a fabric interact and produce graceful folding of cloth as it is draped over any circular support. The draping properties of the fabric specimen under test were measured following the procedure of the Fabric Research Laboratories of U.S.A. The fabric sample was cut into a circular specimen about 10 inches in diameter and was supported on the circular disk about 5 inch diameter of the Drape meter. The circular specimen was draped over the circular disk supporter of the Drape meter and assumed some folded configuration. The drape was measured as the drape coefficient F, which is the ratio of the projected area of the draped specimen to its undraped area, after deduction of the area of the supporting disk. Thus

$F = (A_s-A_d) / (A_D - A_d)$

Where,
A_D= the area of the specimen.
A_d= the area of the supporting disk.
As = the actual projected area of the specimen.

RESULT AND DISCUSSION

Ordinary knit and woven fabrics made from etherified jute yarn blended with cotton, rayon and polyester have shown very good performance potential as they are comparable to cotton fabric structures. Sample description of fabric made from etherified jute yarn blended with cotton, rayon, polyester have been shown in table 1. The structure of a fabric plays an important role in determining the properties of the fabric. Plain weaving structures were chosen for fabrication from etherified jute yarn blended with other fibers, because most fabrics have about 70% plain

structural pattern. From Table 1, it can be seen that each type of fabric was woven with equal warp and weft while maintaining optimal spacing at the yarn intersection. The differences in the number of threads per unit length of fabric were consistent with the yarn text, but for both warp and weft the coating material and their resulting effect on the fabric remained almost identical. Each unit area had weight, although the yarn used differed for different fabrics according to quality. The geometric properties of the fabric from the blended etherified jute fibers were favorably compared with those of 30 tex cotton yarns. The results of the physico-mechanical properties of the fabric, including etherified jute yarn blended with cotton, rayon and polyester are shown in Table 2. It was shown that etherified jute fiber blended with cotton, rayon and polyester respectively gained sufficient flexibility to form fine yarns. Light weight fabrics were made with this blended 30 tex yarn. The mechanical properties of these fabrics were determined to monitor their serviceability in practical use and to ensure their suitability as jute blended cotton and synthetic fabrics. Shirting and suiting are usually made from cotton, rayon and polyester yarns or its blends. The use of jute after etherification in making such fabrics was likely to have diversified uses in the textile sector. The results shown in Table 2 indicate that the softness and handling characteristics represented by the bending length and flexible firmness of the blended fabrics were much more comparable to that of cotton fabrics with uniform fabric structure. The pattern bending length and flexibility of fabrics made from etherified jute fiber blended with cotton were 1.8 cm and 8.7 mNmm respectively, which was only 0.2 and 4.3 points higher than that of cotton fabrics and close to the standard of other blended fabrics. The strength characteristics of the fabric samples from the fiber blends ranged from 20.2 to 21.5 kgf which was obviously very close to the 22.5 kgf strength of the cotton fabric. This implies that the durability and serviceability of fabrics under any kind of pressure is not much less than that of their use time and distortion cotton fabrics. Etherified jute blended fabrics draped very elegantly almost in the same way cotton fabrics are tied on a round support. Table 2 shows that the drape co-efficiency of mixed fabrics is found to be between 37 and 40 which are 2 to 5 points higher than that of cotton fabrics. This indicates that the blending of etherified jute fibers with cotton or any other flexible textile fiber has improved the draping properties of the fabrics made from it and in actual use these fabrics will have beautiful look and durability with almost the same amount of dropping properties cotton fabrics.

Table-1: Details of fabric construction from etherified jute yarns blended with cotton, rayon and polyester

Fabric Sample	Yarn Composition (blend ratio)	Yarn count (tex)	Thread per cm	Cover factor	Cloth cover	Weight (g/cm^2)
A	Etherified jute fibre/cotton (50:50)	warp 30 weft 30	ends 16 pick 16	warp 9.17 weft 9.17	15.3	136
B	Etherified jute fibre/rayon (50:50)	warp 30 weft 30	ends 16 pick 15.5	warp 9.17 weft 8.88	15.2	139
C	Etherified jute fibre/polyester (50 : 50)	warp 30 weft 30	ends 16 pick 15.7	warp 9.17 weft 9.0	15.2	135
D	Cotton 100%	warp 30 weft 30	ends 16.2 pick 16.2	warp 9.28 weft 9.28	15.5	109

Table 2: Mechanical properties of fabrics prepared from etherified jute fibre yarns blending with cotton, rayon and polyester

Sample No	Fabric composition	Bending length (cm)	Flexural rigidity (mNmm)	Tensile Strength (kgf)	Drape co-efficient
A	Etherified jute/cotton (50:50) blend, 30 tex yarn	1.8	8.7	20.2	37.2
B	Etherified jute/rayon (50:50) blend, 30 tex yarn	1.9	10.1	20.4	38.0
C	Etherified jute/polyester (50:50) blend, 30 tex yarn	2.0	11.5	21.5	40.3
D	Cotton (100%), 30 tex yarn	1.6	4.4	22.5	35.3

CONCLUSION

The geometric properties of fabrics from blended yarns were favorably compared with those of cotton fabrics made with the same calculation 30 tex yarns. The softness and handling characteristics presented by the blending length and flexible firmness of the blended fabrics were comparable to those of cotton fabrics. It has been found that the blending of etherified jute with cotton or any other flexible fiber improves the draping properties of the fabric and makes it look beautiful. Etherified jute fiber and its blended products are promising ingredients for diversified use of jute fibre in the textile sector compared to other fibers.

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