

Preparation of Yarn by Blending of Etherified Jute Fibre with Natural and Synthetic Fibre

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ABSTRACT

Yarns were prepared by blending of the etherified jute fibre in different combination with cotton, rayon, polyester and silk waste. A blend of 50:50 for each fibre component was prepared with 50% of the etherified jute fibre respectively and 30 tex yarns from each blend was produced using the ring spinning frame. The physical properties of these yarns were determined with respect to the same numbered yarns of cotton. The 50% of the etherified jute fibre in the blends produced yarns having tenacities between 10.9 to 11.9 (g/tex) which are very much comparable to tenacity 11.5 (g/tex) of the same numbered cotton yarns. The breaking elongation 6.2 to 6.4%, moduli between 181 to 184 (g/tex) and count strength product 1605 to 1638 of the yarns from etherified jute & cotton and etherified jute and rayon in the ratio of 50:50 were almost similar to the respective properties 6.6 %, 171(g/tex) and 1694 of the same numbered cotton yarn. The breaking elongation of yarns from etherified jute and polyester and etherified jute and silk were much higher between 12.4 to 12.7% which were due to highly extensible polyester and silk fibres in the combination.

Keywords: Etherification, blended yarns, Breaking Elongation, Moduli, Count Strength Product.

INTRODUCTION

Jute is called the golden fibre of Bangladesh. Jute is a natural fibre which suffers as a textile fibres for inherent defects which limit its spinning to coarse yarn to produce coarse packing cloths [1, 2, 3]. Cotton and jute occupy the first and second places, respectively, in terms of world production levels of cellulosic fibres [4, 5]. However, compared with cotton, the diversified application of jute has been greatly handicapped due to the inherent shortcomings of the fibre [6]. Partial removal of non-cellulosic components of jute fibre to improve its characteristics has recently been a subject of much interest. During microbial or chemical retting [7], only waxy and pectic substances are mostly removed, resulting in the ordinary fibre filament for commercial use [8]. Jute fibre blends with cotton and other natural and synthetic fibres have been high lighted as one of the main outlets for jute towards an entirely new sector of the textile furnishing and apparel industries [9]. To generate the more profits from jute and jute blended products, appropriate commercially feasible technologies must be developed to overcome the problems associated with the processing of jute and jute blended products [10, 11]. The etherified jute fibre was mechanically processed and blends with cotton, rayon, polyester and silk to make fine yarns and their properties of the yarns were reported [12, 13]. Different yarns samples were prepared with the blended etherified jute fibre in different combination with cotton, rayon, polyester and silk waste. The mechanical properties of these yarns were determined to observed their serviceability in practical usages and to ascertain their suitability in practical as jute blended cotton and synthetic fibres [14,15].By blending jute fibre with cotton and other natural and synthetic fibre, the problem can be somewhat alleviated by the cotton component, however, the blended yarn on its own does not fulfill the requirements of apparel or furnishing fabrics, especially when the jute content is relatively high in the blend[16,17].The present work was, therefore undertaken to prepare the yarns from the blends of etherified jute fibre with natural and synthetic fibres, such as cotton, rayon, polyester and silk waste and to assess their physico-mechanical properties and to use for diverse textile sectors.

MATERIALS AND METHODS

Preparation of yarn

Yarn was made by blending of the etherified jute with cotton, rayon, polyester and silk fibre respectively following the standard processing system - cotton system spinning. The jute staples prepared after cutting the long jute into a length of 35 mm were processed like cotton. The etherified jute fibres were cut into a length of 35 mm. using a cutting machine. The jute staple so made were processed through the mechanical processing units of a miniature cotton spinning count (30 tex) was prepared by blending the etherified jute.

Preparation of Jute-Cotton blended yarn

The etherified jute staples were blended with cotton in the ratio of 50: 50 respectively. The fibres of the jute staples were individualized by passing through the opener machine and were then mixed up with cotton samples in the required proportions, which were then processed in the mini carding machine. Several passages through the carding machine were made for intimate blending of the component fibres. The card slivers were then fed to the mini drawing machine and were spun to 30 tex yarns.

Preparation of Jute-Rayon blended yarn

The etherified jute fibre and rayon filaments were stapled separately into equal length of 35 mm and were processed through the mini carding machine. A blend (50:50) of jute - rayon was prepared and 30 tex yarns were spun.

Preparation of Jute-Polyester blended yarn

The spinning of 30 tex yarn from the jute - polyester blend (50:50) was made possible with some modification of the process. The blend was carded well, but condensing of webs to slivers were done with difficulty. Several passages through the mini carding machine necessary for better mixing of the fibre components before 8 uniform slivers. Sometimes doubling of the slivers was needed to process in the mini drawing frame in order to get even densities of roving in the mini process machine. The yarn were prepared successfully in the ring frame having the same draft and bobbin speed.

Preparation of Jute-Silk-Rayon blended yarn

The silk filaments were collected from Seri-culture Institute, Rajshahi. The staples of the etherified jute fibre were blended with the silk fibre and for better carding some rayon staples were mixed up. The sliver finally contains jute-silk-rayon in the ratio of 10:80:10 respectively, from which 30 tex yarn was spun.

Measurement of Count

210 yards of yarn in length winding on the laboratory reeling frame were weighed and an average of ten such readings was taken to measure the count of the yarn. The yarn counts measured in both jute system i.e. number of pounds in 14400 yards and cotton system i.e. number of hanks (840 yards) in a pound were expressed in the International unit of 'Tex' which measures number of grams in one kilo meter length of the yarn. The count in tex was taken as a measure of linear density of the yarn.

Measurement of Tensile Properties

The yarns were tested in Instron Tensile Tester for measurement of the tensile properties which included tenacity, breaking elongation and initial modulus at 1% elongation. For each experimental value, 10 yarn samples were tested with the tensile tester machine at 10 cm gauge length with a pretension load of 0.4N and at a constant rate of elongation, 5 cm per minute.

The Count-Strength Product (CSP)

The concept CSP may be used to derive an index by which the spinning quality of a fibre or the spinning efficiency of system may be assessed. It was obtained as the product of cotton count and Lea strength of the yarn. A hank of yarn, with its starting and finishing ends knotted, was placed over the hooks of the Lea tester, pendulum lever type, made by Good brand & Co Ltd. As the lower hook descends a load was imposed on the loops of the yarns constituting the hank. The maximum load to break all the threads unraveling the hank was indicated on the dial, which was the 'Lea strength' of the hank.

RESULTS AND DISCUSSION

The etherified jute fibres were stapled to match the cotton staples and were mixed together in the ratio of 50:50. Careful attention was paid to have regular web formation during carding, which ensured uniform blending of the fibre components of the blend. The properties of the

blended yarn have been shown in table 1. It is seen from table 1 that 50:50 blend of etherified jute and cotton give yarns having its mechanical properties very much close to 100% cotton indicating better compatibility of the mixed up component fibres. The etherified jute fibre and rayon fibre were mixed up in a comparatively better form than any other blends, which was probably due to the individual fibre characteristics of both the fibre staples in achieving intimate blending. The yarn properties have been shown in table 2. It is seen from table 2 that the properties of the jute/rayon blended yarn are mostly similar to those of the etherified jute/cotton blended yarn. The rayon staples being regenerated cellulosic fibres seemed to have similar compatibility for inter-mingling with the etherified jute fibre like cotton. The blending of etherified jute with polyester staples was a unique achievement, although the process was difficult. The success was very effectively made to mix up 50% of the etherified jute fibre with 50% of polyester fibre to produce very regular yarn. The properties of the blended yarn have been shown in table 3. Mixing of the etherified jute with silk only was difficult, which was overcome by adding up to 10% rayon staple with the blend. Finally the blend having 10% etherified jute, 10% rayon and 80% silk seemed to be comparatively more uniform and yarn having count 30 tex was spun on ring frame. The properties of the yarn have been shown in table 4. It will be seen from the table- 4 that the properties of Etherified Jute-Silk-Rayon blended yarn are very much comparable to those of the blended yarn from Etherified Jute-Polyester. Jute-Silk was made with some success, but the quality of this yarn was too irregular to report. This was due to very unequal distribution of the fibre components in the yarn cross section, which was however improved when rayon staples up to 10% were incorporated in the fibre combination. The yarns made from the etherified jute fibre and its blends with cotton, rayon, polyester and silk waste show a very good prospect of performance, as they are comparable to the structure of cotton yarns. From this finding, it will be created a new arena of jute used as a textile fibre for diverse use of textile sector.

CONCLUSION

The etherified jute fibre and its blending products are promising materials for the diverse use of textile sectors in comparison with other fibres. Yarns were prepared by blending of the etherified jute fibre in different combination with cotton, rayon, polyester and silk waste. A blend of 50:50 for each fibre component was prepared with 50% of the etherified jute fibre respectively and 30 tex yarns from each blend was produced using the ring spinning frame. The physical properties of yarns from etherified jute blends with other natural and synthetic fibres were much very much close to the cotton fibre.

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Table -1. Properties of etherified jute-cotton blended yarn (Linear density = 30 tex)

Yarn sample	Tenacity (g/tex)	Elongation at break (%)	Initial Modulus (g/tex)	CSP
Jute/Cotton 50/50	11.1	6.2	184	1638
Cotton 100%	11.5	6.6	171	1694

Table -2 Properties of etherified jute-rayon blended yarn (Linear density = 30 tex)

Yarn sample	Tenacity (g/tex)	Elongation at break (%)	Initial Modulus (g/tex)	CSP
Jute/Rayon 50/50	10.9	6.4	181	1605

Table- 3 Properties of etherified jute-polyester blended yarn (Linear density = 30 tex)

Yarn sample	Tenacity (g/tex)	Elongation at break (%)	Initial Modulus (g/tex)	CSP
Jute-polyester 50/50	11.9	12.7	147	1613

Table-4 Properties of etherified jute, silk and rayon blended yarn fibre (Linear density = 30 tex)

Yarn sample	Tenacity (g/tex)	Elongation at break (%)	Initial Modulus (g/tex)	CSP
Jute-Silk-Rayon 10:80:10	11.2	12.4	150	1682