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A Review on Jute Fibre and Its Blends

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Abstract
The objective of this study is to find the effect of jute fiber blending and to identify the economic effectiveness to produce diversified textile materials which will surely reduce the dependability on other fibers. If we study carefully the progress of research works on the jute and jute products in some technologically developed countries. We find that jute has got manifold uses in the countries like UK, USA, India, Japan and some other parts of Western Europe. In these parts of the globe, specialized products such as furnishing fabrics, wall coverings, plaited sole, decorative clothes, union fabrics etc. have been successfully made of jute. A flow chart on blending of jute fibre with cotton (20:80), optimization of twist and rotor speed to produce 40 tex blended yarn for the application of garments purpose have also been discussed in this work.

Keywords: Jute Fibre, Blending, Diversification, Bio-degradability, Rotor speed, Breaking force, Elongation, Tenacity.

1. Introduction
Jute fibre has several advantages like lustrous golden appearance, high tenacity, high moisture regain, bio-degradability and other good properties; also the fibre can cut into staples of suitable length for mixing with other fibres. The disadvantage lies in harsh feel, brittleness, least extensibility, poor bleaching fastness and difficulty to launder. Its disadvantages can be compensated by the surplus properties of the components like cotton,viscose or acrylic in the blend. Softening techniques such as sulphonating or others could be applied to upgrade the quality of jute and thus facilitate jute fitness to blend with other fibres. A good number of researchers reported about the jute-cotton blending for textile purposes [1-14].

However, Bangladesh has rich history of textile manufacturing and trading. Its millennium old handloom weaving demonstrably flourished during the Mughal era when it exported silk and cotton textiles (e.g.,) Muslin & Jamdani fabrics) to Europe and different Asian countries by using the famous silk-route. The jute manufacturing/processing industry that took its birth in Dundee in Britain about 1833 soon had to take parting British ruled Bengal for the supply of raw materials. During the period in between 1951 to 1971 a number of mechanized jute mills were established in East Pakistan (Presently Bangladesh). In the late Pakistan and early Bangladesh time, the jute industry was the main source of earning of foreign currency for the country. Jute is grown in Bangladesh, India, China, Nepal and Thailand. World production of jute fibre was approximately 2.8 million metric tons in 2017. However, in Bangladesh about 1.0 million metric tons of jute have grown. Since late 1980s synthetic polymer (mainly polypropylene) film products, by slitting into tapes for weaving on modern high-speed loom, started entering into the market as alternative materials having similar characteristics to jute goods at lower cost. The result of this competition has caused to decline the demand for jute goods slowly but steadily. It is equally true that the technological research and development activities conducted in different areas have not so far been able to make that breakthrough to make jute yarn useable for bulk production of apparel and furnishing fabrics.

1.1 Use of Jute

Jute is used in woven carpets as weft, warp, or pile, in tufted carpets as the backing material, in linoleum as backing, and in carpet under lays and felts. Small domestic ropes, parcelling twines, horticultural twines are examples of its use as cordage. Roofing felt and damp courses often have a base-cloth of jute. Jute yarns are used in electrical and cable-making industries as packing for power cables or telephone and telegraph cables. Jute may be used for filter cloths, boot and shoe linings, and tarpaulins; it has even had some vogue as a dress fabric. Figure 1 shows the conventional use of jute products.

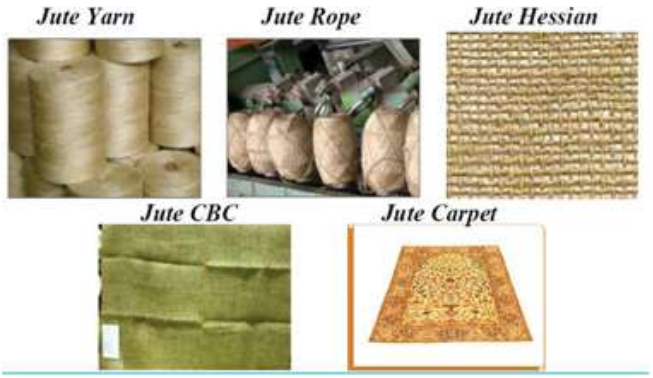

Figure 1. Traditional jute products.

1.2 Some Purposes of blending/mixing are

• Minimize overall production cost of the yarn and fabrics (for economic reasons expensive fibres can be extended by blending them with more plentiful fibres).

• Obtain cross dyed effects or create new colour effects (e.g., when fibres with unlike dye affinity are blended together and then piece dyed, a special look grows).

• Add more value to cheaper components by putting it into the combination.

• Make best suited to mechanical actions than individual component.

2. Discussion

2.1 Diversification of Jute

The technological revolution all over the world, including Bangladesh, Jute has no less contribution than the economic push. Dundee, the city of Scotland has become so world famous today is because of the raw jute of Bangladesh. Before the invention of mechanical means of jute spinning and weaving, the manufacturing of jute yarns and fabrics were carried in hands in Bangladesh at cottage level industry. Very primitive method of spinning and weaving of the cottage industry could deliver a little output. But the mechanization of the jute industry in Dundee brought about technological revolution and subsequently spread the industrial wave all over the world. This was undoubtedly a remarkable contribution of jute towards the global technological change. At present jute is using as making components of car/aeroplane bodies. Figure 4 shows the various types of diversified jute products.

Figure 2. Diversified jute products and jute composites.

2.2 Jute Substitutes

Recently various types of natural and synthetic jute substitutes have been developed in many countries of the world. In the recent years, the overall circumstances-particularly the presence of worldwide jute substitutes-have compelled us to develop alternative methods of newer products for jute and jute blends. Presently, jute has been facing a serious problem due to the introduction of man-made fibre in the world textile market. In the artificial fibre, the textile property can be changed as per requirement of consumer. On the other hand jute is a natural fibre where fibre property cannot be changed easily. A great advantage of jute fibre is that it is biodegradable and eco friendly.

Jute is one of the most important industrial fibres,

which comes next to cotton in respect of its service-ability. It is observed that in the past twenty-five to thirty years a host of the man-made fibres have been moved into the premises of natural fibres and have brought a dramatic change and possibilities in the textile industry. Man-made fibres like nylon, polyesters, acrylic, and polypropylene etc. have been developed with the enormous growth of the petro-chemical industry in the developed countries like UK, USA, Germany and Japan. Petro-chemical industry has opened the new route and introduced a variety of synthetic fibres and materials, particularly the polyethylene and polypropylene, which can be put to similar uses as jute [15-16].

It is quite possible to produce even garments and ornamented clothes having modified spinning, weaving and finishing techniques on the jute manufacturing plant. Introduction of modern automatic shuttle changing looms, dobbies and jacquard would create new fields of diversification of jute products in the industry. It is also possible to produce low cost carpets, Satranji, Jainamaj, woollen blankets, jute tape, ball threads, furnishing fabrics, screen clothes, cushion covers, wall coverings, greeting cards, electric lamp shade, low cost suiting, shoe sole, water- fire, and rot proofed jute clothes by hand loom as well as by power loom.

2.3 Flow chart of manufacturing of jute-cotton blended yarn

Figure 3 shows the manufacturing of jute-cotton blended yarnon slip draft ring frame and rotor frame.

2.4 Optimization of rotor speed on jute blended rotor spun yarn

Ahmedullah 2012 [18] also observed five different rotor speed (55000, 60000, 65000, 70000 and 75000 rpm) to optimize the rotor speed to produce 40 tex jute-cotton (20:80) blended yarn and tensile properties such as Breaking force(N), Elongation (%) and Tenacity (cN/tex) that are provided in figure 4. It was found that 60000 rpm (rotation per minute) shows the best result in terms of breaking force, elongation and tenacity. The maximum breaking force was 4.49 Newton, elongation was 7.4% and tenacity was 9.75cN/tex. The breaking force, elongation and tenacity of the yarn were 4.428 N, 7.36% and 9.68 cN/tex respectively which was manufactured at 55000 rotor rpm. In the same way, it was seen from the figure that the above mentioned parameters were less in 65000, 70000 and 75000 rotor rpm.

2.5 Effect of rotor speed on Evenness properties of jute-cotton blended rotor spun yarn

Ahmed Ullah in 2019 [17] compared the properties of 40 tex jute-cotton blended yarn which was produced both in ring and rotor spinning systems in different jute cotton ratio (20:80, 35:65 and 50:50). The Unevenness (Um%) and imperfections (thin, thick and neps places) and hairiness values of the manufactured 40 tex jute-cotton (20:80) blended yarn were augmented with the increased rotor speed(55000, 60000, 65000, 70000 and 75000 rpm). The Um% was 14.10, Thin places per kilometre (-50) was 88, Thick places per kilometre (+50) was 170, Neps per kilometre (+280%) was 130 and hairiness was (-) 7.6 were found at optimized 60000 rotor rpm. The Um% was 14.20, Thin places per kilometre (-50) was 85, Thick places per kilometre (+50) was 162, Neps per kilometre (+280%) was 125 and hairiness was (-) 7.5 were found at 55000 rotor rpm. It can be revealed from the figure 5 that the values of Unevenness (Um%), Thin, Thick, Neps and Hairiness per kilometre of 40 tex jute-cotton blended yarn were better at 60000 rotor rpm.

2.6 Optimization the TPI (Twist per Inch) for Jute-Cotton blended rotor spun yarn

Ahmedullah 2012 [18] reports the successful outcomes to process the jute fibres along with cotton fibres at the ratio of 20:80using rotor spinning machine. This work covers the optimization of the processing variables e.g. rotor speed for manufacturing the 40 tex jute-cotton blended yarn. The yarn was manufactured at rotor speed 60000 rpm at seven different twist level (TPI 14.0, 15.0, 16.0,

17.0, 18.0 and 19.0) and tensile properties such as Breaking force (B-force in Newton), Elongation (%) and Tenacity (cN/tex) were compared. The results are given in figure 6. The results reveal that maximum B-force was 4.7 Newton, elongation 6.75% and tenacity was 12.40 cN/tex were found at TPI 18 for 40 tex jute-cotton blended rotor spun yarn. The breaking force, elongation and tenacity were 4.65N, 6.80%, 12.35cN/tex of the 17 TPI consisted yarn and 4.4 N, 6.40%, 11.45 cN/tex of the 19 TPI consisted yarn which was less than 18TPI consisted yarn.

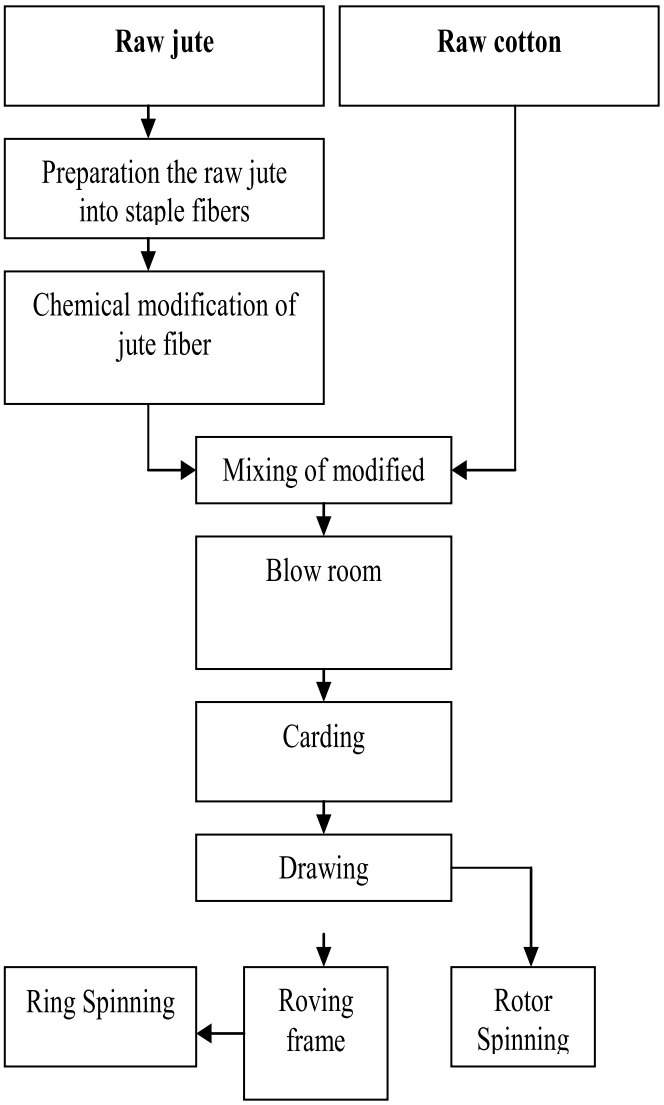

Figure 3. Flow chart of Jute blended yarn spinning [18].

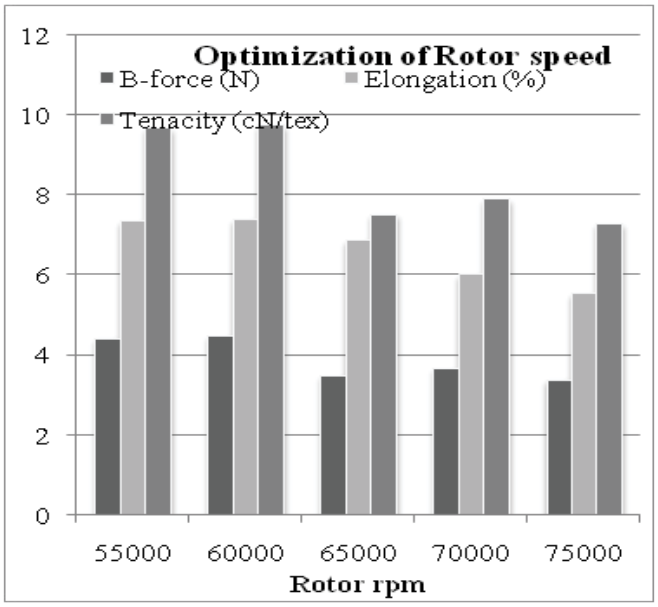

Figure 4. Effects of rotor speed on tensile properties of 40 tex Jute-Cotton blended rotor yarn.

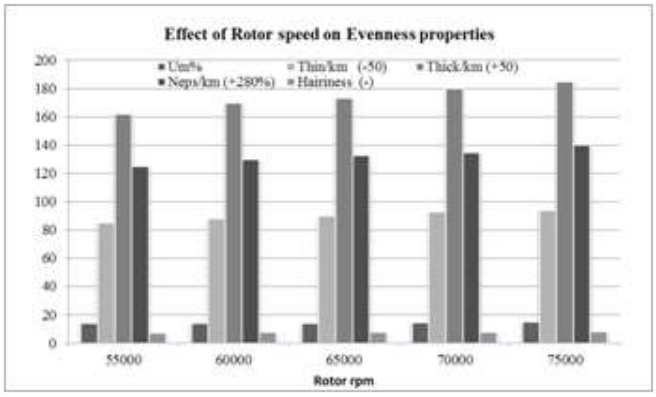

Figure 5. Effect of rotor speed on evenness properties of 40 tex Jute-Cotton blended yarn.

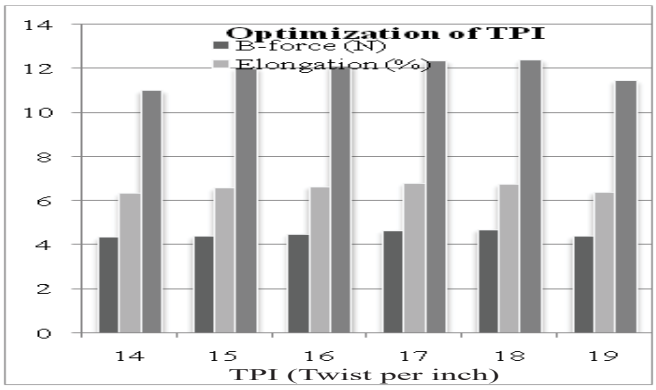

Figure 6. Effect of twist on tensile properties of 40 tex Jute-Cotton blended rotor spun yarn.

3. Conclusion

There is plenty of jute supply in Bangladesh at comparatively lower prices. Therefore, the jute's potentiality to replace other fibre or at least be a partner in the blending is an important object of this research. Over the last few years, researchers have strengthened the investigation in India, Bangladesh and China towards the use of jute in manufacturing the jute diversified products (JDP) in which jute is blended with various textile and non-textile materials to produce non-traditional products, starting from technical textile to home textiles and apparels. But the progress of research in the areas of jute blending for apparel grade cloth is less, nevertheless some home textile products from the jute blended yarn is now in the market. It can be concluded that the blending of Jute: Cotton (20:80) be a potential approach in the field of diversified textile products.

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