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STUDY OF THE EFFECT OF CHANGING DRAFT OF SPINNING FRAME ON THE QUALITY OF BLENDED YARN

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ABSTRACT

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Key words: *yarn, acrylic, jute, spinning*

INTRODUCTION

Jute is a natural cellulosic bast fibre which is extracted from the stems of plants belonging to the botanical genus Corchorus. Approximately 40 species are known, only two viz, capsularies and olitorius are cultivated commercially. Capsularies is knows as “white” and olitorieus as “Tossa Jute” It is a textile fibre of good spinnable character (Barella 1966). Jute is facing tough competition with synthetic fibres. Hence, for the survival of this environment friendly fibre, it is necessary to diversify the use of jute by making new products with jute & blending with other fibres. Usually coarser yarns are manufactured from Jute fibre through the Flyer Spinning, Ring spinning, Modified apron draft spinning and Centrifugal spinning, which we usually used to spin jute yarn. Through modified apron draft spinning of jute such as shopping bag, furnishing fabric, decorative fabrics, finer fabrics etc. As a result, jute fibre may be used in the production of fabric that may further enhance its uses in various fields of textiles. Quality is an important factor for any production-oriented industry. In order to achieve quality products it is necessary to determine the appropriate draft of apron draft spinning system for production of the blended yarn.

Any long chain synthetic polymer composed of at least 85 percent by weight of acrylonitrile units. Which may be used as clothing, carpeting, automobile components, telephone and computer casings, sports equipement, produced plastic that are inpermeable to gases and are ideal for shatter proof bottles which is used for holding chemicals and cosmetics, clear “blister packs” that keep meats fresh and medical supplies sterile and packaging for many other products. It is also a component in plastic resins, paints, adhesive and coatings etc.

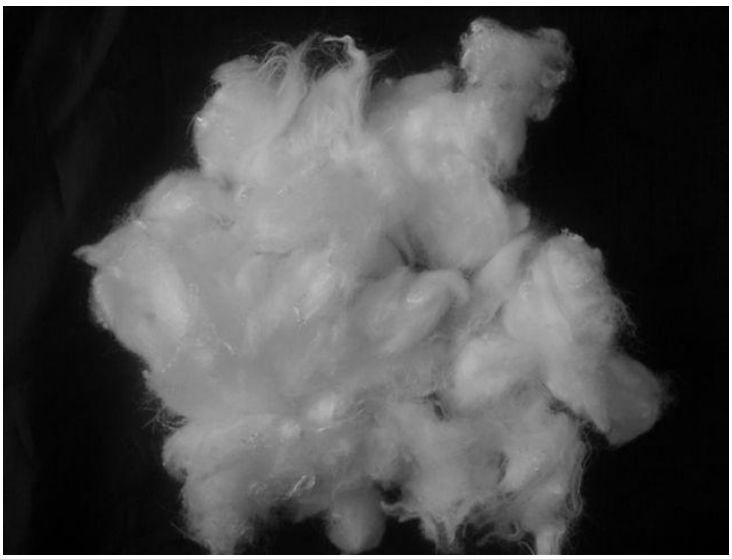


Figure 1. Acrylic Fibre

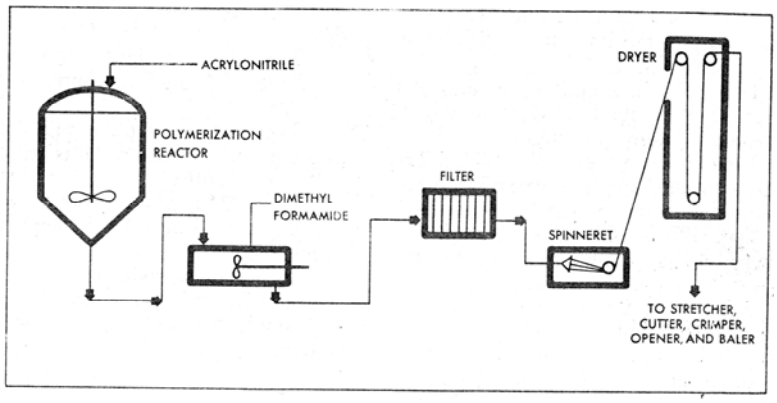


Figure 2. Flow chart of the manufacturing process of Orlon acrylic fibre

Most industrial acrylonitrile is produced by catalytic ammoniation of propylene.

$$CH_3{-}CH{=}CH_2 + NH_3 + O_2 \longrightarrow CH_2{=}CH{-}C{\equiv}N + H_2O$$

After orientation and stabilization, the acrylic filaments are cut into staple length for spinning into yarn. Some of the general common properties of acrylic fibres are:

Strength – Fair
Color Fastness – Good
Flamability – Flammable, Toxic
Elasticity – Low
Absorbacy – Little
Srinkage – Virtually none
Color – Color less to pale yellow
Boiling Point – 77 C

MATERIALS AND METHODS

The processing of the fibres for converting into yarn of 172 tex (5 lbs/spy) was made following the sequences of conventional jute processing system (Barella and Manich, 1993).

For blending, jute and acrylic fibre were first taken by weight as per blend ratio. Then the jute fibre was softened by the application of emulsion in softener machine and piled for 48 hours. The acrylic fibre was separated and opened up manually by hand teasing and tufts of certain weights were made. Blending was carried out by spreading the fibres i.e. jute and acrylic in desired proportion, i.e. 80:20 ratio by weight over the breaker card lattice. The delivered silvers from breaker card were then processed through normal jute processing system and spun into yarns of 172 tex (5lbs/spy).

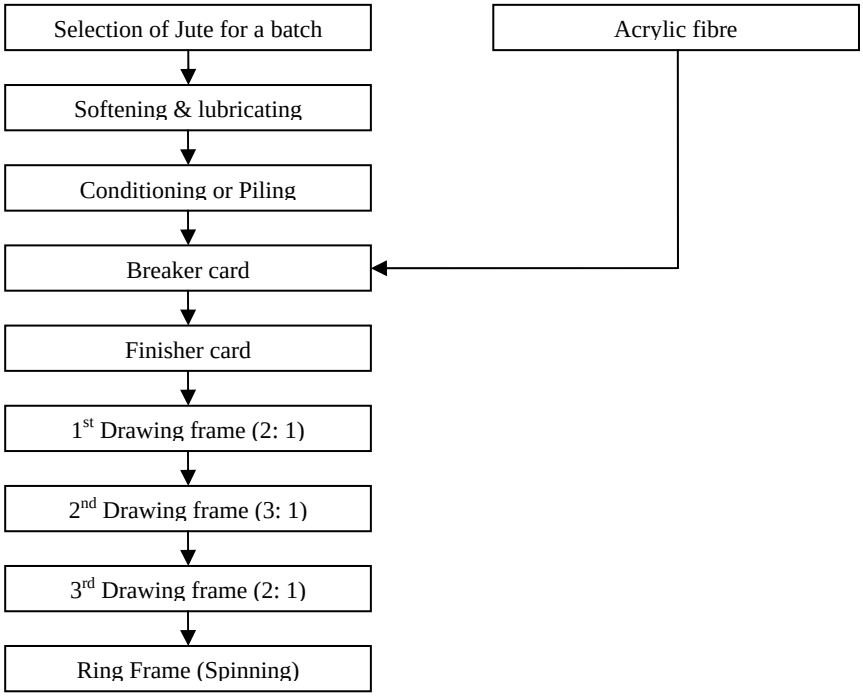
The 3rd Drawing sliver was processed for spinning into yarn with different drafts in the modified apron draft ring spinning frame. In the spinning department, the modified apron draft ring-spinning machine of eight spindles are used in the experiment. James Mackie & sons Ltd. of Ireland manufactured the original machine. All flyers were removed and eight spindles were installed instead of existing flyers in the machine. Instead of flyer, travelers were used for inserting required twist in the yarns. In the flyer type spinning frame, the twist is inserted into yarn by the effect of flyer speed. In the modified apron draft flyer spinning frame, the twist is inserted into yarn by the effect of traveler speed and spindle speed (Kalyanaraman 1992).

In the modified apron draft ring spinning frame used TPI was 6.8 and TCP was calculated to 60.The spindle speed was 7000 rpm.

Steps of producing blended jute-acrylic yarns.

- Study the connected literature
- Assortment of raw materials
- Collection of raw materials (Jute and Acrylic)
- Determination of fibre Properties
- Blending of Jute with acrylic.
- Selection of processing parameters.
- Trial run
- Production of yarn
- Determination of physical properties of the yarn
- Study the yarn performance

FLOW CHART OF JUTE-ACRYLIC BLENDED YARN PRODUCTION PROCESS



Preparatory machines used for the experiment:

The following back processing or preparatory machines were used for the work:

Softener, breaker card, Finisher Card. first, second and third drawing frame (Smith 2001).

Softener

The feed roller in this machine is a spirally fluted. The barrow of jute at the far end of the machine is built up from stricks, which have passed through the machine, and these stricks are now ready for conditioning, and will be stored in a convenient position for future treatment. After the fibre from the softening machine has been conditioned for a pre-fixed time, then is ready for next machine.

Carding

One of the most important process in the cycle of jute manufacture; which is known as carding, and is conducted in two distinctly different types of machines: The breaker card and the finisher card. The slivers travel horizontally with the feed-sheet and enter the machine at a height of about 4 feet from the floor. They thus form, as it were, a sheet of fibrous material at the entrance, and this sheet of fibres comes in contact with the pins of the various pairs of rollers, the cylinder, and the doffer, in the same way as already described (www.cottonyarnmarket.net).

Drawing frames

The sliver from the carding machine are taken-up by the first drawing frame subjected to a further process of doubling and drafting in a very similar machine termed the second drawing frame. For the preparation of sliver for some classes of yarn it is considered desirable to extend the drawing and doubling operation in a third drawing frame; as a rule, however, two frames are considered sufficient for most classes of ordinary yarns (www.uster.com).

Apron Draft spinning frame

Apron draft flyer-spinning machine was used for this experiment. As we know drafting of material of machine of a moving apron which povides a very good control of material throughout the entire drafting zone. This regularity in the yarns brings in good appearance and increased strength and also reduces the number of breaks per unit time. This reduced breakage of slivers during spinning helps increased production and decreasede work load on the spinner (Goswami *et al*. 1977).

The apron draft sliver spinning frame has an automatic cleaner which traverses full length of machine and thus increases yarn cleanliness reducing operator work load. The machine was operated to evaluate its performance at different ranges of parameters such as draft, twist and speed etc.

Figure 3. Blended Yarn

RESULTS AND DISCUSSIONS

Fibre properties

Physical properties such as strength, breaking twist, fineness and elongation of jute fibres and acrylic fibre have been determined. Measured physical properties are furnished below.

Table 1. Physical properties of BWB Jute Fibre

Grade	Statistics	Fineness Diameter(μ)	Bundle Strength (Pressly Index)	Linear Density (Tex)	Breaking Tenacity (g/Tex)	Breaking Elongation (%)
BWB	Mean	38.5	4.8	2.6	28.4	0.8
	Range	20-56	3.0-5.16	1.4-3.8	11-60	0.35-1.6
	CV%	25	20	28.3	35	30.5

Table 2. Physical Properties of Acrylic Fibre

Grade	Statistics	Fineness Diameter(μ)	Bundle Strength (Pressly Index)	Linear Density (Tex)	Breaking Tenacity (g/Tex)	Breaking Elongation (%)
Acrylic	Mean	1.88	8.8	0.6	4.4	0.1
	Range	1.5-2.1	6.0-15.6	0.4-1.8	1.1-6.2	0.05-1.1
	CV%	15	14	18.4	15	20.1

BWB jute and acrylic blended fibre were processed through different drafts at fixed spindle speed along same level of twist to spin 172 tex(5 lbs/spy) yarn. After spinning, the physical properties of the yarn were measured. The results are as follows:

Table 3. Physical characteristics of 5lbs/spy (172 tex) Jute-Acralic blended yarn

Drafts	Nominal Count Lbs/spy (tex)	Actual Count Lbs/spy (tex)	TPI (twist per inch)	Tensile strength in lbs (kg)			Quality ratio (%)
				Mean	SD	CV% of strength	
18	5(172)	5.20 (179.14)	6.8	4.75(2.15)	0.361	16.79	91.34
19		5.19 (178.79)	6.8	4.96(2.25)	0.355	15.78	95.56
20		5.20 (179.14)	6.8	5.20(2.36)	0.297	12.58	100.00
22		4.99 (171.90)	6.8	4.76(2.16)	0.278	12.87	95.39
23		4.95 (170.52)	6.8	4.45(2.02)	0.299	14.80	89.89

To determine the effect of different drafts on sliver of different weight of jute/acrylic blended yarn of 172 tex (5 lbs/spy) in the spinning frame:- It is found that CV% varies with the variation of drafts. From table-3, it is noted that CV% gradually changed with the increasing of drafts. At draft 20, 6000-rpm spindle speed, TPI was 6.8 along with a quality ratio of 100%.

From table 3,it is found that, at different drafts, the CV% of the yarn changes which follows slightly decreasing trend. The yarn spun with 22 drafts, found to possess CV% 12.87 with quality ratio of 95.39%. It may be mentioned that, quality ratio of produced yarn were slightly differ in different drafts. The reason of that variation was the different weight of third drawing sliver. Although in all trials BWB grade jute and acrylic fibre were used. In most cases quality ratios were increased upto 22 draft and at 23 drafts it is decreased (Hearle *at el.* 1959).

It may be concluded that increasing of draft upto a certain level i.e in optimum level quality ratio of the yarn is increased. But further increse of draft the quality ratio is decreased.

CONCLUSION

In the experiment, effect of draft variation on yarn along with its different sliver weight was studied. From this study, it was noted that with the changes of drafts, CV% varied (Hadina and Kovacevic, 1998). The yarn spun at actual twist level of 6.8 Twists Per Inch is relatively nearer to the optimum quality yarn. This may be said the better result of yarn in comparison to the others. Therefore, applied draft 20 on yarn offers better quality ratio.

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