ENRICHMENT OF YARN QUALITY BY THE CHANGE OF DRAFTING ZONE OF DRAWING MACHINES

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Abstract: *In Drawing frame, different pin settings were used to produce 5lbs/spy jute yarn in apron draft spinning frame. Among the pin settings of 1st draw frame: Draft-4.0, 2nd draw frame: 6.3 and 3rd draw frame: 5.4, Doubling- 2:1, 3:1 and 2:1 respectively achieved the highest quality at modified pin settings for said jute yarn. In this experiment, existing pins of 3rd Drawing frame were replaced by new sets of pins with different density, size and shape and yarns were produced from both systems. Physical properties of produced yarn were tested and found modified pins density shows better quality yarn.*

1. Introduction

Jute is a natural cellulosic bast fibre. It is a textile fibre of good spinnable character. In drawing process, carded sliver fibres are randomly placed and more or less meshy in appearance, which is not suitable for spinning. In the drawing lines fibres are combed to make fibre parallel. Different drafts were given here for different count yarn. Draft is the ratio of surface speed of delivery roller and surface speed of feed roller. Draft plays an important role on the quality of yarn. Excessive drafts cause worse quality yarns and low drafts causes the low strength yarn [1]. Drawing frame machinery is a significant part for quality jute yarn. In drawing process-carded sliver fibres are randomly placed and more or less meshy in appearance, which is not suitable for spinning.

During drawing operation, fibres are "combed" to make fibre parallel. Simultaneously, two or three slivers are mixed together and stretched to reduce weight per linear measure and draft play keen role to suit Spinning. Generally, for hessian yarn three drawing passages are used with different draft and doubling [2].

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In the drawing frames, the action of the pins on the slivers from the finisher card is also in a straight path. Moreover, each row or rather double row, of pins is carried separately, which is termed a "faller." The faller as a whole consists of three parts, a) A long iron or steel rod with provision for being moved in a closed circuit, b) Four or six brass plates, termed "gills" or "stocks," fixed to the rod and c) A series of short pins (one row sometimes about 1/8 in. shorter than the second row), termed gill or hackle pins, and set perpendicularly in the above gills [3].

The numbers of fallers used are determined partly by the particular method of operating the fallers, but mostly by the length of the fibre. The gill pins in the fallers are used to restrain the movements of the fibres between two important pairs of rollers. There are actually about four sets of rollers from front to back of a drawing frame; one set of three rollers constitute the "retaining" rollers; then comes the drawing roller and its large pressing roller; immediately after this pair is the "slicking" rollers, and the last pair is the delivery rollers. The delivery rollers of one type of drawing frame, called the "push-bar" drawing frame, and made by Messsrs. Douglas Fraser & Sons, Ltd., Arbroath and the can or cans into which the slivers are ultimately delivered are placed immediately below one or more sections of these rollers and in the foreground of the illustration. The large pressing rollers, which are in contact with the drawing roller, occupy the highest position in the machine and near the centre of it. Between these rollers and the retaining rollers are situated the above-mentioned fallers with their complements of gill pins, forming, so to speak, a field of pins.

The actual distance between the retaining rollers and the drawing rollers is determined by the length of the fibre, and must in all cases be a little greater than the longest fibre. This condition is necessary because the surface speed of the drawing roller is much greater than that of the retaining rollers; indeed, the difference between the surface speeds of the two pairs of rollers is the actual draft [4].

Traditional Drawing machines are used for regular jute yarn. After some modifications in the pinning system of the third drawing frame will improve the quality of the out-put sliver. This sliver is producing regular and fine jute yarn with higher quality than the traditional system. It is necessary to observe that how this modification of the Drawing machine behaves with jute and blended fibre and what types of effects will happen in fine jute yarn quality. All the three drawing machines (1^{st}, 2^{nd} and 3^{rd} Drawing machine) will be improved but initially the experimental work has been done on 3^{rd} Drawing machine [5].

From the very inception of mechanical processing of jute, drawing lines were proved to be a critical part for processing jute into regular yarn. From last decade, some jute goods importing countries have raised objections regarding the quality of jute yarns. As a result it has become predictable to find out the causes of yarn irregularity for hold the position in world jute market. Therefore, this work was aimed at identifying and finding a suitable pin setting at drawing frames for jute processing which could be used effectively for jute industry and at the same time it is found acceptable to the importers. This work was undertaken by considering this point of view.

2. Materials and Methods

This research work was carried out at spinning department of Bangladesh Jute Research Institute in 2008. BWB (Bangla white B) grade of jute fibre was taken as the raw material for the experiment. Fibre was piled with required emulsion and kept for 48 hours for maturation [5]. Then the fibre was processed through Breaker card, Finisher card & the drawing line (1^{st}, 2^{nd} & 3^{rd}) for spinning yarns of 5 lbs/spy. Two different pin settings were used in the drawing process.

According to the conventional jute processing system jute fibre (BWC) passed through Softener machine, Breaker card machine, Finisher card machine, 1^{st} Drawing machine, 2^{nd} drawing machine. Drafting and Drawing zone of the existing 3^{rd} Drawing machine was changed with different pin arrangements of the faller bars. Gap between pins, size, and shape of the pins of the Drawing zone are responsible for the quality of jute sliver. Pin arrangement and its distribution improve the sliver quality for the production of fine jute yarn. The specification of the modified and existing faller bars are given [6,8].

The 2^{nd} Drawing sliver was passed through modified 3^{rd} Drawing machine. The output sliver was spun through Apron Draft spinning machine.

3. Results and Discussions

BWC jute sliver was spun through Apron Draft spinning machine and the physical properties of the yarn were measured.

In this experiment, Tensile strength, Quality ratio, Coefficient of variation, Standard deviation of produced yarn from existing and modified (different pin density) was determined. Modified 3^{rd} Drawing frame shows better yarn physical properties compared to the existing 3^{rd} Drawing frame. The yarn quality was better for modified system. The produced yarn was more regular and uniform compared to the existing drawing frame. As a result, pin arrangements of the drawing machine shows positive impacts on yarn properties.

Existing Faller bar specification	**Modified Faller bar specification**
1. No. of Faller bar = 36	1. No. of Faller bar = 36
2. Total Pin assembly length = 72 mm	2. Total Pin assembly length = 72 mm
3. Total No. of Pin assembly = 4	3. Total No. of Pin assembly = 4
4. No. of Pins per assembly = 18	4. No. of Pins per assembly = 22
5. Pin to Pin Gap in each assembly = 4 mm	5. Pin to Pin Gap in each assembly = 3.5 mm
6. Pin assembly to pin assembly gap= 67 mm	6. Pin assembly to pin assembly gap = 67 mm

Table 1: Physical properties of 5 lbs/spy jute yarn by the existing pin arrangement of drawing machine.

Sl No	Tensile Strength (Lb)	Average Tensile Strength (Lb)	Standard Deviation (SD) for Tensile Strength	Coefficient of Variation (CV%) for Tensile Strength	Quality Ratio (QR%)
1	4.8	4.46	0.1505	3.375	89.20
2	4.5				
3	4.4				
4	4.3				
5	4.5				
6	4.5				
7	4.3				
8	4.5				
9	4.5				
10	4.3				

Table 2: Physical properties of 5 lb/spy jute yarn by the modified pin arrangements of 3rd drawing frame.

Sl No	Tensile Strength (Lb)	Average Tensile Strength (Lb)	Standard Deviation (SD) for Tensile Strength	Coefficient of Variation (CV%) for Tensile Strength	Quality Ratio (QR%)
1	4.8	4.81	0.11	2.287	96.2
2	5.0				
3	4.8				
4	4.7				
5	5.0				
6	4.8				
7	4.8				
8	4.7				
9	4.8				
10	4.7				

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