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## Study on the Physical Properties of Blended Rotor Spun Yarn

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**Abstract:** A study was performed on the properties of different types of jute-cotton blended yarn and 100% cotton yarn. The jute-cotton blend ratios of each category of yarn (10<sup>s</sup>, 15<sup>s</sup> and 20<sup>s</sup>) were 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80 and 10:90, respectively. For each individual count of yarn, it was observed from the test result that the properties of 50:50/jute:cotton blended yarn showed very nearer property to the 100% cotton yarn. For coarse count (10<sup>s</sup>), 80:20/jute:cotton showed very closer property to the 50:50/jute:cotton blended yarn. It was also observed that for each type of yarns, which showed decreasing property with the increase of jute in the blend. So, blend ratio has also important effect on the yarn properties.

**Key words:** Physical properties, rotor spun yarn, blended yarn, hairiness, yarn irregularities

### INTRODUCTION

Jute is a lignocellulosic bast fiber yellowish in color. It is coarse and harsh in comparison to other fibers due to the presence of lignin. So the lignin is removed to make it softer and pliable. On the other hand jute is a long staple fiber. To make a suitable blend to the cotton or any other fiber, it is stapled to a required length. Blending of jute with cotton is not a new idea in the cotton processing style<sup>[1,2]</sup>. But jute-cotton blended rotor spun yarn is a new idea in the industrial sector<sup>[3,4]</sup>. The yarn preparation process in rotor is different from the ring spinning system. Besides these why blending is performed, also is an another issue in yarn production<sup>[5]</sup>. Several aspects are related to blending. Among them cost minimization is an important factor. Due to blending the cost of the products reduces to a minimum level<sup>[6]</sup>. There are also other factors such as processing parameters, machine efficiency and availability of the raw materials etc., related to the cause of blending. Jute is the available raw material in Bangladesh but its use in textile sector is very limited. The utility of big amount of jute in the textile sector can make a tremendous success in the country. The present research has been taken to know how we can maximize use of jute in the textile sector and to find out whether the properties of jute based yarn are similar to the properties of 100% rotor spun cotton yarn or not. It is also showed that whether the blend ratio has any effect on yarn properties or not.

### MATERIALS AND METHODS

The jute fibers and cotton fibers used in this experiment were collected from the Bangladesh Jute Mills Corporation (BJMC) and Cotton Development Board in Bangladesh, respectively in 2004. BWB type jute was used in the experiment to blend with cotton as it is easier to blend white jute with cotton. The staple length of cotton was 1 inch. Before blending of jute with cotton the jute fiber was stapled to 1.25 inch with a jute cutting machine. In that stage the jute fiber was very hard and harsh. So the fiber was softened through the chemical modification. The chemically treated fiber was squeezed and then dried. Chemical treated fiber is opened by the opening machine. This opened chemically treated jute fiber had cotton like appearance and thus was ready for blending with cotton. The required percentage of blending was performed in the blow room section. Then the lap of different blend ratios of jute and cotton (80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80 and 10:90) were produced by the blow room line. Then the produced laps were passed to the carding machine to get the required sliver. After that the slivers were passed to the drawing frame to get the more uniform and regular sliver. All the activities (from jute cutting to sliver preparation) were performed in Jute and Textile Product Development Center (JTPDC) in Bangladesh Jute Research Institute (BJRI). The sliver of 100% cotton yarn was also produced in the JTPDC of BJRI. Then the required count (10<sup>s</sup>, 15<sup>s</sup> and 20<sup>s</sup>) of blended yarn of different blend ratios were

produced in the open end spinning frame (rotor), in Al Raze Textile Mills Ltd. Katchpur, Dhaka, Bangladesh. Then the various properties of the blended yarn were tested in the testing department of BJRI and Bangladesh Textile Mill Corporation (BTMC), Bangladesh. Barella<sup>[7]</sup> states that nonexistence of a material sufficiently satisfactory from both a scientific and a practical point of views for the easy measurement of hairiness in routine industrial processes. All the tests like TPI is tested by the twist tester, strength is tested by the Good Brand Tensile Strength Tester, yarn irregularities are tested by the Uster Testing Machine and the hairiness of the yarn is determined by the Hairiness Tester. All the test were performed in the standard condition of temperature and humidity. Yarn preparation and all the tests were completed within eight months (March to October, 2004).

### RESULTS AND DISCUSSION

In the Table 1 and 2 all the properties of the different blended yarn were nearer to each other. But the properties of 50:50/jute:cotton blended yarn were very nearer to 100% cotton yarn. On the other hand TPI and strength were also comparable to 100% cotton yarn although there was a variation among the CSP. In the Table 3 and 4, it was seen that the variation of yarn properties were similar to the yarn properties of Table 1 and 2. Here the strength and TPI of 50:50 blend was comparable to 100% cotton yarn. In the Table 5 and 6, it was observed that the variation of different properties among the blended yarns was comparable to the 100% cotton yarn. But the strength and CSP of 80:20/jute:cotton blended yarn were very lower than that of the strength and CS of 50:50/jute:cotton blended yarn. For coarser count, the properties of 50:50 /jute:cotton blended yarn were comparable to 100% yarn. The properties of 80:20/jute:cotton blended yarn were also nearer to the properties of 50:50/jute:cotton blended yarn. From the properties of each type of blended yarn it was observed that for 50:50 blend i.e., in case of balance blend all the properties were improved than that of other percentages of blends. Hence, all the properties were increasing with the increase of cotton in the blend and decreasing with increase of jute in the blend. It was also seen that the CSP values of individual counts of blended (50:50) yarn were very nearer to the CSP values of 100% cotton count yarn. The main motive of blending was the cost minimization and to increase the utility of jute with cotton. The higher the percentage of jute

with the blend lesser will be the cost of the product. On the other hand, it should be kept in mind that the quality of the blended product has to be within the acceptable limit. Similar type of cotton yarn shows identical properties and for non blended products, there are also similarities to the properties of each individual products<sup>[10,11]</sup>. From the comparative results of 50:50 blend it was seen that among the three different types of yarn viz., 10<sup>s</sup>, 15<sup>s</sup> and 20<sup>s</sup> only 10<sup>s</sup> yarn showed acceptable properties which were nearer to the properties of 100% cotton yarn but in that case then percentage of jute in the blend was minimum.

Table 1: Relation between blend ratio and irregularities of 10<sup>s</sup> yarn

Blend ratio/Jute:Cot	Thick (km <sup>-1</sup> )	Thin (km <sup>-1</sup> )	CV %	Hairiness (km <sup>-1</sup> )
80:20	350	148	20	316
70:30	342	119	19	302
60:40	308	105	19	296
50:50	247	75	18	258
40:60	287	90	18	260
30:70	267	76	17	260
20:80	243	71	17	258
10:90	237	69	16	258
0:100	199	48	13	281

Table 2: Relation between blend ratio and properties of 10<sup>s</sup> yarn

Blend ratio/Jute:Cot	TPI	Strength	CSP
80:20	14	126	1260
70:30	15	136	1360
60:40	15	138	1380
50:50	15	149	1490
40:60	15	148	1480
30:70	15	149	1490
20:80	15	151	1510
10:90	15	165	1650
0:100	16	167	1670

Table 3: Relation between blend ratio and irregularities of 15<sup>s</sup> yarn

Blend ratio/Jute:Cot	Thick (km <sup>-1</sup> )	Thin (km <sup>-1</sup> )	CV %	Hairiness (km <sup>-1</sup> )
80:20	612	284	20	477
70:30	536	256	18	421
60:40	474	185	17	401
50:50	358	102	17	270
40:60	511	191	17	316
30:70	411	173	17	322
20:80	361	107	17	261
10:90	301	76	15	268
0:100	288	66	14	244

Table 4: Relation between blend ratio and properties of 15<sup>s</sup> yarn

Blend ratio/Jute:Cot	TPI	Strength	CSP
80:20	15	87	1305
70:30	15	88	1320
60:40	16	87	1305
50:50	16	91	1365
40:60	16	96	1440
30:70	15	97	1455
20:80	16	104	1560
10:90	16	107	1605
0:100	16	110	1650

Table 5: Relation between blend ratio and irregularities of 20<sup>s</sup> yarn

Blend ratio/Jute:Cot	Thick (km <sup>-1</sup> )	Thin (km <sup>-1</sup> )	CV %	Hairiness (km <sup>-1</sup> )
80:20	460	135	22	450
70:30	440	118	21	427
60:40	441	108	20	409
50:50	322	91	21	320
40:60	403	97	20	404
30:70	307	95	17	318
20:80	324	91	17	312
10:90	319	88	16	316
0:100	298	83	15	307

Table 6: Relation between blend ratio and properties of 20<sup>s</sup> yarn

Blend ratio/Jute:Cot	TPI	Strength	CSP
80:20	13	57	1140
70:30	14	68	1360
60:40	14	69	1380
50:50	15	81	1620
40:60	15	82	1640
30:70	15	84	1680
20:80	16	85	1700
10:90	18	86	1720
0:100	18	89	1780

The chemical treatment procedure were same for each individual type of blended fiber. For lower count (10<sup>s</sup>), the properties of blended yarn 80:20/jute:cotton showed very nearer result to the properties of blended yarn 50:50 /jute:cotton. But for higher count (20<sup>s</sup>), the properties of blended 80:20/jute:cotton yarn showed very dissimilar properties to the 100% cotton yarn. Again 50:50/jute:cotton blended yarn of 20<sup>s</sup> count showed very similar property to the 100% cotton yarn. So, the percentage of jute in the blended yarn had a strong effect on the properties of the various count of yarn.

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