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Research Article

Evaluation of Processing Performance and Properties of 100% Cotton and Cotton-Polyester Blended Ring-Spun Yarn

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Abstract

The paper provides comparison of properties of 100% cotton yarn with those of two cotton-polyester blended yarns of 50/50 and 20/80 blend ratios. In this regard three types of yarns were produced in the ring frame and for each type two different counts were produced. The blending was carried out in the draw frame. During processing, the settings and parameters were adjusted for optimum performance. After production at each stage samples were collected and investigated. The properties that investigated were count, yarn faults, yarn irregularity and strength. The study showed that, in ring frame it was possible to maintain higher spindle speed and lower twist multiplier for 50/50 & 20/80 blended yarns than 100% cotton yarn. Between 50/50 & 20/80 blended yarns, it was possible to maintain higher spindle speed and lower twist multiplier for 20/80 blend than 50/50 bend. It was observed in all cases that as the percentage of polyester increase the U% i.e. the irregularity in the sliver/yarn decreases. It was also observed that yarn faults decreased with the increase of % of polyester in the yarn. The yarn strength of 50/50 & 20/80 blended yarn was higher than that of 100% cotton and strength of 20/80 was higher than that 50/50 blended yarn.

Keywords: *Blend, CSP, Imperfections, U%, fineness, length, twist*

Introduction

Blending is the mixing of two different staple fibres. Textile fibres are blended for obtaining desirable properties in the yarn (Duckett, k.E., Goswami, B.C., and Ramey, 1979; Gupta. D. K., and Shiekl, 1975). Some of the important properties that are attributed to a blended yarn are uniformity, technical and engineering, functional, aesthetic etc. Apart from this one of the important reasons for blending is to minimize production cost. Understanding its importance in textile industry and rising cost (Bechir Azzouz, Mohamed Ben Hassen and FaouziSakli, 2008). This is done by improving quality and increasing productivity. Blending has enormous impact on the performance of spinning weaving and end use characteristics. Fibre properties during spinning are the most important properties. A high amount of yarn breaks during processing causes higher machine stops, higher piecing in the yarn and reduce machine efficiency (Jamil N, Shahbaj B, Iftikhar M & Haq Z, 2004). Yarn faults are the total number of neps, thick and thin places in a given length of yarn. Ring spun yarn faults badly affect the yarn and fabric quality. Yarn contains more yarn faults exhibits poor appearance, lower strength and poor performance in weaving and will produce low quality fabric (Ochola J, Kisato J, Mwasiagi J & Waithaka A, 2012). Weaving performance of blended yarn is much better than 100% cotton yarns.

This is due to the fact that the strength of blended yarn is better than 100% cotton yarn. It is believed that blending was first introduced to attribute crease resistance property on garments which is due to the presence of polyester. Imperfection generates defects like stripes, barre or other visual faults in the cloth. After dyeing these faults are compounded. Yarn evenness causes variation of strength in the yarn. An irregular yarn breaks more easily during processing because of stress. A blended fabric is more durable than that produced from 100% cotton.

A perfect blend requires the use of appropriate raw materials, machine, and of course adequate knowledge and techniques. . It is serious when a fault appears at regular intervals along the length of the yarn. In this case the faults will be located in a pattern that is very clearly visible to the eye. Evenness of the yarn is the variation of mass per unit length. Evenness can affect some properties of textiles, like appearance of the fabric (Vasconcelos R M, Carvalho V, Monteiro J L and Soares F O, 2008). Blending of fibres are usually made with different fibres having dissimilarity in their properties. Blending is done to achieve or improve

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certain characters of the yarn or its processing performance. When natural fibre blends with classic fibre, the properties of the resultant yarns improves in many ways so that various high quality products e.g. clothing, underwear, socks, textiles products and composites can be made of these fibres (V. Svetnickiene and R. Ciukas, 2009). Other fabric properties such as abrasion, absorbency, reflectance or luster may be influenced by yarn evenness. The effects of irregularity are wide in all areas of the production and use of textile. The increment of polyester fibre in the blended yarn results pilling attitude falls down grade (Shamima Akhter Smriti, Md. Azharul Islam, 2015). Influence favorably the behavior of the raw material during processing Blended yarn from natural and man-made fibre have advantage of successfully combining the good properties of fibre components, such as easy care properties. These advantages can causes stronger marketing and increased variety of product (Ning Pan, Kezhang Chen, Constantin J. Monego and Stanley Backer, 2000).

In this study 100% cotton yarn and two cotton-polyester blend yarn (50% cotton & 50% polyester, 20% cotton & 80% polyester were blended to produce ring-spun yarn. Maximum possible production speed and lowest possible twist per inch (TPI) were used. Highest production without sacrificing quality was one of the key factors during production. Finally manufactured yarns were suitable for selling in the market or made according to buyer requirements. Yarn strength, irregularity, Yarn faults including neps/km, thin/km and thick/km were studied.

Materials & Methods

The works reported in this paper is the evaluation of processing performance and properties of 100% cotton (C) yarn and cotton-polyester blended (CPB) yarn. Two blends of yarns having 50% cotton-50% polyester (CPB1) & 20% cotton-80% polyester (CPB2) were manufactured. In this regard three types of ring yarns each with 30 & 40 counts (Ne) were produced at Yeasmin Spinning Mills Ltd., Sreepur, Gazipur, Bangladesh. Cotton fibres were originated from Cameroon and Chad. The particulars are shown in Table 1.

Table 1: Particulars of cotton fibre

Properties	Cameroon	Chad
Length (mm)	30.29	28.79
Uniformity	83.4	82.9
Fineness (µg/inch)	4.50	4.56
Strength (GPT)	29.8	29.1
Maturity	0.88	0.88
Short fibre index	8.40	8.37

Polyester staple fibre was China Virgin with length 32 mm, Fineness 3.95 µg/inch.

For spinning yarns, both cotton & polyester fibres were processed separately in blow room & carding. The two types of card slivers (100% cotton & 100% polyester) were blended at draw frame according to their percentage. In Draw frame it is easier to obtain uniform blend ratio. During opening, cleaning in blow room and carding, optimum settings for each blend component (cotton & polyester) can be used for better quality of output with less damage of fibres. It is also easy to control the process in draw frame blending by doubling of different slivers. For blending of cotton-polyester three draw frames were used and two draw frames were used for 100% cotton process. The detail doubling plan of blending showed in Table 2. In every stage of manufacturing, produced sliver, roving and yarn were tested. Cotton Fibre were tested by High Volume Instrument (HVI) and average values were showed. Irregularities as U% and Yarn fault as imperfections (IPI) in terms of thick places, thin places and neps were tested by Uster tester (UT-4). Uster statistics were different for 100% cotton and cotton-polyester blend yarn. Yarn count was measured by Wrap Reel and Balance method. Yarn strength were measured as Count Strength Product (CSP) by Lea Strength Tester. To carry out count measurement sample of 120 yards (Lea) were made by Wrap Reel and lea were weighted in Electronic weight balance. After that these lea were used for strength measurement in Lea Strength tester. Numbers of samples were ten and average values were taken. Yarn twist was tested by Mag twist tester. All the tests were done in Standard testing condition.

Table 2: Plan of blending at breaker draw frame (Sliver weight in grains/6yards)

Process	Breaker Draw		Finisher Draw 1	Finisher Draw 2
C	420*5 doubling		420*8 doubling	
CPB1	Cotton 465*3 doubling	Polyester 390*4 doubling	385*8 doubling	380*8 doubling
CPB2	Cotton 340*2 doubling	Polyester 460*6 doubling	335*8 doubling	330*8 doubling

Results and Discussion

Produced sliver and roving quality measured as U% showed in Table 3, 4 and 5. In all cases it was observed that the U% is higher in C than CPB materials (sliver & roving) and U% decreased with the increase of polyester percentage. During production of the three types of yarns, attempts were to utilize maximum possible spindle speed and lower TM to maximize production. Table 6 shows that the spindle speed was higher and lower twist for CPB than C yarn. More spindle speed & less twist results higher production. Higher spindle speed in C roving causes excessive breakage in ring frame lower the production as well as quality of yarn. Lower twist in C yarn causes insufficient strength of yarn. It was possible to maintain higher spindle speed and lower twist for CPB1 & CPB2.

Table 3: Quality of breaker drawn sliver

Yarn Type	U%	CVm%	CVm 1m%
C	2.58	3.26	0.85
CPB1	2.56	3.25	1. 30
CPB2	2.48	3.13	1.27

Table 4: Quality finisher drawn sliver

Process	U%	CVm%	CVm 1m%
C	2.35	2.94	0.56
CPB1	1.95	2.70	0.74
CPB2	1.72	2.15	0.63

Table 5: Quality of simplex roving

Process	U%	CVm%	CVm 1m%	CVm 3 m%
C	4.07	5.13	1.85	1.18
CPB1	3.05	3.83	1.19	0.71
CPB2	2.99	3.57	1.60	1.10

Table 6: Particulars of ring frame setting utilized for different yarns

Parameters	30 Ne			40 Ne		
	C	CPB1	CPB2	C	CPB1	CPB2
Actual count	30	30.20	30.10	40	40.15	40.20
Spindle speed	15000	16000	16500	16000	17000	17500
Break draft	1.13	1.15	1.16	1.13	1.15	1.16
Roller gauge	44*54	45*65	45*65	44*54	45*65	45*65
TPI	20.97	19.20	17.45	25.01	24.17	23.05
TM	3.82	3.50	3.18	3.95	3.82	3.64
Spacer	Yellow	Yellow	Yellow	Red	Red	Red

Table 7: Yarn count & strength test for different blend yarns

Process	30 Ne			40 Ne		
	Average count	Average lea Strength	C.S.P	Average count	Average lea Strength	C.S.P
C	30.02	92.07	2764	40.05	65.15	2609
CPB1	30.10	116.20	3497	40.02	86.75	3471
CPB2	30.15	129.36	3901	40.10	94.26	3780

Table 8: Yarn quality found in ring frame

Count	Blend	U%	CVm%	Thin (-50%)	Thick (+50)%	Neps (+200) %	IPI (thin + thick+ neps)
30 Ne	C	11.22	14.33	2.5	142.5	274	419
	CPB1	9.92	12.59	0	49.5	108	157.50
	CPB2	9.70	12.12	0	42.5	99	141.50
40 Ne	C	11.40	14.35	7.5	190	395.5	593
	CPB1	10.69	13.58	2.5	94	178.5	275
	CPB2	11.28	14.28	13.5	93	160	266.50

Further to this the spindle speed was higher and twist was lower in CPB2 compare to CPB1. Yarn CSP were higher in CPB1 & CPB2 yarn than C yarn (Table 7). The CSP in the yarn increases with the increase of polyester percentage. Since the % of polyester is higher in CPB2 therefore CSP was higher than that of CPB1 yarn. Imperfections (IPI) and U% were lower in CPB than C yarn as showed in Table 8. Due to higher percentage of polyester in CPB2 both U% and Imperfections were lower than CPB1. After carding cotton slivers contains some impurities and short fibres and these can eliminate only after combing at comber. Short fibres and impurities were hindrance for getting higher quality C yarn. In every stage of manufacturing (Sliver, roving, yarn) U% and Imperfections (IPI) of yarn largely depends on fibre fineness, length and uniformity. Yarn strength influenced by fibre strength. These are the fibre properties responsible for required qualities like strength, lower U% and imperfections in the produced yarn. Polyester fibre used in this study had greater fineness, length and uniformity with compare to cotton fibre. It is also known that polyester fibre is stronger than cotton fibre. Impurities and amount of short fibre are always lowest in manmade fibre. The differences in properties of fibres also could be the main reason that enables higher spindle speed, lower twist level and overall favourable behaviour of CPB yarn.

Conclusion

This study is comparison between 100% cotton yarn and cotton-polyester blend yarn. The most important fibre properties required in ring-spinning are greater in polyester fibre than cotton fibre. As a result, it was observed the yarn strength increases with the increase of polyester percentage in the yarn. When the percentage of polyester increases the evenness in the yarn increases. In the ring frame it was possible to maintain more spindle speed and lower twist for blended yarn than 100% cotton yarn. Between the two blended yarns, the spindle speed was higher and twist was lower for higher percentage of polyester. It was also seen that yarn faults decreased with the increase of share or % of polyester in the yarns. It may be said that, for a spinner processing cotton-polyester blend is more convenient than processing 100% cotton regarding both production and quality.

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References

Duckett, k.E., Goswami, B.C., and Ramey, H.H., Jr. (1979), Mechanical Properties of cotton/polyester yarns, Textile Res. J., Vol. 49, pp 262-267

Gupta. D .K., and Shiekl, A. E. (1975), The Mechanics of blended yarns, Appl. Polym. Symp., Vol 27, pp. 295-315

Bechir Azzouz, Mohamed Ben Hassen and FaouziSakli (2008), Adjustment of cotton fibre length by the statistical normal distribution: Application to Binary Blends, Journal of Engineered Fibres and fabrics, Vol. 3 (3), pp. 35-46.

Jamil N, Shahbaj B, Iftikhar M &Haq Z (2004), Int J Agricult Biol, 6 (6), 1053

Ochola J, Kisato J, Mwasiagi J &Waithaka A (2012), Asian J Tex, 2 (3),(32)

Vasconcelos R M, Carvalho V, Monteiro J L and Soares F O (2008), Text Res J 78 (2, 119

V. Svetnickiene and R. Ciukas (2009), Investigation of frictional properties of yarns from natural fibres, Mechanika, Vol 1 (75), pp. 73-76

Shamima Akhter Smriti, Md. Azharul Islam (2015), An Exploration on Pilling Attitude of Cotton Polyester Blended Single Jersey Knit Fabric after Mechanical Singeing. Science Innovation. Vol. 3, No. 1, pp. 18-21

Ning Pan, Kezhang Chen, Constantin J. Monego and Stanley Backer (2000), Studying the Mechanical Properties of blended Fibrous Structures Using a Simple Model, Textile Research Journal, Vol. 70 (6), pp. 502-507