

EFFECT OF BLENDING RATIOS AND TECHNIQUES ON THE QUALITY PARAMETERS OF 30'S POLYESTER/COTTON YARN

Shahid Saleem Shad¹, Asim Mumtaz¹ & Iqbal Javed²

Departments of Fibre Technology¹ and Math. & Stat.², University of Agriculture, Faisalabad

The present study was conducted to determine the impact of polyester/cotton ratio on the quality characteristics of yarn. The quality characters depend upon the ratio of polyester and cotton in the blend and also on the blending technique adopted during fibre production to yarn spinning. The quality characters such as single yarn strength, yarn elongation and rupture per kilometer of yarn were directly proportional to the ratio of polyester with cotton in the blend. Draw frame blending produced better quality yarn as compared to blow room blending, lap former blending and simplex blending.

Key words: blending techniques; cotton/polyester ratio

INTRODUCTION

The cotton has a lion's share in the economy of Pakistan. It provides raw material for our leading industrial sector. The growing world population needs and ever-changing fashions have changed the consumer trends. Now they demand great versatility, wide variety, higher standards and precision in fabrics, which are scarce in cotton products due to fibre to fibre variation, pest attack and uncontrollable environmental conditions. Therefore, the natural fibres are blended with synthetic fibres, such as cotton with polyester. The ratio of natural and synthetic fibres in the blend is of prime importance due to its multiple uses, economical and environmental conditions.

Blending of natural and synthetic fibres is still carried out in sliver form on the draw frame (Klein, 1987). This provides the best blend in the longitudinal direction. Nawaz et al. (1999) reported that there is a gradual decline in yarn strength as the share of polyester fibres decreases in the blend. Li and Van (1990) reported that fibre properties had a significant effect on yarn strength. Anandjiwal and Goswami (1999) investigated that the blending of dissimilar fibres leads to their non-uniform distribution throughout the yarn cross-section, which in turn leads to preferential migration depending on both fibre properties and mechanism of certain spinning processes. The present study was conducted in order to find out the impact of polyester/cotton ratio on the quality characteristics of yarn and also to find out the optimal blending stage that produced excellent quality yarn.

MATERIALS AND METHODS

The present study on the comparison of different blending techniques of cotton and polyester at different stages during fibre to yarn spinning was carried out at the Kohinoor Textile Mills Ltd., Faisalabad and in the Department of Fibre Technology, University of Agriculture, Faisalabad during 1999-2000. Lint cotton samples of MNH-93 were taken from the mills, with

average values of fibre properties as fibre length 27.07 mm, fibre length uniformity ratio 48.58%, fibre bundle strength 90.81 thousand lb/ir², fibre fineness 4.52 ug/in, fibre maturity 82.53% and trash contents 0.20%, while polyester fibre having the quality characteristics as fibre length 38 mm, fibre denier 1.2, colour/luster semidull, moisture regain 5%, elongation 18.30%, tenacity 7.04 gden and crimps per inch 13.10, was used in the study.

The blendings of polyester and cotton were carried out in ratios i.e. R1 (65:35) and R2 (52:48) at various stages i.e. blow room (T1), lap former (T2), draw frame (T3) and simplex frame (T4). The yarn thus prepared was tested for evaluation of following characteristics:

Tensile Properties of Single Yarn: The tensile properties viz. single yarn strength, elongation and rupture per kilometer, were calculated with Uster Tensorapid. The procedure adopted is that of ASTM Committee (1997). The data were analysed statistically using completely randomised design and Duncan's new multiple range test, as suggested by Steel and Torrie (1984).

RESULTS AND DISCUSSION

Single Yarn Strength: The statistical analysis of single yarn strength at 30' (P/C) blend is shown in Table I(a) which shows that the effect of different blending ratios and blending techniques during fibre to yarn spinning were highly significant, while the interaction between RxT on single yarn strength was non-significant.

The Table I(b) shows that the mean values of single yarn strength for 30' (P/C) yarn were observed as 412.45, 398.61, 422.03 and 387.38 g for T1, T2, T3 and T4 respectively. The best single yarn strength was noted in case of blending technique at draw frame while the lowest value was observed for simplex frame.

For blending ratio, R1 (65:35 PIC) produced yarn of the best single yarn strength while the lowest value was in case of R2 (52:48 PIC) yarn. The results showed that more the percentage of polyester fibres, more would be the single yarn strength and vice versa. Similar views were expressed by Nawaz et al. (1999) who reported a gradual decline in yarn strength due to a reduction in polyester fibres in the blend.

Table 1(a). Analysis of variance for quality parameters

Quality Parameter	S.Y.S			RKM			NS		
	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
Strength	16.776	0.711	4.24%	16.796	0.711	4.24%	17.333	0.711	4.04%
Yarn breakage	10.041	0.577	5.75%	10.041	0.577	5.75%	10.041	0.577	5.75%
Yarn length	0.402	0.013	3.23%	0.402	0.013	3.23%	0.402	0.013	3.23%
Yarn count	3.886	0.119	3.06%	3.886	0.119	3.06%	3.886	0.119	3.06%
Yarn tenacity	31.17	1.581	5.07%	31.17	1.581	5.07%	31.17	1.581	5.07%

** S.Y.S = single yarn strength; RKM = rupture per kilometer.

Quality Parameter	Mean	SD	CV
Strength	16.776	0.711	4.24%

Table 1(b). Comparison of means

Quality Parameter	S.Y.S			RKM			NS		
	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
Strength	16.776	0.711	4.24%	16.796	0.711	4.24%	17.333	0.711	4.04%
Yarn breakage	10.041	0.577	5.75%	10.041	0.577	5.75%	10.041	0.577	5.75%
Yarn length	0.402	0.013	3.23%	0.402	0.013	3.23%	0.402	0.013	3.23%
Yarn count	3.886	0.119	3.06%	3.886	0.119	3.06%	3.886	0.119	3.06%
Yarn tenacity	31.17	1.581	5.07%	31.17	1.581	5.07%	31.17	1.581	5.07%

NS = non-significant; S.Y.S = single yarn strength; RKM = rupture per kilometer.

Booth (1983) reported that several factors tended to influence the single yarn strength. He further reported that fineness of fibre affected several properties of the yarn and therefore, influenced the behaviour and properties of resultant yarn and fabrics. Hamid (1987) noted that the single yarn strength gradually diminished with a progressive increase in yarn number.

Yarn Elongation: The statistical analysis of yarn elongation at 30' (PIC) blend is shown in Table I(a) which showed that the effect of different blending ratios and blending techniques during fibre to yarn spinning was highly significant while the R \times T interaction on yarn elongation value was significant.

The Table I(b) shows that the mean values of yarn elongation for 30' (PIC) yarn were observed as 8.04, 7.87, 8.08 and 7.71% for T1, T2, T3 and T4 respectively. The best yarn elongation was noted in case of blending at draw frame while the lowest value was observed for simplex frame. These findings were identical to those of Klein (1987) who found that blending of natural and synthetic fibres is still carried out in sliver form on the draw frame. This provides the best blend in the longitudinal direction.

Regarding blending ratios, R1 (65:35 PIC) produced yarn of best elongation while the lowest was obtained in case of R2 (52:48 PIC). These results showed that the higher the percentage of polyester fibres, more would be the yarn elongation and vice versa. Elongation is a key factor (Sheikh, 1991). He further opined that the yarn elasticity and elongation were also very important in yarn spinning processes. Yarn with low elasticity i.e. low elongation tended to break more frequently in weaving. However, Zhu and Ethridge (1997) claimed that increase in elongation would reduce the hairiness of yarn.

Rupture per Kilometer of Yarn: The statistical analysis of rupture per kilometer at 30' (PIC) blend is shown in Table I(a) which indicates that the effect of different blending ratios and blending techniques during fibre to yarn spinning was highly significant while the R \times T interaction on rupture per kilometer of yarn was non-significant.

Table I(b) shows that the mean values of rupture per kilometer for 30' (PIC) yarn were observed as 21.07, 20.48, 21.52 and 20.01 *gtex* for T1, T2, T3 and T4 respectively. The best rupture per kilometer of yarn was noted in case of blending technique at draw frame, while the lowest value was observed for simplex frame. These findings were similar to those of Klein (1987) who found that with evidently different raw materials (e.g. blends of natural and synthetic fibres), the blending at blow room was often unsatisfactory owing to uncontrolled extraction of flocks and the danger of subsequent de-blending.

As to the blending ratio, R1 (65:35 PIC) produced yarn of the best rupture per kilometer while the lowest was in case of R2 (52:48 PIC) yarn. The results showed that higher the percentage of polyester fibres, the more would be the rupture per kilometer of yarn and vice versa. The properties of raw material seemed to directly influence the yarn properties as reported by Li and Yan (1990) who remarked that fibre properties had a significant effect on yarn strength. However, Anandjiwal and Goswami (1999) investigated the blending of dissimilar fibres, leading to their disuniform distribution throughout the yarn cross-section, which in turn led to preferential migration depending on both fibre properties and mechanism of certain spinning processes.

Conclusion: The study reveals that the quality characters such as single yarn strength, yarn elongation and rupture per kilometer of yarn were directly proportional to the ratio of polyester with cotton in the blend. However, draw frame blending produced better quality yarn as compared to blow room blending, lap former blending and simplex blending.

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