
Characterization of Low Twist Yarn: Part-I Effect of Blend Ratio (Polyester/Cotton)

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ABSTRACT

The present study was conducted to determine the impact of PE/CT (Polyester/Cotton) blend ratio on the low twist yarn properties. A range of yarn count with similar low twist was spun on ring machine with 70/30 and 30/70 PE/CT blend ratios. The yarn properties such as evenness, hairiness and strength were studied. It was observed that single end yarn and skein strength, elongation and hairiness were directly proportional to the ratio of polyester fibre in the blend. It was revealed from the experimental findings that the evenness and strength improved with an increase of proportion of polyester fibre. They also increased with increasing yarn count.

Key Words: Ring Spinning, Low Twist Yarn, Cotton, Polyester, Strength and Hairiness.

1. INTRODUCTION

The world has entered to more fashion-oriented era and that is changing consumers' clothing demands such as great versatility, higher standards and precision in fabrics. All these demands may not be fulfilled by only cotton fibre. This is because cotton alone does not provide easy care, wash and wear with longer life of the textiles. In order to overcome this problem and meet the consumer demands the natural fibres such as cotton are blended with the synthetic fibres such as polyester.

Blending of PE/CT fibres has the prime importance due to its multiple end uses and economical productivity. The best way of blending staple fibres is on with the draw-frame during pre-spinning processes, because that gives longitudinal blending. It was investigated by Nawaz et al

that the percentage of polyester increases the strength of blended yarn and the strength decreases as the share decreases [1]. Li, et. al. [2] reported that fibre properties play an important role by maintaining the yarn strength. Anandjiwala, et. al. [3] investigated that the blending of dissimilar fibres increases the non-uniform distribution in the yarn cross section which can lead to preferential migration depending on both fibre properties and mechanism of certain spinning processes. Fibre properties such as type, length, fineness, coefficient of friction play a vital role in fibre migration during twisting [4-13]. Twist is applied to hold the fibres together and give strength to the yarn. Generally, yarn strength increases with an increase in yarn twist up to certain limit, beyond which the strength starts decreasing [14]. The main objective of this research was to find out the impact of 70/30 and 30/70

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PET/CT blend ratios on the evenness and tensile properties of a range of low twist yarn counts.

2. MATERIALS AND METHOD

Cotton and polyester fibres were used as raw material. The raw material properties were tested using USTER Fibrograph, Stelometer and Micronaire equipment and the results are given in Table 1. The two PE/CT blending ratios were 70/30 and 30/70. Both fibres were mixed on the Rieter draw-frame RSB-D35. The low twist yarns were finally produced with three different counts, i.e. 30, 40, 50 tex. The low twist yarns were spun with 230 turns/meter on ring spinning machine EJM 168 using 15000 rpm spindle speed. The general samples plan is shown in Fig. 1.

The textile yarn properties were measured using computerised testing machines - Uster Tensorapid 4 and Uster Tester 4 by using the standard procedure. Before testing the samples were conditioned at $65 \pm 2\%$ and $20 \pm 2^\circ\text{C}$ for at least 24 hours. Minimum 10 samples for each count were tested according to ASTM (American Society for Testing and Materials) standards [15-18].

3. RESULTS AND DISCUSSION

3.1. Analysis of Low Twist Yarn Evenness

The mass variation, coefficient of variation, uniformity index and hairiness (Fig. 2) of low twist yarns with a range of count were measured. Blend ratio was the main criteria for assessing the quality of yarn. Figs. 2(a-b) show that U% (Mass Variation) and CV% (Coefficient of Variation) was decreased in the yarn made with higher polyester

ratio (70/30). Count 50 exhibited highest decrease in U% and CV% comparing to other yarn counts. This decrease leads to increase in the yarn strength. U% and CV% remain almost same in all yarn counts made with 30/70 blend ratio. However yarn count 50 had slightly lower CV%.

The LT yarn made of 70/30 ratio appeared with higher uniformity index, Fig. 2(c). The yarn count 50 tex showed highest index among other yarn counts. The hairiness of yarn Fig. 2(d), present almost similar values. The LT yarn made with 70/30 ratio showed lower hairiness percentage as comparing with yarns made with 30/70 blend ratio. This is due to lower proportion of cotton fibres.

3.2. Tensile Properties of Low Twist Yarn

3.2.1 Single Yarn Strength

Single yarn tensile properties were evaluated and the results are shown in Fig. 3. The figure shows that yarns made with 70/ 30 blend ratio are stronger as compared to yarns made with 30/ 70 blend ratio. Though, yarn strength and breaking force, Fig. 3-(a-c), increase with an increase of yarn count in both blend ratios. Yarn count 50 (70/30) possesses highest strength and breaking force. The Fig. 3(c), reveals that all yarn

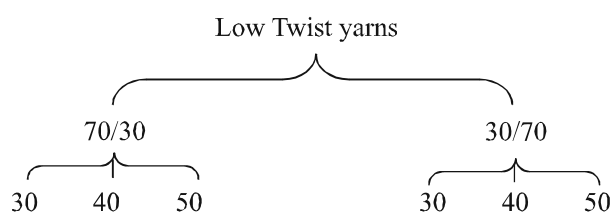


FIG. 1. SCHEMATIC DIAGRAM OF EXPERIMENT PLAN

Table 1. Properties of Cotton and Polyester Fibres

No.	Cotton Fibre Properties	Measurement	Polyester Fibre Properties	Measurement
1.	Fibre Tenacity	32 g/tex	Denier	1.2
2.	Uniformity Index (%)	83%	Tenacity	7.2 gm/den
3.	Mic Value	4.3	Elongation	20%
4.	Length (mm)	28mm	Crimps/cm	6.5
			Fibre length	38mm

counts in both blend ratios have almost similar elongation percentage. However the yarn count 50 tex (70/30) had higher elongation percentage when compared with the same yarn count in 30/70 blend ratio and other counts in both blend ratios. This means that yarn count 50 exhibited favourable tensile behaviour with low twist.

3.2.2 Lea Strength

Fig. 4 illustrates the comparison of tensile properties of yarns (lea strength) of different blend ratios and counts. Fig. 4(a) reveals that yarns made of 70/30 blend ratio possess higher strength than that of the 30/70 blend ratio. The strength in 70/30 yarns increases significantly with increase in yarn count. Yarn count 30 and 40 in 30/

70 blend ratio possess lowest strength if compared with all yarns in both blend ratios. The elongation behaviour Fig. 4(b), shows similar behaviour as was revealed for strength. The yarn count 50 in 70/30 blend ratio possesses highest elongation among all types of yarns. The Fig. 4(c) shows that the yarn made of 70/30 blend ratio exhibited higher breaking force comparing to the yarns of 30/70 blend ratio. And yarn count 50 possesses the highest breaking force.

4. CONCLUSIONS

A comparative study has been carried out to analyse the effect of polyester/cotton blend ratio (70/30 and 30/70) in low twist (230 turns/meter) yarn with a range of yarn count on yarn evenness and tensile behaviour. Compared to

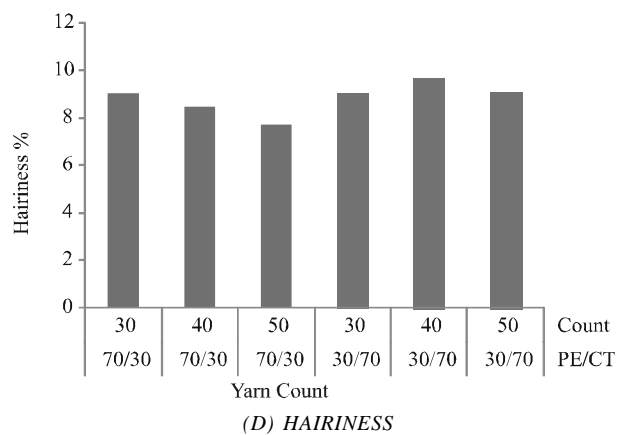
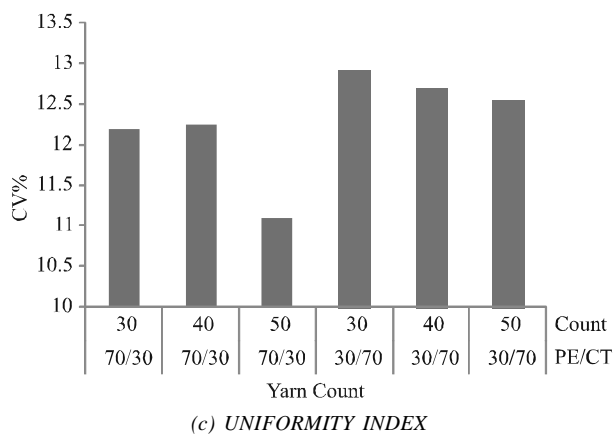
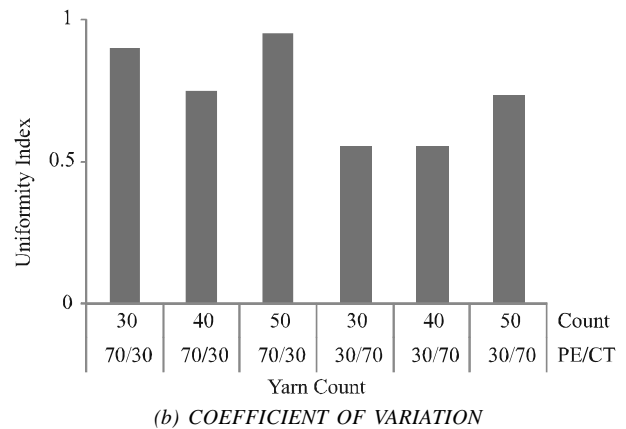
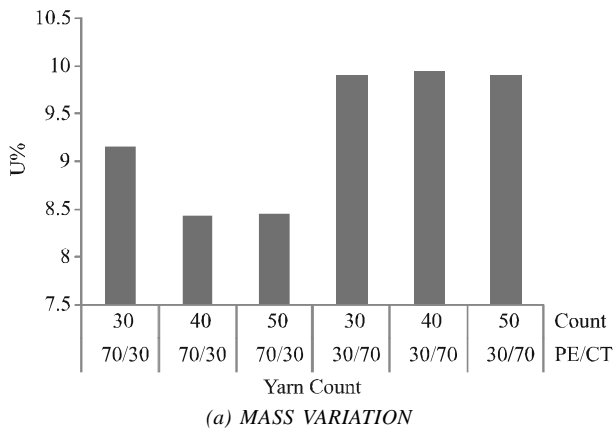
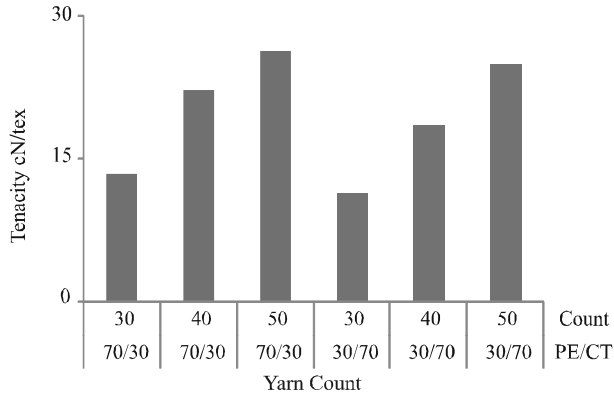
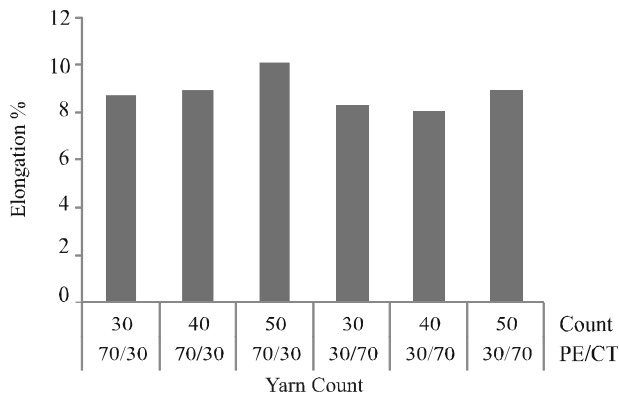


FIG. 2. PROPERTIES OF LOW TWIST YARN SPUN WITH 70/30 AND 30/70 BLEND RATIOS

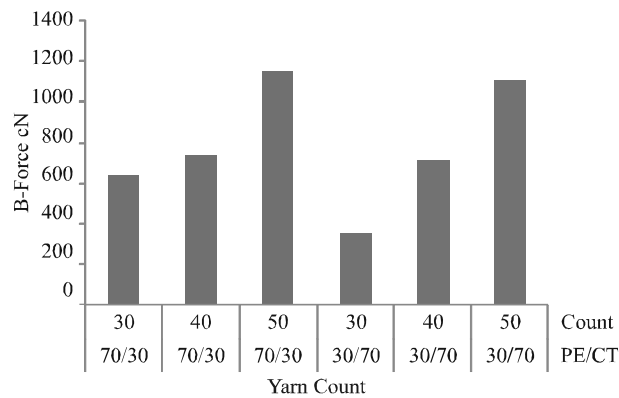
yarn count 30, 40 and 50 made with 30/70 blend ratio, low twist yarns made with 70/30 ratio had improved yarn properties such as U%, CV%, Hairiness, Single end and



(a) ULTIMATE STRENGTH



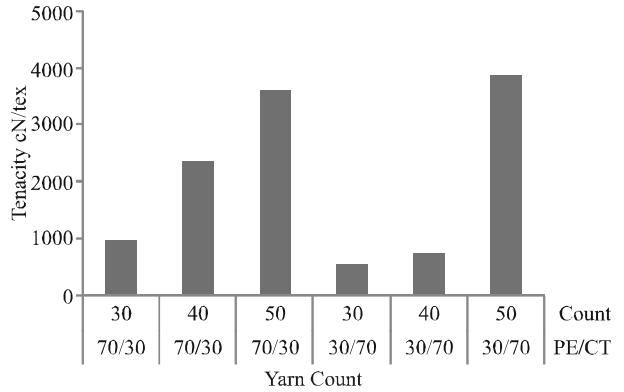
(b) ELONGATION



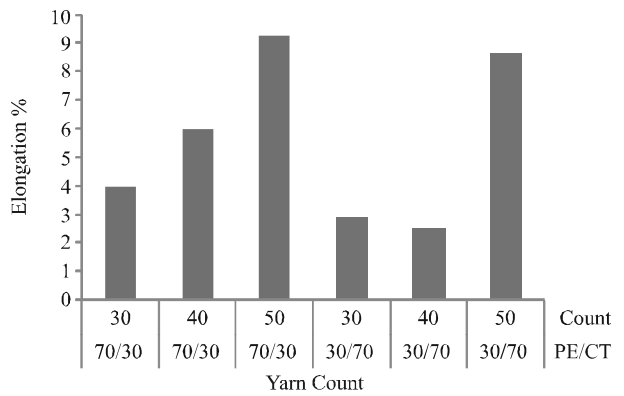
(c) BREAKING FORCE

FIG. 3. COMPARISON OF TENSILE PROPERTIES OF SINGLE LT YARNS MADE OF 70/30 AND 30/70 BLEND RATIOS

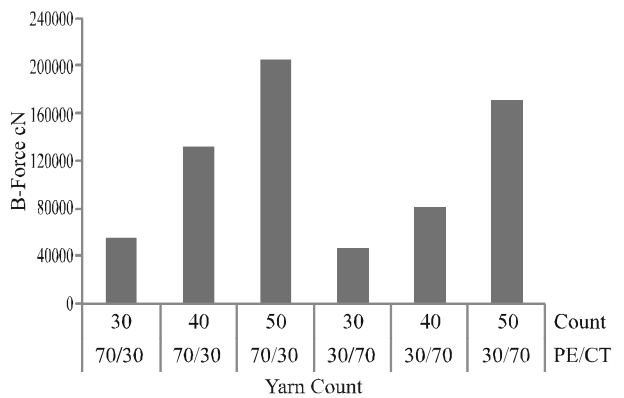
skein strength. This advantage is mainly due to lower ratio of cotton fibres and higher proportion of polyester fibres in a low twist yarn.



(a) ULTIMATE STRENGTH



(b) ELONGATION



(c) BREAKING FORCE

FIG. 4. COMPARISON OF TENSILE PROPERTIES OF LT YARNS MADE OF 70/30 AND 30/70 BLEND RATIOS

The yarn count 50 exhibits improved strength, U%, CV% and hairiness among the yarn types of 70/30 blend ratio. Usually, hairiness and strength largely depends on the level of yarn twist. However, the results showed that variation in blend ratio may also affect yarn evenness and tensile properties. This may be attributed to high percentage of polyester with respect to the fibre strength and staple length i.e. all polyester fibres have similar staple length.

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