Comparison of silk/polyester core and spun silk yarns and fabrics

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Silk wrapped polyester core yarns produced on an improved pedal spinning wheel have been compared with yarns spun from 100% silk waste. The fabrics made from both normal spun and core-spun yarns have also been evaluated for various properties. It is observed that the fabrics produced from core yarns as weft are stronger and more durable than those made from normal spun yarn as weft. The core-spun yarn fabrics show superior dyeing and fastness properties, better cover and better abrasion resistance, and are more suitable for furnishing and upholstery fabrics.

Keywords: Core-spun yarn, Pedal spinning wheel, Spun silk yarn

1 Introduction

Core-spun yarns have been used in fields other than silk to improve the strength, durability, aesthetics and functional properties of fabrics. In the silk spinning industry, the concept of core-spun yarns is in its infant stages and its introduction in silk industry may have far reaching benefits.

The cocoon waste can be advantageously used for hand spinning on pedal spinning wheel and it has a wide potential for rural employment generation. The yarn spun on pedal spinning wheel has wide applications in the production of dress materials and furnishing and upholstery fabrics. Certain new approaches of yarn spinning can be adapted to silk waste spinning to produce innovative yarns.

The object of this study was to develop core-spun silk yarn fabric with improved strength and durability, while maintaining the desirable inherent properties of silk. Core yarns spun with polyester filament core and silk waste wrappings were produced on an improved pedal spinning wheel and compared with similar yarns spun from 100% silk waste. Fabrics were produced from both regular spun yarn as well as core-spun yarn, degummed, dyed and evaluated for strength and other performance properties.

2 Materials and Methods

The cocoon waste was degummed by the conventional method using 3 g/l soap and 1 g/l soda at boil for 1 h, keeping the material-to-liquor ratio at 1:40. The degummed waste was thoroughly washed and dried. The degumming loss was found to be around 29%. 100% silk yarn was spun from the degummed waste on pedal spinning wheel (Fig. 1). The degummed cocoon
waste was slightly opened by hand and fed manually to the spindle through the guide and the spindle was rotated by the pedal through a connector and crank.

The core-spun yarn was produced by feeding the core polyester filament textured yarn (50 denier with 36 filaments) from a double flanged bobbin along with the opened cocoon waste by hand (Fig. 2).

Both the normal spun and core-spun yarns were tested for count, tenacity, elongation and twist. The tenacity and elongation were tested on Instron 6021 using a test length of 10 cm. The stress-strain curves for polyester filament yarn, core-spun yarn and normal spun silk yarn are shown in Fig. 3.

The cross-sectional view of core-spun yarn as well as the normal spun yarn, as observed under a microscope, are shown in Fig. 4.

The core-spun yarn was analyzed for percentage composition of polyester and silk content and it was found to be around 20% and 80% respectively.

The core-spun yarn and normal spun yarn were used as weft with raw silk as warp and the fabrics were woven on a powerloom. The fabrics were subjected to a mild degumming treatment to remove the gum from the warp. The weight loss after degumming was found to be around 8% in both the cases.

The degummed fabrics were tested for various quality parameters. The degummed fabrics were also dyed. The fabric with normal spun silk yarn as weft was dyed with an acid dye, Sando Silk Navy Blue 5RL (1%), at 90°C for 45 min. The fabric with core-spun yarn as weft was dyed in two stages. It was initially dyed with a disperse dye, Terasil Navy Blue RE IN (1%), at 120°C for 45 min followed by reduction clearing treatment. In the second stage, the silk component was dyed with an acid dye, Sando Silk Navy Blue 5RL (1%). The colour was measured on a Datacolor computer system. The K/S values of dyed samples were calculated at a wavelength of maximum absorption. The wash fastness test was carried out as per ISO 11 test method.

3 Results and Discussion

The yarn strength and elongation properties of core-spun yarn, normal spun silk yarn and polyester filament yarn indicate that the core-spun yarn has a higher tenacity as compared to the normal spun yarn and polyester filament yarn has the highest tenacity (Table 1). The normal spun yarn has a little higher elongation than the core-spun yarn and the elongation.
The coefficient of variation of breaking strength of the core-spun yarn was at a desirably low level, indicating that the strength uniformity of the core yarns is better. Table 1 shows that both count CV and twist CV of the core-spun yarns are better as compared to that of normal spun yarn. These results indicate that the core-spun yarn is indeed much stronger and uniform than the equivalent 100% silk yarn. Apparently, the presence of polyester with high tenacity and uniformity mainly contributed to the improvement in breaking strength and uniformity of the core-spun yarn. The yarn hairiness and twist liveliness of the core-spun yarns, as indicated by subjective evaluations, were also low.

It is observed from Table 2 that the core-spun yarn fabric is 23% stronger in the weft direction as compared to the normal spun silk yarn fabric. The abrasion resistance of the core-spun yarn fabric is 58% higher as compared to that of the normal spun yarn fabric. This is a very distinct advantage of core-spun yarn fabric. Because of the excellent fabric strength and abrasion resistance, and presence of up to 80% silk for comfort and aesthetic point of view, the core-spun yarn fabrics are well suited for furnishing and upholstery fabrics. Although the silk content of the core-spun yarn fabrics is 80% by weight, these fabrics actually have nearer to a 100% silk surface, which should make them even more comfortable in the end-use applications. The 20% polyester content of the fabrics provides improved strength retention and abrasion resistance.

Table 3 shows improved dye absorption in core-spun yarn fabric compared to that in normal spun yarn fabric. Further, the wash fastness of core-spun yarn fabric is better as compared to that of normal spun yarn fabric.

The fabrics produced from core-spun yarn show better cover. Flexural rigidity, crease recovery and bursting strength are also marginally better in the case of core-spun yarn fabric.

**4 Conclusion**

It is possible to produce stronger and more durable fabrics with better cover from silk/polyester filament core yarns than from 100% spun silk yarns. This constitutes a vital advantage, especially for furnishing and upholstery fabrics.

Pedal spinning wheel has vast potential for the cottage industry sector. The core yarn spinning on pedal spinning wheel increases the productivity and improves the appearance of the yarn because of better evenness. Therefore, the core yarn spinning concept could be extended to the hand spinning sector much to the advantage of hand spinners.
References


