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Technological Studies on Elastic Core Cotton Covered Yarn

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Abstract: The research was conducted to assess the effect of different contents of elastane, at different twist multipliers by feeding single and double roving upon 14^5 elastic core cotton covered yarn quality, was initiated in Department of Fibre Technology, University of Agriculture, Faisalabad in coordination with Nafees Cotton Mills Ltd., Muzaffargarh, Ayub Agriculture Institute, Faisalabad and Crescent Textile Mills Ltd., Faisalabad. Different parameters and their interactions exerted highly significant effect upon elastic core yarn properties.

Key Words: Strech Yarn, Core Yarn, Elastane

Introduction

The only elastic substance that was available for use in apparel was rubber and prior to 1930, yarn was cut from sheets of rubber. This method was replaced when a technique was developed for extruding liquid latex in to a finer, round rubber yarn. To make the yarn suitable for garments, the rubber thread was covered by winding around it two layers of such yarns as cotton or rayon. These yarns were known by such names as lastex.

Halanca stretch yarn introduced in 1947, was made from nylon filament. This was the first elastic yarn made entirely of a textile. Other similar stretch yarn soon followed. However none of these are truly elastomeric yarns because the fibres themselves do not stretch materially, their stretch ability is dependent upon the straightening out of the coil, curl and crimp of the filaments. Further more, the amount of stretch is about one quarter to one half that of rubber. These stretch yarns do not have the ability to resist pulling, nor do they have the restraining power of rubber.

Simultaneously an experimental elastomeric textile identified as fibre K was created in 1947. After much development efforts the fibre was introduced to the trade for evaluation. This led to its commercialization as the first spandex fibre and the adoption by Du Pont of the lycra trade mark in 1959. The fibre met with some initial resistance from buyers who were skeptical about its alleged stretch and holding power. However, Du Pont began full scale production of lycra spandex fibre in 1962. Other companies also joined the competition with the production of spandex fibres under the trade names Numa, Vyrene, Spandelle, Blue C, Fibre 32, Durospun, Unel and Dorlastan (Bayer's Spandex fibre).

Hehl (2000) reported that special additional equipment to manufacture core-spun yarn could be attached to the ring spinning machine, thus enabling core spun yarn to be produced while utilizing all the advantages of modern ring spinning machine. Sawhney (1974) produced elastic core-spun yarn of cotton and wool blend and stated that yarn count distribution significantly varies fabric stretch. Khan (1991) reported that core-spun yarns containing lycra does not have a constant and obvious stabilization point at which yarn number can be determined. Babaarslan (2001) narrated that core-spun yarn containing elastane (lycra) have lower tenacity than staple yarn, this may be perhaps, due to the fact that core spinning did not have good fibre control compared to staple spinning. The results confirm that the less extensible staple fibres mainly take up most of the loading stress in core-spun yarns, and the core (lycra) does not contribute much to yarn. Keeping in view the unique properties offered by the elastane core spun yarn, it is considered obligatory to produce cotton wrapped elastane filaments core yarn on a modified ring spinning frame.

Materials and Methods

The present "Technological studies of elastic core, cotton covered yarn spun on a modified ring frame" was initiated in the Department of Fibre Technology, University of Agriculture, Faisalabad and conducted at Nafees Cotton Mills Ltd, Muzaffargarh, Ayub Agriculture Research Institute, Faisalabad and the Crescent Textile Mills Ltd, Faisalabad. The lint cotton of the variety MNH-93 and elastane filament was taken from the running materials of the Nafees Cotton Mills, Ltd. Muzaffargarh.

Cotton was processed through blow room carding drawing and simplex frame. To produce elastic core-spun yarns, conventional ring spinning frame was modified with a positive feed roller system using a v-groove guide to feed elastane to the front roller of the drafting system. As seen from the figure-1 the drafted cotton staple fibers and the highly elastic filament yarn (elastane) are brought together at the nip point of the delivery roller of the drafting unit. Elastic filament yarn is stretched between the positive feed roller and the v-groove yarn guide. While the elastane delivery unit is positively driven, the v-groove guide roll is driven by the friction force occurring between the top front roller of the drafting unit and the v- groove guide roll. The elongation of the elastic core yarn and percentage of elastane in the final core yarn govern the amount of elastic filament yarn elongation essentially.

The core was positioned centrally on the roving ribbon. In this design the core enters the twisting zone at the center of the spinning triangle in the spinning geometry Controlled elongation is applied to the core yarn so that it covered and wrapped by the cotton fiber for a higher quality yarn structure and properties. Following

parameters were selected to study their effect,

Twist Multiplier (T.M.)	Elastane Contents	Mode of Feeding
T1 = 3.75	B1= 3%	R1 = Single rove
T2 = 4.00	B2 = 6%	R2 = Double rove
T3 = 4.25	B3 = 9%	

The yarn of 14^S count thus produced, was tested for the Yarn Count, Yarn Lea-Strength and Count Lea-strength Product Value,

Results and Discussion

Yarn Number: The statistical analysis of variance and comparison of individual treatment means for 14,s cotton covered elastane core yarn count shown in table-1 (a&b), indicates that contents of elastane (B), different twist multipliers (T) and single and double roving feed set up (R) as well as their all possible interactions produced highly significant effect.

Individual comparison of means for different contents of elastane filament reveals that the minimum count is recorded for B1 (3%elastane) followed by B2, B3 and B0. The mean values for different ratios i.e. B0, B1, B2 and B3 are 14.07, 13.44,13.68 and 13.73 respectively. The results show that B0 and B1 differ significantly from one another and from B2 and B3, however B2 and B3 are non- significant with respect the each other. These results show that the introduction of elastane in the core of yarn, the yarn become finer with respect to control B0 (pure cotton). It had been reported by Khan (1991) that core spun yarns containing Lycra (elastane) do not have a constant, and obvious stabilization point at which yarn number can be determined, which support the irregular trend noted in the present findings where the impact of elastane add up is not linear. Anonymous (2001) stated that as little as 2 percent of lycra (elastane) is enough to improve fabric quality, contributing liveliness, drape and better shape retention.The respective values of the count of core-spun yarn for different twist factors T1, T2 and T3 are 13.70,13.80 and 13.69 respectively. T2 is significantly different from T1 and T3, while later are non-significant. The actual yarn count is almost equal/near to the nominal count. In a research study Wu and Lee (1995) described the effect of twist on structure and properties of composite yarn and reported that volume of yarn structure decreases with increasing twist, due to its special structure of the composite yarn.

The mean values of yarn count for single (R1) and double roving feeding technique (R2) as shown in table-1 are 13.79 and 13.67 respectively, which differ significantly from each other .It can be inferred that the double rove yarn count is slightly finer. While Subramaniam *et al.* (1989) revealed that double rove spinning is becoming more popular because of tremendous cost saving. Double rove yarn strength increases with optimum twist level.

Yarn Lea Strength: The statistical analysis of variance and comparison of individual treatments means among variables for lea strength of 14s shown in table-2 (a) and (b), revealed that the feeding of single and double roving(R), contents of elastane (B) and twist factor (T) resulted highly significant affect upon lea strength for 14,s elastic core yarn. Even their interactions also produced highly significant effect.

The individual mean values for lea strength at different contents of elastane (B) i.e. B0, B1, B2 and B3 are 154.9, 89.87,87.07 and 86.5 pounds respectively. All the values significantly differ from each other. Maximum strength was obtained for B0 (pure cotton), which was 154.9 lbs. The minimum value was at B3 (9% elastane), 86.5 lbs. The lea strength decreased gradually by increasing the elastane contents in yarn. In a previous study Babaararslan (2001) observed similar effect and narrated that core spun yarn containing lycra have lower tenacity than staple yarn, this may be perhaps due to the fact that core spinning did not have fibre control compared to staple spinning control. The less extensible staple fibres mainly take up most of the loading stress in core spun yarns, and the core (lycra) does not contribute much to yarn strength.

The mean values of lea strength for different twist factors viz. T1, T2 and T3 are 98.94, 105.5 and 109.4 pounds respectively. The comparison of mean values for lea strength among different twist multipliers shows that these values are significantly different from each other and the results also revealed that by increasing the twist factor, lea strength increases gradually. This evidence is confirmed by Wu and Lee (1995) who stated that increasing twist in the spinning of a composite yarns, skein strength and abrasion resistance increases.

The comparison of individual mean values table-3 (b) indicates that for single roving (R1) and double roving feed (R2), lea strength values are 107.45 and 101.74 pounds respectively. The maximum lea strength is recorded in single roving.

Count Lea Strength Product Value (CLSP): Analysis of data regarding the count lea strength product is shown in table-3 (a and b) it indicates that the content of elastane (B), feeding single and double roving (R), twist multipliers (T) and all of their interactions produce highly significant effect.

Comparison of individual treatment means under different contents of elastane revealed that B0 is significantly different as compared to B1, B2 and B3, but B2 and B3 are non-significant with each other. The maximum count strength product value is obtained at B0 and minimum at B3. The mean values for B0, B1, B2 and B3 are 2178,1208, 1191 and 1187 hanks respectively. It can be seen that the clsp of elastic core yarn decrease gradually by increasing the elastane content. As it has already been discussed that lea strength of yarn decrease by increasing the elastane content and because clsp is the product of count and strength therefore the similar trend is observed in this case. These results get some support from Babaarslan (2001) who stated that core spun yarn containing lycra (elastane) have lower tenacity/strength than staple yarn. This may be perhaps due to the fact that core spinning did not have good fibre control compared to staple spinning. The results confirmed that the most of the loading stress in core spun yarn is mainly taken up by the less extensible staple fibres, and the core lycra does not contribute much to yarn strength.

The mean values for twist multiplier T1, T2 and T3 are

Table 1a: Analysis of Variance for 14s Core Yarn Count

S.O.	V.D.F	S.S	M.S	F.value	Prob.
B (Elastane)	3	6.128	2.043	95.8204	0.0000**
R (Roving)	1	0.407	0.407	19.1009	0.0000**
T (Twist)	2	0.320	0.160	7.4995	0.0009**
AxB	3	1.637	6.546	25.5938	0.0000**
RxT	2	1.233	0.617	28.9295	0.0000**
BxT	6	0.605	0.101	4.7317	0.0003**
RxBxT	6	0.669	0.111	5.2280	0.0001**
Error	96	2.046	0.021		
Total	119	13.05			

** = Highly significant

Table 1b: Comparison of Individual Means for 14s Core Yarn Count

Contents of Elastane	Mean	T. M.	Mean	Roving	Mean
B0	14.07a	T1	13.70b	R1	13.79a
B1	13.44c	T2	13.80a	R2	13.67b
B2	13.68b	T3	13.60c	R3	13.73b

Note: - Means with in each column sharing no letter in common do not differ significantly at p = 0.05

Table 2a: Analysis of Variance for 14s Core Yarn Lea Strength

S.O.V.	D.F	S.S	M.S	F.value	Prob.
B (Elastane)	3	101559.552	33853.000	40695.7102	0.000**
R (Roving)	1	977.552	977.552	1175.1383	0.000**
T (Twist)	2	2233.04	1116.522	1342.1973	0.000**
RxB	3	6475.538	2158.513	2594.7988	0.000**
RxT	2	77.843	38.922	46.7886	0.000**
BxT	6	549.615	91.602	10.1175	0.000**
RxBxT	6	450.894	75.149	90.3384	0.000**
Error	96	79.859	0.832		
Total	119	112403.896			

** = Highly significant

Table 2b: Comparison of Individual Means for 14s Core Yarn Lea Strength (lbs)

Contents of Elastane	Mean	T. M.	Mean	Roving	Mean
B0	154.9a	T1	98.94c	R1	107.45a
B1	89.87b	T2	105.5b	R2	101.74b
B2	87.07c	T3	109.4a		
B3	86.51d				

Note: - Means with in each column sharing no letter in common do not differ significantly at p = 0.05

Table 3a: Analysis of Variance for Count Lea Strength Product Value (CLSP) for 14s Core Yarn (Hanks)

S.O.V.	D.F	S.S	M.S	F.Value	Prob.
B (Elastane)	3	21707302.834	7235767.000	14967.312	0.000 **
R (Roving)	1	266414.670	266414.000	551.0834	0.000 **
T (Twist)	2	440013.308	220006.000	455.0876	0.000**
RxB	3	874235.430	291411.000	602.7905	0.000**
RxT	2	87.051	43.526	0.0900	0.000**
BxC	6	105031.516	17505.000	336.2099	0.000**
RxBxT	6	83449.341	13908.000	28.769	0.000**
Error	96	46410.047	483.438		
Total	119	23522944.196			

** = Highly significant

Table 3b: Comparison of Individual Means for 14s Core Yarn (CLSP)

Contents of Elastane	Mean	T. M.	Mean	Roving	Mean
B0 (pure cotton)	2178a	T1	1359c	R1	1488a
B1	1208b	T2	1459b	R2	1393b
B2	1191c	T3	1504a		
B3	1187c				

Note: - Means with in each column sharing no letter in common do not differ significantly at p = 0.05

1359, 1459 and 1504 hanks respectively. All three values in this case differ significantly. It is concluded that by increasing the twist multiplier the csip values increases. The comparison of treatment mean given in table-4 (b) reveals that the mean values of single roving (R1) and double roving (R2) are 1488 and 1393 hanks respectively. Significant difference is found between these two values. Lower value is observed in case of double roving.

Conclusion

On the basis of present investigations, it was inferred that the control sample B0 (pure cotton yarn) posses higher tea-strength, CLSP and other tensile parameters as compared to the elastic core/cotton covered yarn. Most of the tensile parameters of elastic core spun yarn increased at higher twist multipliers.

References

Anonymous, 2001. Lycra; What Lycra Is----what Lycra does. Technical Brochure Du Pont (U.K) limited. 94 Regent Road,G.B- Leicester LEI 7DJ:1-4.

Babaarslan, O., 2001. Method of Producing a Polyester/viscose Core-spun Yarn Containing Spandex Using a Modified Ring Spinning Frame. Tex. Res. J. 71: 367-371.

Hehl, R., 2000. Core Spun Yarns Market of the Future. Link, Rieter Text. Sys. Switzerland. 12: 22-23.

Khan, M., 1991. Producing Core Spun Yarns Containing Lycra. Bulletin L. 519. Du Pont Pak. Operations (Pvt.) Ltd. Karachi: 8-9.

Sawhney,A.P.S., 1974. The Effect of Fabric Structure on the Properties of Two Way Stretch Fabrics Made from Elastic Core Spun Yarns of Cotton and Wool blend. Text. Res. J. 44: 506-512.

Subramaniam, V.V.R. Srinivasamorthi and A. Peer Mohamed, 1989. Effect of Processing Parameters on the Properties of Double Rove Spun Produced on Short Staple Spinning System. Tex. Res. j. 59: 762-767.

Wu, W.Y. and J.Y. Lee, 1995. Twist in Spinning of Composite Yarn. Tex. Res. J. 65: 522-526.