Journal of Applied Sciences

ISSN 1812-5654

Journal of Applied Sciences 6 (5): 1090-1093, 2006
ISSN 1812-5654

How Twist and Twist Directions Influences the Sewing Thread Spinablity

Sh. Muhammad Nawaz, Babar Shahbaz, M. Qamar Tusief and Engr. Manzoor Hussain
Department of Fibre Technology, University of Agriculture, Faisalabad, Pakistan

Abstract: Doubling of yarns is key process for sewing thread fabrication. The spinability of sewing thread mainly depends upon the amount of twist and twist direction of yarn. Keeping in view the importance of thread on the garment quality, this research is performed to evaluate the spinability of sewing thread under variant counts, twist levels and twist directions of single spun yarns. The variant counts, twist levels and twist directions of single spun yarns affected the spinability of sewing thread significantly.

Key words: Sewing thread, count, strength, CLSP, twist direction, doubling process, plied yarns and twist multiplier

INTRODUCTION

Sewing thread is one of the most important elements required to produce a neat, firm and durable seam, which gives the garment the necessary aesthetics and the stamp of a quality product. The appearance, durability and general usefulness of garments and articles depend significantly upon its appearance. Two or more yarns are plied for fabrication of sewing thread. Sewing thread may be defined as smooth, evenly spun, hard twisted ply yarn created by a special finishing process to make it resistance to stresses while its passage through the eye of needle sewing machines and through material involved in seaming and stitching operations.

All conventional sewing threads begin their production cyclic single yarns. These single yarns generally has S-direction twist and are next twisted together in the Z- direction, the twist being balanced to eliminate snarling. Twist in the basic yarn provides a consolidating force . This is usually referred to as singling twist. The twist in the single yarns is balanced by applying reverse twist when two or more yarns are combined to form the thread construction. Therefore there is a need for an optimum twist level. If twist is too low, yarns may fray and break, if is too high, the resulting liveliness in the thread nay cause snarling, looping, knots or spillage. Further causing the length contraction which means the reduction in the count of thread. Hanif (2002) described that reduction in strength occurs when yarn number is increased. Similarly, Salhotra (1989) noted that for the production of snarl-free sewing thread, the balanced structure can be achieved whereby doubling twist normally lies between 50 and 60% of single yarn twist. Farooq 2000) concluded that the yarn strength either lea strength or single end strength increase with doubling and it touches an optimum value when the ply twist is balanced.

The objectives of the present research was to optimize the level of Twist and Direction of Twist in the Sewing Thread manufacturing in order to achieve the best quality thread.

MATERIALS AND METHODS

Present research was initiated in the Department of Fibre Technology, University of Agriculture, Faisalabad and conducted at Nishat Textile Mills Limited, Faisalabad during the year 2004-2005. Samples of pure polyester were spun in both S and Z twist directions at 34's, 40's 50's and 60's counts.

Raw material used: The material used was Polyester and the representative samples of polyester were collected from the running stock in the mills with following characteristics.

Fibre length	=	38 mm
Denier	=	1.20
Luster	=	Semi dull

Preparation of hank roving for spinning: The samples of polyester were processed in the blow room, carding section, drawing section and then, at simplex frame to produce hank roving of 1.015, 1.22, 1.336 and 1.509 for fabrication of 34, 40, 50 and 60 single yarns, respectively.

Corresponding Author: Sh. Muhammad Nawaz, Department of Fibre Technology, University of Agriculture, Faisalabad, Pakistan

Table 1: Coding for different variable factors

Thread count (C)	Twist multiplier (TM)	Twist direction (D)	Ply-direction (d)
C_1 = 34/3	TM_1 = 3	D_1 = SSS	d_1 = S
C_2 = 40/3	TM_2 = 4	D_2 = SSZ	d_2 = Z
C_3 = 50/3	TM_3 = 5	D_3 = SZZ	
C_4 = 60/3		D_4 = ZZZ	

Spinning process: Pure polyester Samples were spun under both S and Z twist directions at 34's, 40's, 50's and 60's counts and quality parameters were evaluated and then these yarn samples were plied under following process and programme.

Doubling process: Doubling was performed on two – For-One Twister, by combining the single yarns in four combinations of twist directions viz, SSS, SSZ, SZZ and ZZZ in both doubling directions i.e., S and Z. Three different twist levels were employed for each thread sample.

The coding for different variable factors is shown in Table 1.

All these samples of single yarns and thread were tested and evaluated for following Characteristics

Yarn count: The count of single yarn and thread was determined employing Digital Auto Sorter-III according to the procedure suggested by ASTM Committee (2004a) which gives direct reading. A lea of 120 yards was fed to the Digital Auto Sorter-III and then, count was noted from its automatic digital display.

Skein strength: Lea strength tester was used to find the single yarn and thread lea strength in pounds. The lea of 120 yards was fed to pendulum type instrument according to the method recommended by ASTM Committee (2004b).

Count lea strength product: The count lea strength product was calculated by multiplying the count value with the respective lea strength value of yarn and thread.

$$\text{CLSP} = \text{Count} \times \text{Lea strength}$$

Atmospheric conditions: The testing work was carried out under standard laboratory conditions which were maintained at 65±2% relative humidity and 20±2°C temperatures.

Statistical analysis: Duncan's Multiple Range test was applied for individual comparison of means among various quality characters as directed by Faqir (2003). The data was subjected to statistical analysis on computer employing M-Stat Microcomputer Program devised by Freed (1992).

RESULTS AND DISCUSSION

Count of thread: The individual mean values of thread count at different levels of twist multiplier i.e. TM_1=3, TM_2 = 4, TM_3 = 5 are 14.95, 14.72 and 14.36 respectively, It indicates that with the increase in twist multiplier, reduction in thread count occurs, because of too high twist, over twisting occurs to produce coarser yarn (i.e., 3-ply yarn) (Table 2). In a previous study Oxtoby (1987) reported that under these circumferences i.e., S on Z yarns or S on Z yarns and S on S yarns or Z on Z yarns with low amount of folding twist folded yarn become longer than the single yarn components and as folding twist beyond balanced position is increased, the extension decreases and further increase causes the length contraction. It means that length contraction causes the reduction in the count of thread. Similarly, Salhotra (1989) described that for the production of snarl-free sewing thread, the balanced structure can be achieved whereby doubling twist normally lies between 50 and 60% of single yarn twist.

The individual mean values of thread counts at C1, C2, C3 and C4 are 10.81, 12.70, 16.01 and 19.18 respectively. In previous study, Booth (1996) reported that the count is a numerical expression which defines fineness. The individual mean values of thread count for different levels of combination of single component's twist direction i.e., D1, D2, D3 and D4 are 14.69, 14.68, 14.66 and 14.67, respectively. The different combination of twist direction has no definite effect on yarn count. Booth (1996) explained that from spinning point of view, it normally matters little which way twist goes. The mean values of thread count under two types of doubling direction i.e., d_1 = S and d_2 = Z, are 14.69 and 14.66, respectively. It means that mean value for d_1 is statistically significant than that for d_2.

The above results depict that different twist level and direction of twist in the doubling of yarn have no definite effect on the yarn count.

The individual comparison of mean values of thread count with single yarns reveals that yarn number of respective thread (i.e., 3 ply yarns) is less than one–third of yarn number of respective single yarn. This reduction in the count is due to the presence of doubling twist. The same observations were reported by Booth (1996) who described that doubling process caused a contraction in length component threads and contraction caused these yarns to become coarser.

Lea strength: The comparison of individual mean values of the lea strength applying the DMR test at different levels of twist multipliers (i.e., TM_1 = 3, TM_2 = 4, TM_3 = 5) presented in Table 3, are 345.37, 328.61 and 311.29 lbs,

Table 2: Comparison of individual mean values for thread count

TM	Mean	C	Mean	D	Mean	d	Mean
TM_1	14.95a	C_1	10.81d	D_1	14.69	d_1	14.69
TM_2	14.72b	C_2	12.70c	D_2	14.68	d_2	14.66
TM_3	14.36c	C_3	16.01b	D_3	14.66		
		C_4	19.18a	D_4	14.68		

Table 3. Comparison of individual mean values for lea strength

TM	Mean	C	Mean	D	Mean	d	Mean
TM_1	345.37a	C_1	430.01a	D_1	353.18a	d_1	329.9
TM_2	328.61b	C_2	361.41b	D_2	303.8b	d_2	326.95
TM_3	311.29c	C_3	285.25c	D_3	302.76b		
		C_4	237.01d	D_4	353.65a		

respectively which indicate that with the increase in the twist multiplier, reduction in the lea strength of thread occurs. Because at too high twist, breakage of fibres takes place which reduces strength in case of 3-ply yarn. Similar views are given by Farooq (2000) who concluded that the yarn strength either lea strength or single end strength increase with doubling and it touches an optimum value when the ply twist is balanced. Similarly, Salhotra (1989) described that for the production of snarl-free sewing thread, the balanced structure can be achieved whereby doubling twist normally lies between 50 and 60% of single yarn twist.

From the results it can be concluded that as twist in the yarn increases above a certain level the strength decreases.

The individual mean values of the lea strength of sewing thread for different levels of count i.e., C1 = (34/3), C2 = (40/3), C3 = (50/3) and C4 = (60/3), are 430.01, 361.41, 285.25 and 237.01 lbs, respectively, which indicates that lea strength decreases as the thread become finer. These results get support from the researches of Booth (1996) and Hanif (2002) stated that as the count of yarn becomes finer, strength will decrease.

The individual mean values of the lea strength of thread for different levels of combination of single component's twist direction i.e., D_1, D_2, D_3 and D_4, are 353.18, 303.8, 302.76 and 353.65 lbs, respectively. These results indicate that lea strength of thread having all single components with same or opposite twist directions to the direction of doubling is greater than thread having single components with different twist directions. This happens because of untwisting of one or two component yarns having twist direction opposite to folding twist and over twisting of two or one component yarn with same spinning and folding twist. These results get some confirmation from Farooq (2000) who stated that untwisting of yarn component with opposite direction of spinning and folding twist and over twisting of yarn component with same direction of spinning and folding twist decrease strength. It has also been reported by Chattopadhyay (1997) who described that surface fibres contribute mainly towards tenacity. When ply twist of opposite direction is inserted the individual strand rotates on its axis cause the wrapped fibres to become loose. Hence the strength is low because loose fibres do not contribute towards the structure reinforcing. Similarly, ply twist of same direction is inserted, the wrapped surface fibres become twisted in the same directions which reinforce the structure in the beginning but gradually the strength decreases because of over twisting which cause the fibres to break and causes weakening the structure. This statement explained that a thread having all single components with same or opposite twist directions to the direction of doubling is preferred.

The values of lea strength of thread under two types of doubling direction i.e., d_1=S and d_2=Z, are 329.9 and 326.95, respectively. It means that mean value for d_1 is statistically significant than that for d_2.

So it be inferred from the present results that the increasing twist in the yarn has a positive effect on the yarn strength. Also the same direction of twist in the yarn and the doubling twist in the thread give less value of strength as compared to the opposite directions of both types of twists.

Count lea strength product: By the application of DMR test the individual mean values of the CLSP at different levels of twist multipliers (i.e., $TM_{1=}3$, TM_2 = 4, TM_3 = 5) are shown in Table 4, which are 4923, 4605 and 4249 respectively. It shows that with increase in twist multiplier, reduction in the CLSP of thread occurs. Because at too high twist, breakage of fibres occurs to reduce strength in case of 3-ply yarn. The same views are given by Farooq (2000) concluded that the yarn strength either lea strength or single end strength increase with doubling and it touches an optimum value when the ply twist is balanced. The CLSP is a parameter of analyzing the yarn strength, as reported by Booth (1996) who concluded that the CLSP as useful measurement of the merit of yarn from strength point of view. Similarly, Salhotra (1989) described that for the production of snarl-free sewing thread, the balanced structure can be achieved whereby doubling twist normally lies between 50 and 60% of single yarn twist Hence, all results are almost follow the same pattern as the lea strength of the threads.

The individual mean values of the CLSP of thread for different levels of count i.e., C1 = (34/3), C2 = (40/3), C3 = (50/3) and C3(60/3) are 4654, 4595, 4571 and 4549, respectively. It indicates that lea strength count product decreases as thread becomes finer. These results get support from the research of Hanif (2002) who described that reduction in strength occurs when yarn number is increased.

Table 4: Comparison of individual mean values for clsp

TM	Mean	C	Mean	D	Mean	d	Mean
TM_1	4923a	C_1	4654a	D_1	4944a	d_1	4613
TM_2	4605b	C_2	4595b	D_2	4251b	d_2	4571
TM_3	4249c	C_3	4571bc	D_3	4229b		
		C_4	4549c	D_4	4957a		

The individual mean values of the CLSP of thread for different levels of combination of single component's twist direction i.e., D_1, D_2, D_3 and D_4, are 4944, 4251, 4229 and 4957, respectively. These results indicate that CLSP of thread having all single components with same or opposite twist directions to the direction of doubling is greater than thread having single components with different twist directions. This happens because of untwisting of one or two component yarns having twist direction opposite to folding twist and over twisting of two or one component yarn with same spinning and folding twist. In a previous study Farooq (2000) who stated that untwisting of component yarn with opposite direction of spinning and folding twist and over twisting of yarn component with same direction of spinning and folding twist decrease strength of that type of thread. Similarly, Chattopadhyay (1997) described that surface fibres contribute mainly towards tenacity. When ply twist of opposite direction is inserted the individual strand rotates on its axis cause the wrapped fibres to become loose. Hence the strength is low because loose fibres do not contribute towards the structure reinforcing. Similarly, ply twist of same direction is inserted, the wrapped surface fibres become twisted in the same directions which reinforce the structure in the beginning but gradually the strength decreases because of over twisting which cause the fibres to break and causes weakening the structure. The values of CLSP of thread under two types of doubling direction i.e., d_1 = S and d_2 = Z, are 4613 and 4571, respectively.

CONCLUSIONS

From the present research it can be well concluded that twist multiplier and different levels of count had highly significant effects on the count and strength of the sewing thread. Similarly, different combinations of twist direction affected sewing thread quality.

- Tenacity parameters get better by plying the single yarns.
- Count Lea Strength Product and Lea-strength decreases as thread became finer.
- The thread in which all yarn components with opposite spinning and plying twist direction was stronger and better in quality as compared to thread with all yarn components of same spinning and plying twist direction or other combinations.
- The quality of sewing thread in respect to strength deteriorated as twist multiplier was increased beyond the balanced twist.

REFERENCES

ASTM Committee, 2004a. Standard test method for measurement of yarn properties, ASTM Designation D: 1907-97, D: 1578-93, D: 1425-96, D: 2255-66. Amer. Soc. for testing and materials, Philadelphia, USA.

ASTM Committee, 2004b. Standard test method for measurement of sewing thread properties, ASTM Designation: 204- 97. Annual Book of ASTM Standards (1998), Vol.07.02.

Booth, J.E., 1996. "Yarn Dimensions" Principles of textile testing, 3rd Edn. CBS Publishers and Distributors, New Dehli. pp: 225-237.

Chattopadhyay, R., 1997. The influence of plying on the tenacity, breaking extension and flexural rigidity of air jet spun yarns. J. Text. Inst., 88: 76-78.

Faqir, M., 2003. Statistical Method and Data analysis. Kitab Markaz, Bhawana Bazar, Faisalabad, pp: 303-316.

Farooq, A., 2000. The effect of multiply S and Z yarns on double weft fabric quality. M.Sc. Thesis, Univeristy of Agriculture, Faisalabad, pp: 40-97.

Freed, R.D., 1992. M. Stat Micro computer statistical program. Michigan State, University of Agriculture, Unieristy of Norway 324-B. Agriculture; Hall East Lausing, Michigan Lausing, USA.

Harrison, P.W., 1997. Sewing threads."Tex.Progress". Vol. 30, Tex. Institute, pp: 3-38.

Hanif, M., 2002. Optimization of rotor speed for different yarn counts spun at BD-200 and RNK open –end system. M.Sc. Thesis, Univeristy of Agriculture Faisalabad, pp: 39-96.

Lord, P.R. and P. Radhakrishnaiah, 1987. Tenacities of plied friction-spun rotor-spun and ring- spun yarns. J. Text. Inst., 2: 140-142.

Oxtoby, E., 1987. Yarn Folding. Spun Yarn Technology. (Butterworth, London), pp: 175-181.

Salhotra, R.R., 1989. Spinning of man made fibres and blends on the cotton system., Tex. Association, Bombay, India, 2nd Edn., pp: 171.