Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 5, Issue, 09, pp.2478-2481, September, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

PRODUCTION OF BAMBOO/COTTON AND BAMBOO/POLYESTER BLENDED RING SPUN YARNS AND ASSESSMENT OF THE QUALITY CHARACTERISTICS USING THE SELF DEVICED TORQUE INSTRUMENT

Sowmya Ramani[1,*] and Dr. N. Vasugi Raaja[2]

Department of Textiles and Clothing, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641 043, Tamilnadu, India

ARTICLE INFO

Article History:
Received 14th July, 2013
Received in revised form
08th August, 2013
Accepted 20th August, 2013
Published online 14th September, 2013

Key words:
Torque,
Bamboo,
Polyester,
Torsional, Spinning

ABSTRACT

A direct technique developed for measuring yarn torque is explored for the case of bamboo, polyester and cotton ring spun yarns with its respective blends. The technique balances the torque in a yarn hank against a wire of known torsional rigidity. It is shown that this technique gives a reliable measure of the torque per strand independent of the size of the hank. The difference between the dry torque and wet torque is visualized and it can be found that as the sample becomes wet, the torque value decreases.

INTRODUCTION

Blending of different fibres is a very common practice in the spinning industries. The blending is primarily done to enhance the properties of resultant fibre mix and to optimize the cost of the raw material. The properties of blended yarns primarily depend on the properties of constituent fibres and their compability. Moreover, the proportion of fibres in the blend also plays a significant role. It has been observed that the stronger component has to be mixed at least by a certain proportion in order to gain in terms of tensile properties[1].However many times reduction of cost of natural fibres is considered important. The sort of material for blending is also very important because not all materials can be mixed together. Wrong combinations can result in shrinkage or very weak structure of fabric. So, it becomes essential for the researcher to design and introduce novel and vibrant yarns to the market to satisfy the consumers with various tastes and variety of end applications [2].

In the cotton spinning process, blending has the objective of producing yarn with acceptable quality and reasonable cost. A good quality blend requires the use of adequate machines, objective techniques to select bales and knowledge of its characteristics. Knowledge of the importance of blended products in the textile industry and the generally rising costs of production make the achievement of economic and good quality blends with different kinds of cotton more and more critical. Bamboo and bamboo-cotton blended yarns are a key part of the 'natural product 'theme and are recommended for use in 'soft look/soft feel' textiles, like towels, knits and socks, as well as in home-textiles sourced by leading global MNC brands. Yarns of bamboo fibre provide the desirable properties of high absorbency, antimicrobicity and soft feel in textiles and made-ups[3]. Torque is the capability of rotating objects around a fixed axis. In other words, it is the multiplication of force and the shortest distance between application point of force and the fixed axis. Torque is a vector quantity both having direction and magnitude. However, since it is rotating around a fixed axis its direction can be clockwise or counterclockwise. Textile fibers and yarns are subjected to torsional strains during various processes of manufacture. Such strains affect snarling, unwinding, knittability, etc. during processing and spirality, shape factor, dimensions of loop in knitted products and drape, crease recovery, crepe effect, etc in woven fabrics. It is therefore essential to test and characterize the torsional properties for achieving better production and quality[4]. The present study was conducted to find out the impact of the bamboo/cotton and bamboo/polyester blend ratio on the quality characteristics of yarn and also to optimize the blending ratio that produced excellent quality yarn were selected with the following objectives. To produce twenty six different blend proportions of Bamboo/Cotton and Bamboo/ Polyester with two different levels of twist factors. Development of yarn testing instrument in relation to torque.

***Corresponding author: Sowmya Ramani,** *Department of Textiles and Clothing, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641 043, Tamilnadu, India*

METHODOLOGY

The methodology of the study consists of the following aspects.The experimental part of the present study investigating the influence of the bamboo content in bamboo/cotton and bamboo/polyester blends at the different stages of spinning fibre to make yarn was carried out.

Selection of fibre: Five kgs Cotton samples of Sankar-6 were selected with the following parameters tested such as fibre length 28.4 mm, strength 22.5g/tex, elongation 5.3%, fineness (micronaire) 3.7 μ_g/ in.

Ten kgs bamboo fibre were selected with the following parameters such as fibre diameter 0.01323 mm, fibre length 38mm, strength 2.54g/den, elongation 19.2%, denier-1.2. Five kgs polyester fibre were selected with the following parameters such as fibre diameter .00971mm, fibre length 40mm, strength 6.41g/den, elongation 17.5%,denier-1. The process steps of fibre blending, lap production, carding, drawing, rove-preparation and spinning were controlled to result in 19.68 tex. The following table-1 illustrates the blend ratio of blended manufactured yarn.

Selection of spinning process: Ring spinning machine is universally applicable to any material can be spun to any required fineness. It delivers yarn with optimal characteristics. Ring spinning is still accepted as the most important method in short staple spinning and in spite of the new spinning methods which come on the scene with the purpose to increase the production, ring spinning is still in the first category owing to its continous development [5]. The process steps of fiber blending, lap production, carding, drawing, rove-preparation and spinning were controlled to result in 19.68 tex. The following process were followed for ring spinning process to produce yarn from selected fibre and blends

Table-1. Blend ratios of Bamboo, Cotton and Polyester with two different twist factors (3.4 & 4)

100% bamboo	100%cotton
80% bamboo	80%cotton
20% polyester	20%bamboo
67% bamboo	67%cotton
33% polyester	33%bamboo
50%bamboo	50%cotton
50%polyester	50%bamboo
33% bamboo	33%cotton
67% polyester	67%bamboo
20%bamboo	20%cotton
80% polyester	80% bamboo
100%polyester	_nil_

There are five stages in spinning. They are :

1. Lap to card sliver by the carding process.
2. Card sliver to doubling is drawing process.
3. Drawing Sliver to roving is called simplex process.
4. Roving sliver to yarn by further drafting and twisting process is ring spinning process.
5. Yarn reeled on bobbins, spools, or cones by the winding process.

Development of yarn testing instruments- Torque

The torquemeter was the instrument developed by the investigator to find out the accurate value of the produced yarns (Plate-1).

"To find the torsional rigidity of yarn using torquemeter by balance method".

Mount 80 yarns on the chart measuring (20 cm X 10 cm) in an ellipse form. Take the mounted yarn and tie it vertically between the twistmeter and bob making sure that yarns are parallel to each other. Tighten the yarns using the screw.Twist the thread sample using the twistmeter 20 times and observe the twist in the wire in the torquemeter. Now measure the angle of twist for the wire using 360 deg protractor attached to the wire. So to balance the twist produced in the wire by rotating back to its normal position. Use the measured angle to perform the t series test and obtain corresponding torque value. This is the torsional rigidity of the wire. We know that torsional rigidity of the thread sample is going to be less than the torsional rigidity of the wire. Actually ratio of the torsional rigidity of yarn to the torsional rigidity of the wire is 1:100. So we divide the obtained torsional rigidity value of the wire by 100 to get the torsional rigidity of the

Table-2

S.No	Sample No.	Twist No.	Expanded Name
Bamboo and Polyester			
1	**A-1**	T.M. 3.4	100% Bamboo count 30s
2	**A-2**	T.M. 4.0	100% Bamboo count 30s
3	**B-1**	T.M. 3.4	80% Bamboo 20% Polyester count 30s
4	**B-2**	T.M. 4.0	80% Bamboo 20% Polyester count 30s
5	**C-1**	T.M. 3.4	67% Bamboo 33 % Polyester count 30s
6	**C-2**	T.M. 4.0	67% Bamboo 33% Polyester count 30s
7	**D-1**	T.M. 3.4	50% Bamboo 50% Polyester count 30s
8	**D-2**	T.M. 4.0	50% Bamboo67% Polyester count 30s
9	**E-1**	T.M. 3.4	33% Bamboo 67% Polyester count 30s
10	**E-2**	T.M. 4.0	33% Bamboo 67% Polyester count 30s
11	**F-1**	T.M. 3.4	20% Bamboo 80% Polyester count 30s
12	**G-1**	T.M. 4.0	20% Bamboo 80% Polyester count 30s
13	**G-2**	T.M. 3.4	100 Polyester count 30s
14	**G-2**	T.M. 4.0	100% Polyester count 30s
Bamboo and Cotton			
15	**H-1**	T.M. 3.4	100% Cotton Count 30s
16	**H-2**	T.M. 4.0	100% Cotton Count 30s
17	**I-1**	T.M. 3.4	80% Cotton 20% Bamboo count 30s
18	**I-2**	T.M. 4.0	80% Cotton 20% Bamboo count 30s
19	**J-1**	TM. 3.4	67% Cotton 33% Bamboo count 30s
20	**J-2**	T.M. 3.7	67% Cotton 33% Bamboo count 30s
21	**K-1**	T.M. 3.4	50% Cotton 50% Bamboo count 30s
22	**K-2**	T.M. 4.0	50% Cotton 50% Bamboo count 30s
23	**L-1**	T.M. 3.4	33% Cotton 67% Bamboo count 30s
24	**L-2**	T.M. 4.0	33% Cotton 67% Bamboo count 30s
25	**M-1**	T.M. 3.4	20% Cotton 80% Bamboo count 30s
26	**M-2**	T.M. 4.0	20% Cotton 80% Bamboo count 30s

thread sample. Repeat the above experiment to calculate torsional rigidity of all the other thread samples. More is the torsional rigidity , more it is difficult to twist. Less is the torsional rigidity, more it is easier to twist. All the produced yarns was evaluated using the above instrument and procedure followed to the get the torque of the yarns.

Plate- 1: Torque Meter

RESULTS AND DISCUSSION

The results of the various tests were analyzed statistically by one way ANOVA. The difference between the samples and within the samples was found. The t test was applied to find the difference between the two samples (in this case between two twists 3.4 & 4.0). DMRT (Duncan Multiple Range Test) is applied to find out significant difference amongst (26 samples) by ranking the series. From the tables it can be concluded that when statistical analysis using anova to compare the above tests values , it is evident that as P value is less than 0.001, there is significant difference amongst all samples for all the tests in both the twists between 3.4 and 4.0. Please note that sample with one series indicates 3.4 twist and sample with two series indicates 4.0 twist. The following table-2 nomenclature of the sample is presented below.

Tables -3. Twist 3.4 Group Dry Torque test results

		Mean	SD
Sample	A1	93.33^{a}	15.28
	B1	68.33^{a}	20.82
	C1	168.33^{c}	30.55
	D1	220.00^{d}	70.00
	E1	185.00^{d}	48.22
	F1	172.33^{bc}	56.45
	G1	166.67^{bc}	18.93
	H1	150.00^{bc}	45.83
	I1	260.00^{d}	52.92
	J1	230.00^{cd}	78.58
	K1	193.33^{cd}	16.07
	L1	170.00^{bc}	40.00
	M1	161.67^{bc}	15.28
F value		4.023	
P value		$<.001^{**}$	

Tables- 4. Twist 3.4 Group Wet Torque test results

		Mean	SD
Sample	A1	85.00^{b}	13.23
	B1	63.33^{a}	20.82
	C1	161.67^{bc}	28.43
	D1	207.00^{cd}	60.56
	E1	176.67^{cd}	55.08
	F1	155.67^{bc}	60.47
	G1	160.00^{bc}	20.00
	H1	141.67^{bc}	32.53
	I1	253.33^{d}	50.33
	J1	221.67^{cd}	68.07
	K1	186.67^{cd}	23.09
	L1	156.67^{bc}	40.41
	M1	153.33^{bc}	11.55
value	4.432		
Pvalue	$<0.001^{**}$		

Tables – 5. Twist 4.0 Group Dry Torque test results

		Mean	SD
Sample	A2	116.67^{a}	30.55
	B2	130.00^{ab}	55.68
	C2	179.00^{bcd}	3.61
	D2	296.67^{f}	15.28
	E2	285.00^{ef}	52.20
	F2	198.33^{cd}	20.21
	G2	197.67^{cd}	48.54
	H2	231.67^{cde}	27.54
	I2	272.33^{ef}	15.37
	J2	236.67^{de}	5.77
	K2	195.00^{cd}	27.84
	L2	186.67^{bcd}	42.52
	M2	170.00^{abc}	26.46
F value	8.503		
P value	$<0.001^{**}$		

1. ** denotes significance at 1% level.
2. Different alphapet between tension denotes significant at 1% level using P Duncan Multiple Range Test (DMRT).

From the above two tables it can be inferred that sample A_1 and G_1 is compared with its respective blends, there is significant difference in DMRT mean value of first order 220 and 185 for the samples D_1 and E_1 respectively followed by second order significance for the sample I_1 with the DMRT mean value of 260 (Dry torque) when it is compared to A_1 and H_1 samples. When samples A_1 and H_1 is compared with its respective blend composition samples I 1, follows first order of significance with DMRT mean value of (253.33. wet torque)

Tables-6. Twist 4.0 Group Wet Torque test results

		Mean	SD
Sample	A2	103.33^{a}	15.28
	B2	106.67^{a}	40.41
	C2	169.00^{b}	16.82
	D2	283.33^{e}	28.87
	E2	260.00^{de}	52.92
	F2	186.67^{bc}	11.55
	G2	190.00^{bc}	45.83
	H2	220.00^{bcd}	20.00
	I2	265.67^{de}	4.04
	J2	233.67^{cde}	5.51
	K2	191.67^{bc}	23.63
	L2	176.67^{b}	35.12
	M2	166.67^{b}	30.55
F value	10.818		
P value	$<0.001^{**}$		

Table-5 and 6 shows the torque between the two twists (3.4 and 4.0) for 26 samples. From statistical analysis using anova to compare the torque levels, it is evident that as p value is less than 0.001, there is significant difference between the tenacity levels in both the twists between 3.4 and 4.0. When sample A_2 and G_2 is compared with its respective value of 296.67 for the sample D_2. (Dry torque). Similarly when sample A_2 and G_2 is compared with its respective blend composition sample D_2 follows first order of significance which shows increase in mean value of 283.33 followed by second order of significance showing increasing in mean value 169 for the sample C_2. (Wet torque). When sample A_2 and H_2 is compared with its respective blend composition samples C_2,$M_{2\ \text{and,,L2}}$ shows increase in DMRT mean value of 176.67 and 166.67,177 respectively. (wet torque).

Statistical Analysis

The results of the various tests were analyzed statistically by one way ANOVA. The difference between the samples and within the samples was found. The t test was applied to find the difference between the two samples (in this case between two twists 3.4 & 4.0). DMRT (Duncan Multiple Range Test) is applied to find out significant difference amongst (26 samples) by ranking the series. The results of the various tests were analyzed statistically by one way ANOVA. The difference between the samples and within the samples was found. The t test was applied to find the difference between the two samples (in this case between two twists 3.4 & 4.0). A widely used procedure for comparing all pairs of means is the multiple range test developed by Duncan in 1955. The application of Duncan's Multiple Range Test (DMRT) is similar to that of ∫sd test. DMRT involves the computation of numerical boundaries that allow for the classification of the difference between any two treatment means as significant or non-significant. DMRT requires computation of a series of values each corresponding to a specific set of pair comparisons unlike a single value for all pairwise comparisons in case of ∫sd. It primarily depends on the standard error of the mean difference as in case of ∫sd . This can be easily be worked out using the estimate of variance of an estimated elementary treatment contrast through the design. For application of the DMRT rank all the treatment –means in decreasing or increasing order based on the preference of the character under study states[6].

Conclusion: The sample D1 – 50% Bamboo 50% Polyester, E1 - 33% Bamboo 67% Polyester, D2 – 67% Bamboo 33% Polyester showed increase dry torque sample I1 – 80% Cotton and 20% Bamboo, C2 -

67% Bamboo 33% Polyester, M2 – 20% Cotton 80% Bamboo, L2-33% Cotton 67% Bamboo showed increase wet torque the sample showed significant difference. It can be inferred that as the sample becomes wet, torque value decreases.

REFERENCES

1) Abhijit Majumdar, Samrat Muhopadhyay, Ravindra yadav and Achintya Kumar Mondal , " Properties of ring-spun yarns made from cotton and regenerated bamboo fibres", Indian Journal of Fibre and Textile Research, Vol.36, March 2011, pp 18-23
2) Sandeep, D.N., Shivaprakash, A.V. and Mahraddi, V.H. "Development of Bamboo/Spun Silk Blended yarn for Knitted Garments", Man-made Textiles in India, Vol.XXXIX, No.3, March 2011, p-89
3) Ozguney, A.T., Donmezkretzse, S., Ozcelik,G. and Ozerdem, A. (2008) The comparison of cottonknitted fabric properties made of compact and conventional ring yarns before and after the printing process,Textile Research Journa,Vol.78,No.2, Pp 138-143.
4) BalaKrishnan .P. (2012), " Develoment of torque meter for measuring torque of yarns, B.Tech thesis, Jaya Engineering College, Thirunindravur, P-1
5) Erden Ko and Ernel Kaplan (2007),An investigation on energy consumption in yarn production with special referenceto ring spinning, FIBRES & TEXTILES IN Eastern Europe, Vol.15, No.4 (63) p-18
6) Rajender parsad, Multiple comparison procedure, I.A.S.R.I., Library Avenue, New Delhi-110012

****