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Dimension of yarn twist, An Innovative Techniques

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Abstract: This study presents a new technique for defining yarn twist that removes the disadvantages of the presently used 'reverse-twisting technique'. The new technique may be defined as a 'two-end untwisting/twisting technique'. In this technique, the test sample of a yarn is subjected to untwisting and twisting by two clamps rotating in opposite directions. Pre-tension of the test sample is effected by loading it at its mid-length point, by virtue of which the sample takes the shape of a broken line instead of a straight line. Owing to the use of two rotating clamps and pre-loading the sample at its middle point, there is no 'ballooning' of the sample during testing. The ballooning phenomenon occurring in the reverse twisting technique is responsible for uncontrolled elongation of the test sample, due to slippage of the fibers. The two-end untwisting/twisting technique is much less sensitive to the amount of pre-tension applied to the test sample.

Keywords: Twist, New Technique, Twist-Tester CZ-1, Test Yarns, Test Approaches, Optimum Pre-Tension.

1. INTRODUCTION

The twist of yarn is one of its more important morphological properties. This property has so far been difficult to test, and the approaches employed for that purpose continue to be a matter of dispute. The amount of twist inserted in a yarn is a factor on which are dependent not only the tensile properties of the yarn but also a number of other properties which qualify the yarn for a particular use in weaving or knitting. One can say no more about the twist and measurement of a given yarn than that it can be pre-selected in the so-called spinning plan and checked on a ring spinning frame by measuring the revolving speed of the yarn balloon and the rate at which the strand of fibers is supplied to the twisting system, and (in the case of an open-end yarn) by measuring the yarn delivery rate and speed of the rotor.

Testing of twist in a laboratory presents many difficulties, and the most common technique consists in untwisting and then re-twisting the yarn in the opposite direction. This technique has its advantages, among which are simple and easy procedure and short test time, but it also has certain imperfections which make the method inaccurate. Inherent in the method is the possibility of the fibers slipping along the yarn axis as the yarn is being untwisted. This results in uncontrolled elongation of the test length, the consequence of which is that the reverse twist is inserted in a greater amount than that of the original twist. Another imperfection of the untwist-twist method is that the fibers of an untwisted yarn pose a greater resistance to twisting when the yarn is being twisted in the opposite direction. The value of the resistance depends on the parameters of the fibers &the yarns, and the specificity of the spinning system.

It has been shown that the results of the untwist-twist method vary with the value of the pre-tension applied to the test specimen Czaplicki. (1999), Czaplicki (2000). Various modifications of this technique have been reported, some of the authors are using conventional twist meters, and others using automatic twist meters Czaplicki (2000) None of these modifications has provided an answer to the question of how to determine the real number of turns the yarn has been given in twisting. The explanation lies in the design of the twist testing devices, all of which cause 'ballooning' of the test specimen while it is being untwisted and twisted, resulting in uncontrolled elongation of the yarn. The results are also affected by the amount of pre-load applied to the test specimen.

Observing the behavior of the cotton and woolen yarns in twist tests by various untwist-twist methods inspired us to undertake a project aimed at developing a new modification of the twist measurement technique, as well as a twist meter that would measure twist by the modified untwist-twist technique.

2. METHODOLOGY

An Innovative Techniques for Dimension of yarn twist

The alteration would consist in the untwisting and twisting of the test specimen being induced from both ends, instead of from one end only. The guidelines for

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the development of the new twist measurement technique were as follows:

- Untwisting and twisting the test yarn specimen takes place at both ends of the specimen, and is effected by two clamps revolving in opposite directions;
- Pre-load is applied to the test specimen at its center;
- The axis of the test specimen is bent at the center of the specimen, i.e. at the point the pre-load is applied;
- The cut length of the test specimen is 250 mm or 500 mm;
- The rotary speed at which the specimen is untwisted and twisted is adjustable, and is constant during measurement;
- The test is abruptly stopped by an automatic control as soon as the test specimen reaches its initial, starting length;
- Control of the test is semi-automatic.
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To meet the guidelines, a special twist meter was developed Czaplicki (2001) and adapted to measure twist by the new method **(Fig. 1).** The new twist meter had two rotary clamps revolving in opposite directions, so that the test specimen was untwisted and twisted from both ends. The twist meter was also provided with a special tension-imparting system for applying pre-tension to the test specimen at its center. The system incorporated elements for imparting tension and elements for supervising specimen elongation during untwisting. The points which must be supervised are the beginning and end of the test, the measurement of twist being performed automatically.

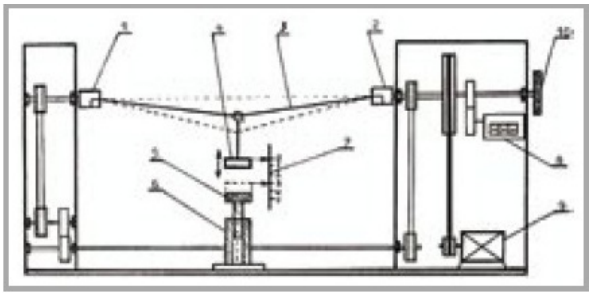


Fig.1 A schematic diagram of a device used for measuring twist with a new technique [5]; 1, 2 – rotary clamps, 3 – yarn sample, 4, 5, 6 – device tensioning initial sample in its center, 7 – elongation scale, 8 – output of twist values, 9 – motor, 10 – hand driven clamps.

The rotary clamps and central application of the pre-load (at the bending point of the specimen) helped eliminate the so-called 'ballooning' of the yarn during test. In this way, the undesirable phenomenon of uncontrolled elongation of the test specimen during untwisting and twisting was also eliminated.

(Fig. 2). shows how tension strength F acts on a sample during its elongation over the untwisting time and its shortening (with respect to initial length) over the re-twisting time.

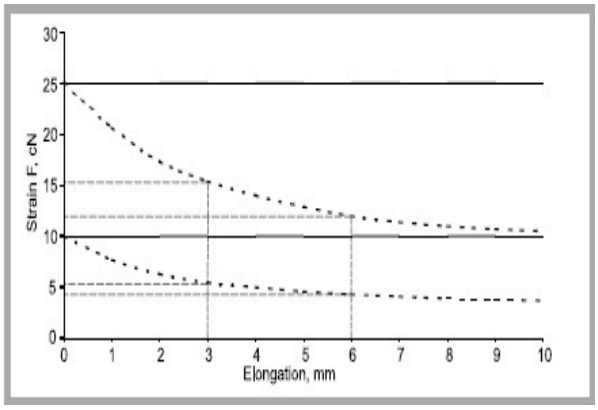


Fig. 2. Changes of strain in samples of yarn as a function of elongation; For yarn 50 tex, and q = 0,2 cN / tex, F = 10 cN and q =0, 5cN / tex, F=25cN,__-traditional method,. . . . . - new method.

The new technique was tested on model, ring and spinning machines, on which yarns of three different classes of linear density and with three different twist factors were made. The yarns were spun from cotton, viscose and wool & polyester, and from blends of these fibers with man-made fibers. The twist of the yarns was tested on specimens 250 mm and 500 mm long, which were subjected to varied pre-tensions. Parallel to these tests, the twist of the yarns was tested by the conventional untwist-twist method based on Zweigle's semi-automatic twist-meter.

3. RESULTS AND DISCUSSIONS

The aim was to produce ring-spun yarns of a known machine twist TM with a proportion of colored fibers. The real initial twist T0 was determined by 'direct counting' on samples 250 mm long, using a pre-tension q = 0.3 cN/tex. The yarn twist was also tested by the 'reverse twist' (i.e. the traditional) method (Zweigle's twist-tester) (Czaplicki's twist-tester). The pre-tension was assumed to be q = 0.1 to 0.8 cN/tex. The length of yarn samples was the same as those used in the 'direct counting' method.

The results obtained suggest that for every yarn there is – for the 'reverse twist' technique – an optimum pre-tension q opt at which T0 =Tl =Tn . A relationship has been determined between the real initial twist T0, the real reversed twist Tn, and the twist-meter reading to **(Fig. 3-6).** Czaplicki (2002) The relationship presented in **(Fig. 3 to 6).** suggest the following three cases regarding the reverse twist method:

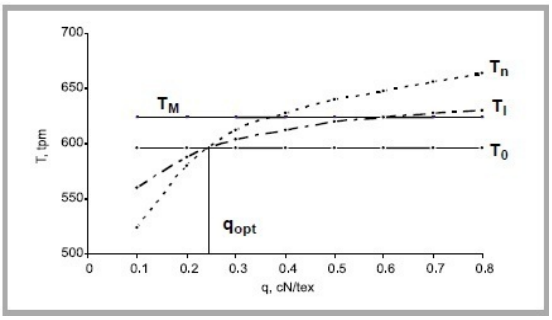


Fig. 3. Inter-relationship between real initial twist T0, real reversed twist Tn, and twist-meter reading Tl. Cotton yarn 40 tex. Traditional method

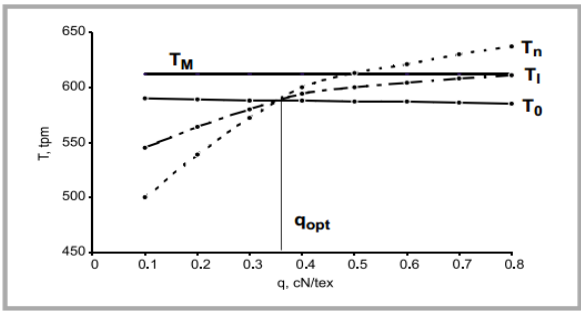


Fig. 4. Inter-relationship between real initial twist T0, real reversed twist Tn, and twist-meter reading Tl. Cotton yarn 40 tex. New method

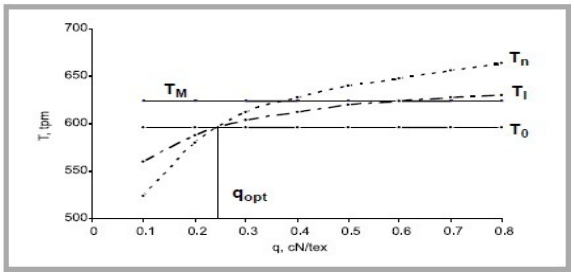


Fig. 5. Inter-relationship between real initial twist T0, real reversed twist Tn, and twist-meter reading Tl. Wool yarn 25 tex. Traditional method.

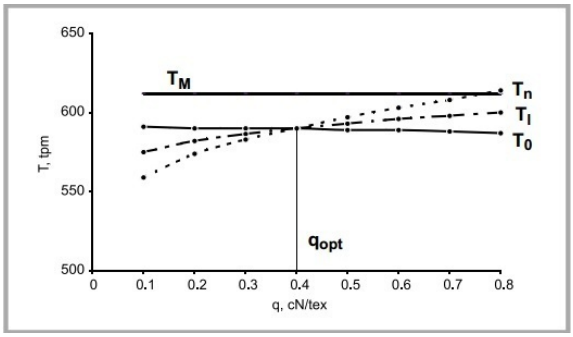


Fig. 6. Inter-relationship between real initial twist T0, real reversed twist Tn, and twist-meter reading Tl. Wool yarn 25 tex. New method.

1. For q < q opt, the twist-meter values, , are lower than the real twist before test T (T0,l < T0,);
2. For q = q opt, the twist-meter values, Tl , are equal to the real twist before test T0 (Tl = T0);
3. For q > q opt , the twist-meter values, Tl , are higher than the real twist before test T0 (Tl > T0);

For pre-tension values that are greater or less than qopt, the twist-meter reading does not represent the real twist of the yarn. For q < qopt and q > qopt, the twist-meter readings Tl are the mean values of T0 and Tn.

Tl = (T0 +Tn [)/2, tpm (1)

Where: tpm = twist per meter

If the real initial twist T0 and the twist-meter reading Tl are known, the formula (1) can be used to calculate the real reverse twist Tn:

Tn = 2Tl - T0, tpm (2)

The exact analysis of determined inter-relationship between T0, Tl and Tn is presented in **(Fig.7).**

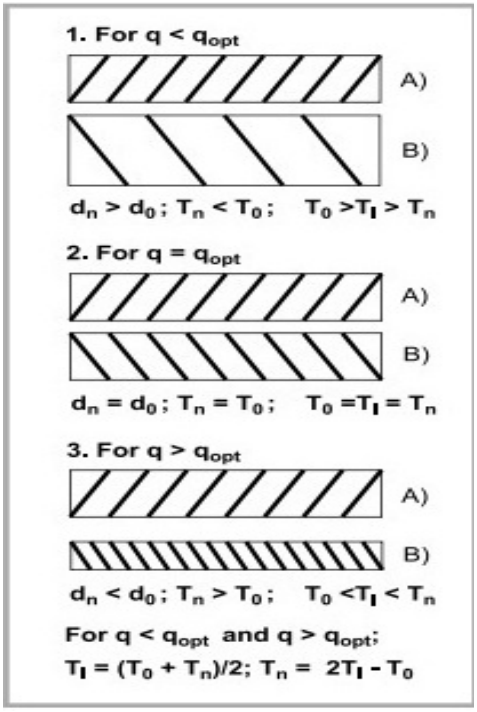


Fig. 7. *Values of twist Tl obtained by the reverse twisting method, depending on the value of pre-tension q; A - yarn sample before test on twist-meter (d0, T0); B– yarn sample after test on twist-meter (dn, Tn, Tl); d0 – initial diameter of yarn (before measurement of twist by reverse twisting); T0 – real initial twist arrived by direct counting; dn–diameter of yarn after measurement of twist by reverse twisting; Tn – real*

twist of yarn arrived by direct counting; Tl – value of twist read from twist-meter

4. CONCLUSIONS

The results obtained showed that the new technique was about 50% less 'sensitive' to the amount of pre-tension applied to the test specimen. In addition, the untwisting-twisting process in the new technique was more regular, owing to the apparent shortening of the test specimen and the dual untwisting-twisting drive arrangement.

By using test yarns with marked fibers, it was possible to establish the real twist without the need for untwisting the yarn. The real twist was used as a reference for the measurements performed in parallel by the new and conventional untwist-twist methods.

The results obtained confirmed the suitability of the new method, and its superiority in terms of accuracy by at least 50% over the conventional untwist-twist method. Both the technique and apparatus are unique, and heretofore unknown.

REFERENCES:

Czaplicki T. (1999), 'The Real Twist of a Yarn and Its Twist Value Measured by the Reverse Twist Method', Proceedings of the International Conference TEXCI 98, 65-68, Liberec, Czech Republic.

Czaplicki T. (2000). 'Determining Real Twist in Bast-Fibre Yarns.' Natural Fibers, Vol. 11, No 3. 321-328. Liberec, Czech Republic.

Czaplicki, T., (2000). 'Selecting Method and Test Conditions for Accurate Determination of Yarn Twist' Scientific Bulletin, 97-99, Technical University of Łódź.

Czaplicki, T., (2001). Patent Application P344096, Method and application for measuring twist of yarns. Włókiennictwo, 26-31. Liberec, Czech Republic.

Czaplicki, T., (2002), Measurement of yarn twist by the two-way twisting method', Proceedings of the 'Magic World of Textiles' - International Textile, Clothing & Design Conference, 77-81, Dubrovnik, Croatia.