International Journal on Textile Engineering and Processes ISSN 2395-3578
Vol. 2, Issue 4
October 2016

Tensile Behavior of 100% cotton fabrics made from different directional twisted doubled yarns

Prof. Ramesh Narkhedkar
D.K.T.E'S Textile and Engineering Institute, Ichalkaranji

Abstract

Twisting is very essential process in the production of staple yarns, twine, cord and ropes. There is certain yarn parameter which decides the quality of 100% cotton fabric. Twist in the yarn has a twofold effect, firstly twist increases cohesion between the fibers by increasing lateral pressure in the yarn, thus giving enough strength to the yarn, secondly, twist increases helical angle of fibers and tries to bind all fibres along with protruding fibres, in the yarn body which leads to contribute maximum fibre strength to the yarn strength. In this the author used plain weave to produce fabric but only change is arrangement of warp and weft with differential twist direction. Then this sample is tested for the different fabric properties to check its performance. It helps to check effect of twist direction and arrangement of warp and weft on these properties. The purpose of this study is to explore the effect of different ply yarn twist direction on various fabric properties. It helps in deciding the suitability of a fabric used for the crease resistant purpose. In this research the four sets of fabrics with different combination of warp and weft threads having the 'S' and 'Z' directional twists were used. The fabric samples were tested for fabric tensile properties.

Key Words: Count, EPI, PPI, Twist, Elongation.

Introduction

Woven fabrics are constructed with lengthwise and width wise yarns interlaced at right angles. Each set of yarns (warp and weft) looks like parallel set of wires crossing the other set. The interlacing points are the major locations where interactions between the yarns in the two system takes place and through which the yarns forms an interlocked structure. In other words this yarn interaction at the crossing points is the essential feature of woven fabric and will affect more or less all the fabric properties. In fact, engagement and friction between the warp and weft, which are directly related to yarn surface configuration and fibre alignment at the intersection, would play a role in fabric mechanical properties. In this aspect, yarn twist which identifies the yarn surface characteristic and fibre alignment, has an effect on fabric behavior during handling, cutting, sewing and even final use. It has been proved that yarn pull out force, fabric formability and fabric buckling force are greater in fabrics in which warps and wefts are unidirectional in the twist directions.

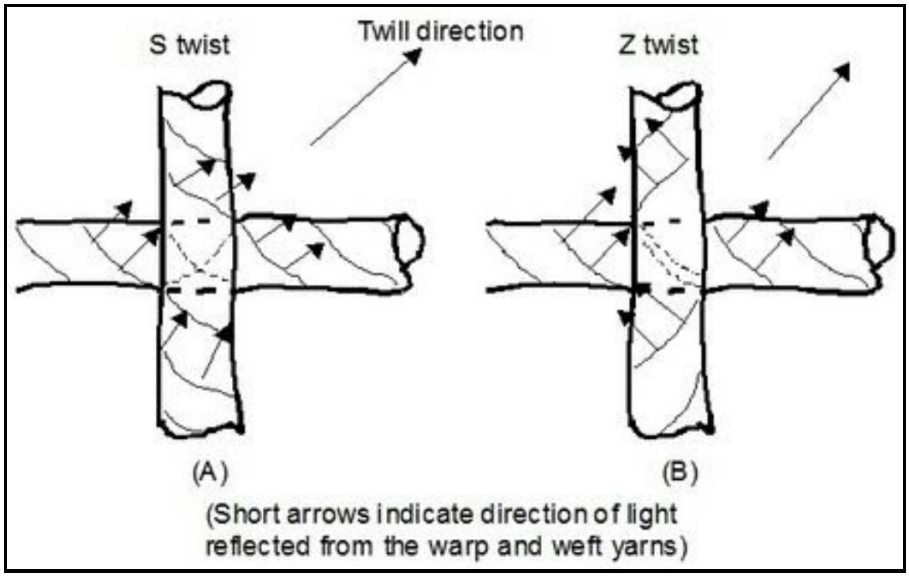


FIGURE 1TWILL WITH DIFFERENT YARN TWIST DIRECTIONS

Above figure 2 shows two identical twill weave fabrics with warp yarn of different twist directions. Fabric A will be more lustrous than fabric B, because light reflected by the fibers in warp and weft is in same direction. Fabric A will be softer while fabric B will be firmer, because in fabric B the surface fibers on the warp and weft in the region of contact are aligned in the same direction and they may 'get stuck' inside each other and reduce mobility of the intersection. Whereas for fabric A, the surface fibers on the warp and weft are crossed over in the region of contact and they can move about easily. The freedom of movement at the yarn intersections is the key for fabric softness. The above example demonstrates that there is effect of twist direction on fabric properties.

Material and methods:

Fabric preparation*:* The yarns manufactured on Savio and TFO was taken for manufacturing the fabric with EPI 60 and PPI 50 for plain woven fabric. In this research following six number of samples were manufactured for testing the effect of ply yarn twist direction.

TABLE 1 FABRIC SAMPLES

Sample	Warp Yarn	Weft Yarn
S1	1(S/Z),1(Z/S)	S/Z
S2	1(S/Z),1(Z/S)	Z/S
S3	2(S/Z),2(Z/S)	S/Z
S4	2(S/Z),2(Z/S)	Z/S
S5	1(S/Z),1(Z/S)	1(S/Z),1(Z/S)
S6	2(S/Z),2(Z/S)	1(S/Z),1(Z/S)

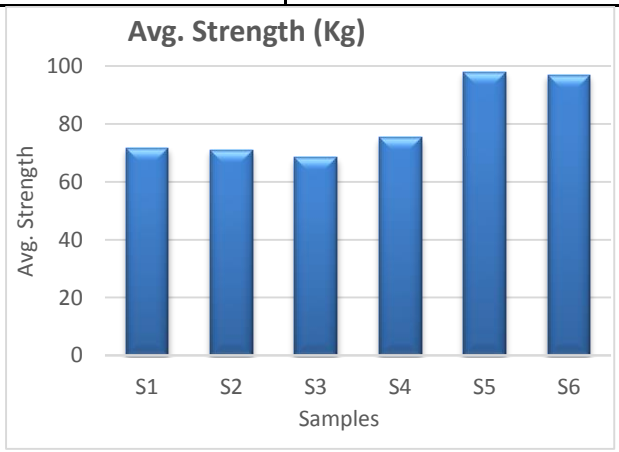
Result and Discussions:

1) Fabric Strength:

The fabric strength is mainly decided by the strength of yarns from which it is made as well as by the fabric construction. Some new fabric constructions are prepared with combination of different directionally twisted pied yarns. The fabric samples prepared with above mentioned warp and weft thread combinations are tested for fabric tensile strength and the average fabric strength is tabulated in the following table no 2.

TABLE 2 AVG. YARN STRENGTH

Sample	Avg. Strength (Kg)
S1	71.66
S2	70.00
S3	68.30
S4	75.33
S5	98.00
S6	97.00



GRAPH 1 YARN AVERAGE STRENGTH

The above table 1 and graph 1 reveals that, for the fabric samples S5 & S6 the tensile strength is found to be more than that of the other fabric samples because the samples S5 & S6 are manufactured with the continuous alternate combination of S/Z & Z/S ply twisted yarns in both warp and weft directions which leads to supporting action of the adjutant threads this phenomenon is called as fabric assistance i.e. fabric assistance will increase.

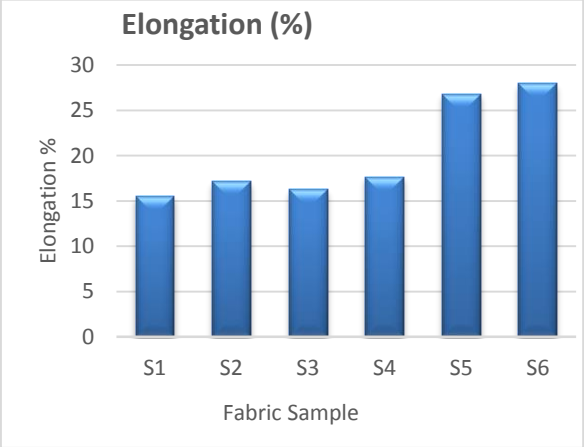
By the statistical analysis the 'P' value for Sample (S1, S2, S3, S4) and sample (S5, S6) is 7.94E-07 which is less than 0.05 that means there is significant difference between the average fabric strengths of Sample (S1, S2, S3, S4) and sample (S5, S6).

2) Fabric Elongation:

The different fabric samples prepared with the combination of different directionally twisted pied yarns are taken for measuring the elongation at break of the fabric. The fabric percentage elongation is very important for deciding the various important properties of the fabric. Higher the elongation better the properties of the fabric.

TABLE 3 AVG. YARN ELONGATION

Sample	Elongation (%)
S1	17.50
S2	19.15
S3	16.30
S4	17.65
S5	26.80
S6	28.00



GRAPH 2 YARN ELONGATION %

From the above table no 3 and graph 2 it is found that, the samples (5) and (6) are manufactured with the continuous alternate combination of S/Z & Z/S ply twisted yarns in both warp and weft directions shows more breaking elongation as compared to all other fabric samples. This is due to the fact that the different directional twisted yarns supports the neighboring threads during the elongation of the fabric before break which leads to increase in total fabric breaking elongation.

The 'P' value for the average elongation of Sample (S1, S2, S3, S4) and sample (S5, S6) is 1.894E-07 which is less than 0.05 this shows that, there is significant difference between the average elongation of Sample (S1, S2, S3, S4) and sample (S5, S6).

Conclusion

The fabric samples prepared with the double yarns of S/Z and Z/S alternately both is warp and weft directions do not shows significant difference in both fabric strength and breaking elongation.

Fabrics with alternate [1(S/Z), 1(Z/S)] and [2(S/Z), 2(Z/S)] yarns both in warp & weft shows more strength and elongation as compared to all other fabric samples. Even these fabric samples shows better fabric strength and elongation this fabric manufacturing is complicated and time consuming for the preparation of wears beam as well is difficulty during the drawing-in process.

References

1. M. Mollanoori, A. Alamdar-Yazdi "Twist Direction Effect on the Mechanical Properties of Woven Fabric".
2. N R Halari1, A K Rakshit1, S K Chattopadhyay2 & M Bhowmick "Effect of twist level and twist direction of core (double) yarn on dref-3 spun yarn".
3. Pelin Gürkan Ünal "Investigation of Some Handle Properties of Fabrics Woven with Two Folded Yarns of Different Spinning Systems".

4. Ayano banale & chattopadhyay ‘effect of yarn twisting and de-twisting on comfort characteristics of fabrics’ IJFTR
5. Pan N, Young Yoon M, Behavior of Yarn Pullout from Woven Fabrics. Textile Research Journal, 1993, 629-637.
6. R.N. Narkhedkar, Influence of twist direction on tensile properties of double yarns, Textile Asia, Nov-Dec, 34-36.
7. Zhang YT, Xu JF, Buckling analysis of woven fabrics under simple shear along arbitrary directions. Textile Research Journal, 2002, 147-152.