

Effect of Fibre Blend Ratios on Yarn Properties

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Abstract: Yarn properties can be altered through blending fibres. According to the requirement different properties can be achieved by different blending ratios. Among the different blends cotton and polyester, cotton and wool, wool and acrylic, cotton and nylon, jute and acrylic, cotton and rayon etc are common. Flax and polyester has been a popular blend now-a-days and depicts excellent properties than their individual yarn properties. Different proportion of flax and polyester has been tested to observe the yarn properties and it is found that polyester was perfectly fits with low proportion of flax. Their blends with specific ratios exhibit excellent properties which hence ultimately contribute to the fabric properties.

Index term: Polyester, Flax, blend, imperfection, hairiness.

1. Introduction:

According to W. Klein (2010), neither natural nor man-made fibres are optimally suited to certain fields of use, but a blend of these two fibre types can give the required characteristics. In such cases, a blending step is the obvious solution. The proportion of products made of blended yarns is therefore continually increasing. Furthermore, blending is not confined to the mixing of natural fibres with man-made fibres; blends of different types of man-made fibres are also on the increase. In Central and Northern Europe, more than one-third of all fabrics produced now consist of two or three fibre components, and in the USA the proportion is much higher.

The circumstances in which a blend becomes advisable and the appropriate proportions depend upon the properties required in the end product. Professor Krause (ETH, Zurich) cites the properties shown in Fig. 1 as important in relation to outerwear.



Figure 1. Some requirements for outer-clothing fabrics

From the point of view of aesthetic (visual/handle properties), the main factors are:

-Surface structure

-Luster
-Volume
-Weight
-Stiffness.

The chief functional demands are:

-effectiveness for purpose
-comfort
-easy care
-physiological optimization

The economic factors are:

-use life
-price
-used value.

It has been suggested by W. Klein that when two fiber components are brought together, each will contribute characteristics that are advantageous and less advantageous for the purpose. These individual characteristics exert a greater or smaller influence depending upon the blend properties of the components. If both the requirements of the end product and the fiber properties are known, then the optimal blending proportions can be approximately determined. This can be illustrated by the examples shown in fig. 26, taken from Dr. Albrecht.

Common blends:

Polyester fibre/cotton

(85/15); (65/35); (67/33); (50/50); (45/55)

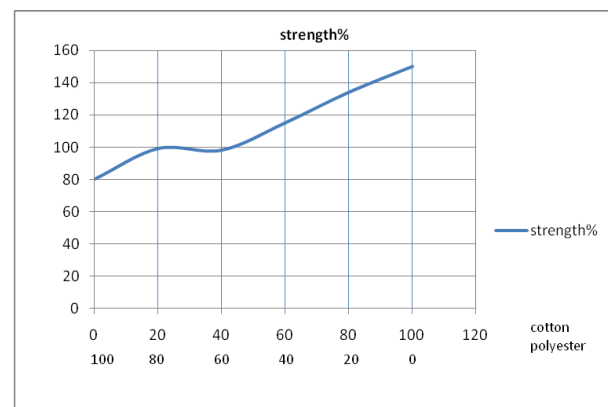


Figure 2. Yarn strength and blend ratios (%) of cotton and polyester fibre.

Polyester fibre/Modal fibres

65/35

Polyester fibre/Viscose

67/33

Acrylic fibre/Cotton

85/15; 70/30; 50/50

Hoechst quotes the relationship in Fig. 2 between yarn strength and blend ratios (%) of cotton (combed) and polyester fibre.

2. Methodology:

2.1 Materials: Polyester and flax

26's, 30's and 34's count yarn with different blend ratios, for example; 85/15, 80/20 and 50/50 etc.

2.2 Machine: Uster tester: (Uster Evenness Tester)

The instrument or M/C, Uster Evenness Tester or Uster Tester is used to measure or calculate the unevenness (U %), co-efficient of variation of mass (CVm %), yarn hairiness, imperfection index (IPI) and thick, thin place, neps etc of yarn and roving sliver. The evenness of yarn is an important index of quality control of textiles, so the researches about the yarn evenness test method have been the hotspot in the textile measurement for recent years. The evenness of yarn is one of main indexes to measure the quality of yarns. The unevenness of yarns will deteriorate the mightiness of yarns, and increase the end breakage rate in the spinning, and the increase of the end breakage rate will directly limit the speed of the machines and reduce the productivity. In addition, the unevenness of yarns will seriously influence the appearance quality of textiles.

Raw material as well as spinning problem can be detected by the measurement of yarn unevenness which is done by Uster evenness tester or uster tester-5. The quality parameter is determined by a capacitive sensor. In this case the yarn, roving or sliver is passed through the electric field of a measuring capacitor. Mass variation of the material causes the disturbance of the electric field which is converted into electric signal. That is proportional to the mass variation of the material. The unevenness is recorded as a diagram.

Hairiness is a measure of the amount of fibers protruding from the structure of the yarn. In the past, hairiness was not considered so important. But with the advent of high-speed looms and knitting machines, the hairiness has become a very important parameter.

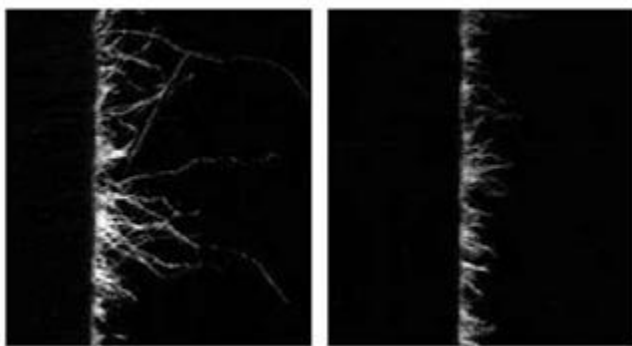


Figure 3. Hairiness of yarn

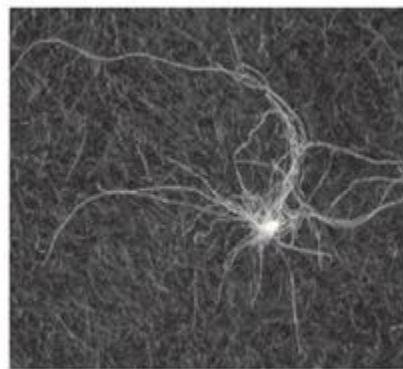
In general, yarn spun with Indian cotton show high level of hairiness due to the following reasons.

- High short fiber content in mixing.
- Low uniformity ratio.
- High spindle speeds.

Hence most of the Indian yarns have a hairiness index above 50% Uster standards. Uster Hairiness Index is the common method followed in India. The hairiness index H corresponds to

the total length of protruding fibres within the measurement field of 1cm length of the yarn. Uster hairiness index give the total length of hairs.

The general definition of neps is 'hopelessly entangled masses of fibres' (figure-4). The appearance of common neps on yarns and fabrics is shown in figure-4. Neps may be further categorized into 'seedcoat neps' – which have a piece of the seedcoat attached to the fibres (figure-5) – and 'shiny neps' – which consist of dead fibres, with insufficient cellulose to even absorb dye (figure- 5). If neps are incorporated into the yarn, it is quite likely they will survive into the fabric. Generally, if neps exceed a fairly low threshold, the resulting fabric is not suitable for high-value textile products. Thin place and thick place were measured per kilo and 3 kilometers were taken for 3 samples.



Source: International Textile Center.

Figure 4. A nep in the raw cotton

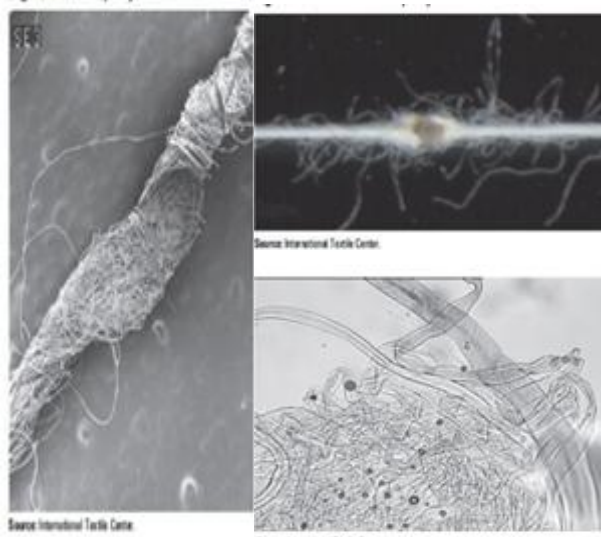


Figure 5. Neps in the yarn

We have calculated the hairiness and unevenness of selected samples; shown below

26's, 30's and 34's count yarn with different blend ratios, for example; 85/15, 80/20 and 50/50 etc. Uster evenness tester will count unevenness (U%), yarn hairiness, imperfection index, and thick and thin place, neps of yarn.

3. Data and Result:

Table 1: CV% for different count of Polyester-flax blended yarn

count	85/15	80/20	50/50
26'S	20.25	21.64	30.59
30'S	20	21.59	31.08
34'S	21.75	23.93	33.2

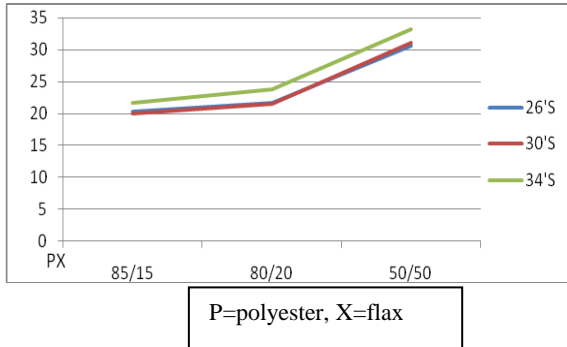


Figure 6. Co-efficient of variation of polyester & flax blended yarn in different count.

From the fig-6, it is found that CV% of 26'S count, 85/15 polyester and flax blend yarn is 20.25. It gradually increases for 80/20 ratio which is exactly 21.64 and pick at 30.59 with 50/50 blend ratio. It is clear from the above figure that CV% is higher for high proportion of flax in polyester and flax blend. It continues for 30'S and 34'S count in the same way.

Table 2: Unevenness or U% for different count of Polyester-flax blended yarn

count	85/15	80/20	50/50
26'S	15.19	16.34	23.53
30'S	15.01	16.92	24.39
34'S	16.16	17.89	25.42

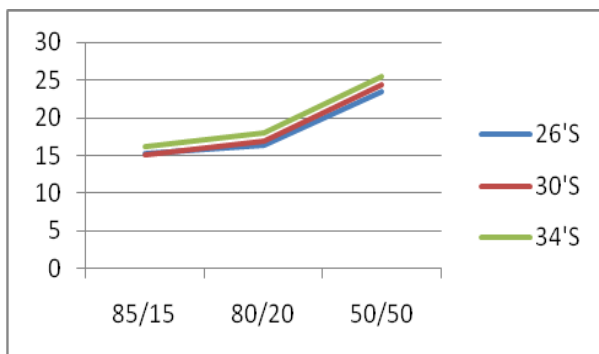


Figure 7. Unevenness of polyester & flax blended yarn in different count.

From the fig-7, it is found that U% of 26'S count, 85/15 polyester and flax blend yarn is 15.19. It gradually increases for 80/20 ratio which is exactly 16.34 and pick at 23.53 with 50/50 blend ratio. It is clear from the above figure that CV% is higher

for high proportion of flax in polyester and flax blend in case of 30's as well as 34's count.

Table 3: Hairiness for different count of Polyester-flax blended yarn.

count	85/15	80/20	50/50
26'S	5.51	5.92	7.93
30'S	.24	5.69	7.04
34'S	4.99	5.37	6.86

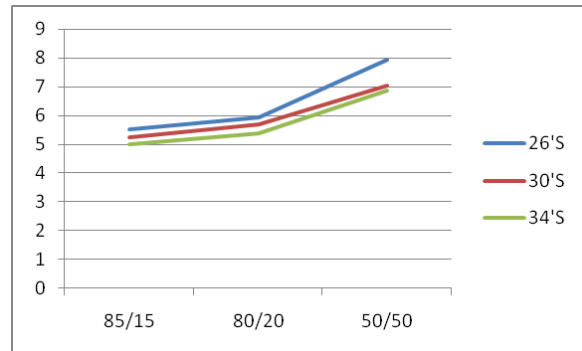


Figure 8. Hairiness of polyester & flax blended yarn in different count.

From the fig-8, it is found that Hairiness of 26'S count, 85/15 polyester and flax blend yarn is 5.51. It gradually increases for 80/20 ratio which is exactly 5.92 and pick at 7.93 with 50/50 blend ratio. It is clear from the above figure that hairiness is higher for high proportion of flax in polyester and flax blend ratio. The same trend follows for 30's as well as 34's count.

Table 4: Neps per kilometer for different count of Polyester-flax blended yarn

count	85/15	80/20	50/50
26'S	3685	3779	9108
30'S	3407	5966	10645
34'S	4213	5412	11380

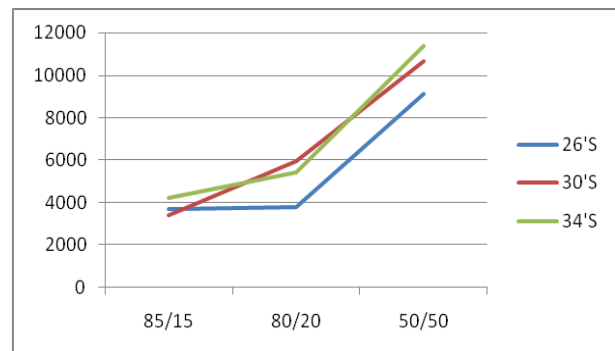


Figure 9. Neps of polyester & flax blended yarn in different count.

From the fig-9, it is found that Neps of 26'S count, 85/15 polyester and flax blend yarn is 3685. It gradually increases for 80/20 ratio which is exactly 3779 and pick at 9108 with 50/50 blend ratio. It is clear from the above figure that neps are higher

for high proportion of flax in polyester and flax blend ratio. The same trend follows for 30's as well as 34's count.

Table 5: Thick place per kilometer for different count of Polyester-flax blended yarn.

count	85/15	80/20	50/50
26'S	1677	1841	4280
30'S	1492	2854	4673
34'S	2016	2483	5062

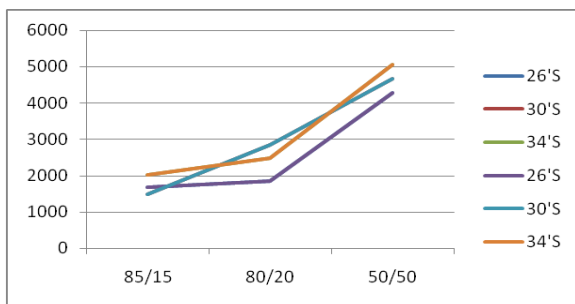


Figure 20. Thick place of polyester & flax blended yarn in different count.

Table 6: Thin place per kilometer for different count of Polyester-flax blended yarn.

count	85/15	80/20	50/50
26'S	339	704	4939
30'S	56	359	3451
34'S	173	485	4031

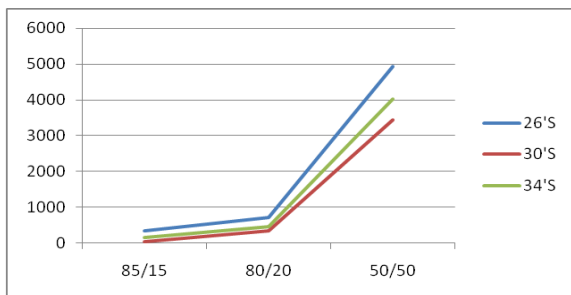


Figure 11. Thin place of polyester & flax blended yarn in different count.

As we witnessed, thick and thin place follows the previous quality parameter. With the higher value of flax in polyester and flax blend ratio we find more thick and thin place for 26'S, 30'S and 34'S count.

4. Conclusion:

In the bottom line, it is clear that with the more percentage of flax in polyester and flax blend ratios yarn irregularities are higher. Polyester is better compatible with lower proportion of flax in their ratios hence exhibits suitable performance. The reason could be the properties of flax which is fixed naturally. Thereafter the high proportion of flax is not compatible with polyester.

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