Investigation of Inter Fiber Cohesion in Yarns. II. Influence of Fiber and Process Parameters on the Cohesion in Man Made and Blended Yarns

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Abstract: This paper discusses the inter fiber cohesion in man made and blended yarns. The fiber parameters such as fiber length and fineness influence the cohesion. Studies have been focused on polyester and viscose spun yarns. Though polyester and viscose yarns show similar trend in cohesion, viscose yarns exhibit better cohesion due to their serrated cross section. Studies on the effect of blend proportion of polyester cotton and polyester viscose yarns reveal that increase of polyester and viscose in the respective blends improve the inter fiber cohesion.

Keywords: Blend, Cohesion, Polyester, Twist multiplier, Viscose

Introduction

In the previous paper [1], the effect of some important spinning parameters on the inter fiber cohesion in cotton yarns have been discussed. This paper investigates the influence of fiber and process parameters that are found to affect the inter fiber cohesion in man made and blended yarns. The study is focused on polyester and viscose blended yarns. The influence of fiber type and cross section is also investigated. Barella [2,3] in his work has made only a generalized study on the cohesion phenomenon in cotton yarns. No further study has been done beyond this ever since. However, recently, elaborate studies have been done on cotton yarns [4,5]. In this article an effort has been made to study the inter fiber cohesion in man made and blended yarns.

Materials and Methods

The yarn samples of 20 tex have been used in the study. These include 100 % polyester spun yarn, 100 % viscose spun yarn, Polyester/cotton blended yarn as well as polyester viscose blended yarns with blend proportions of 50/50, 65/35 and 75/25 respectively.

In order to study the influence of varying fiber length and denier in the 100 % polyester and viscose yarn samples, the fiber lengths and deniers chosen are 1.0 D × 32 mm, 1.2 D × 38 mm, 1.4 D × 38 mm, and 1.4 D × 44 mm respectively.

In studying the influence of the twist multiplier on the cohesion of 100 % polyester spun yarns, the TM levels used are 3.0, 3.1, 3.2, and 3.3. In the case of 100 % viscose spun yarns, the TM levels used are 2.7, 2.8, 2.9, and 3.0.

The yarns have been tested for cohesion in terms of the minimum twist of cohesion (MTC) following the method discussed in the preceding paper [1].

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Results and Discussion

Influence of Twist Multiplier (TM) on MTC

The influence of varying TMs on the MTC of polyester spun yarns is shown in Table 1. It can be observed from the Table that as the TM increases, the MTC decreases, indicating better inter fiber cohesion. This can be ascribed to the better gripping of fibers at higher TM. Increase in twist tends to bring the fibers closer together and thereby increase the packing density of the fibers in the yarn.

The influence of varying TMs on the MTC of viscose spun yarns is shown in Table 2. It can be observed from the Table that the MTC of 100 % viscose yarn showed similar

Table 1. Influence of TM on MTC of 100 % polyester yarn

S. no	Type of material	Fiber specifications	Yarn tex	TM value	MTC value*
1	100 % polyester	1.2 D × 38 mm	20	2.7	95
2	100 % polyester	1.2 D × 38 mm	20	2.8	89
3	100 % polyester	1.2 D × 38 mm	20	2.9	85
4	100 % polyester	1.2 D × 38 mm	20	3.0	82

*Mean of 20 readings.

Table 2. Influence of TM on MTC of 100 % viscose yarn

S. no	Type of material	Fiber specifications	Yarn tex	TM value	MTC value*
1	100 % viscose	1.2 D × 32 mm	20	3.0	88
2	100 % viscose	1.2 D × 32 mm	20	3.1	84
3	100 % viscose	1.2 D × 32 mm	20	3.2	81
4	100 % viscose	1.2 D × 32 mm	20	3.3	79

trend as that of 100 % polyester yarn. However, the lesser value of MTC in the viscose yarn reflects better cohesion as compared to polyester yarn. This is because of the multilobal or serrated cross section of the viscose fiber which generates higher frictional forces between the fibers and thus enhances the inter fiber cohesion in viscose yarns.

Influence of Fiber Fineness and Staple Length on MTC

The influence of denier and fiber length on the MTC of 100 % polyester spun yarn is shown in Table 3. It can be observed from the Table that fiber having 1.2 denier and 32 mm length gives the least cohesion, i.e., highest value of MTC. It can be seen that polyester fiber having 1.4 denier and 38 mm staple length shows lesser cohesion as compared with the previous sample, i.e., 1.2 denier and 38 mm. It means that for a given fiber length, the higher is its denier, then higher will be the MTC value, which implies that the cohesion is lesser. This is because of the fact that finer fiber provides more surface area and thereby increases the frictional resistance. In addition finer fibers lead to higher yarn packing density due to better migration. It can also be seen from the Table that sample having 1.4 denier and 44 mm gives better cohesion as compared with the sample of 1.4 denier and 38 mm. Longer fibers have more number of contact points and thereby give better cohesion.

The influence of denier and staple length on the MTC of 100 % viscose spun yarn is shown in Table 4. It could be seen that though polyester and viscose yarns showed the same trend with regard to the influence of fiber length and denier, viscose showed better cohesion due to the presence of serrated cross section.

Influence of Various Cross Sections of Fibers

Trilobal and circular cross sectional fibers have been compared for the cohesion and this is shown in Table 5. From the Table it can be inferred that fibers having trilobal cross section has better cohesion as compared with circular cross section. This can be ascribed to the fact that for a given fiber fineness, trilobal shaped fibers provide more surface area compared to circular fibers. Therefore, trilobal shaped fibers give higher frictional resistance.

Table 3. Influence of fiber length and fineness on MTC of 100 % polyester yarn

S. no	Type of material	Fiber specifications	Yarn tex	TM value	MTC value*
1	100 % polyester	1.2 D × 32 mm	20	2.9	94
2	100 % polyester	1.2 D × 38 mm	20	2.9	89
3	100 % polyester	1.4 D × 38 mm	20	2.9	91
4	100 % polyester	1.4 D × 44 mm	20	2.9	85

Table 4. Influence of fiber length and fineness on MTC of 100 % viscose yarn

S. no	Type of material	Fiber specifications	Yarn tex	TM value	MTC value*
1	100 % viscose	1.2 D × 32 mm	20	3.0	88
2	100 % viscose	1.2 D × 38 mm	20	3.0	83
3	100 % viscose	1.4 D × 38 mm	20	3.0	86
4	100 % viscose	1.4 D × 44 mm	20	3.0	79

Table 5. Comparison of the cohesion values of circular and trilobal polyester fibers

S. no	Type of material	Fiber shape	Yarn tex	MTC value*
1	100 % polyester	circular	20	91
2	100 % polyester	trilobal	20	82

Influence of Blend Type

The influence of the type of blend on the MTC of yarn is shown in Table 6. From the Table it can be seen that polyester viscose blend gives better cohesion as compared with polyester cotton blend. The better cohesion in the polyester viscose blend could be due to the contribution of the viscose component in the blend. As viscose fibers have a serrated cross section, the frictional resistance of viscose fiber is better as compared with the cotton fiber. Furthermore, the average length of viscose fibers is greater than that of cotton fibers.

Effect of Blend Ratio

The influence of blend ratio of the blended yarns is shown in Table 7. From the Table it could be seen that with the decrease in the percentage of polyester component, the cohesion of fibers in the yarn improves. Though both polyester-cotton and polyester-viscose blend yarns show almost the same trend for different blend proportions, polyester-viscose yarn shows better results. This may be explained to the same reason ascribed in the preceding section.

Table 6. Influence of type of blend on MTC of yarn

S. no	Type of blend	Yarn tex	MTC value*
1	Polyester cotton (50/50)	20	97
2	Polyester viscose (50/50)	20	89

Table 7. Influence of varying blend proportion on MTC

S. no	Type of blend	Blend proportion	Yarn tex	MTC value
1	Polyester viscose	75:25	20	102
2	Polyester viscose	65:35	20	91
3	Polyester viscose	50:50	20	87
4	Polyester cotton	75:25	20	105
5	Polyester cotton	65:35	20	96
6	Polyester cotton	50:50	20	91

Table 8. Influence of fiber type on MTC

S. no	Type of material	Yarn linear density, tex	MTC value
1	100 % cotton	20	105
2	100 % polyester	20	97
3	100 % viscose	20	83

Effect of Fiber Type

The influence of the type of fiber on the MTC of yarn is shown in Table 8. From the Table it can be seen that the MTC value in the case of cotton is the maximum, which suggests that yarn made from cotton fibers have the least cohesion. This may be due to the effect of average fibre length on cohesion. Cotton fibre having lesser average fibre length results in lower value of cohesion. The inter fiber cohesion in the case of viscose fiber is the best, even better than that found in the polyester fiber. This is due to the multilobal cross section of the fiber, which increases the frictional resistance between the fibers in the yarn.

Conclusions

The studies reveal the following results: The cohesion increases with increase in TM. Though both polyester and viscose yarns show similar trend, viscose yarns exhibit better cohesion in comparison with polyester yarns. Longer and finer fibers give better cohesion. Trilobal polyester gives better cohesion as compared with circular one. For a given blend proportion, polyester viscose yarn gives better cohesion as compared to that of polyester cotton yarn. Increase in the percentage of polyester component in the blend reduces the inter fiber cohesion. Viscose yarns give the best inter fiber cohesion in comparison with that of polyester and cotton.

References

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