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Influence of Optimal Spacer Size on CVC Blended Yarn Properties at Ring Frame

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KEYWORDS

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U%
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Hairiness

ABSTRACT

It is a great challenge for textile spinners to ensure the quality of ring-spun blended yarn (CVC) with smooth production. 30 Ne blended yarn (Cotton and polyester at the ratio of 60/40) was produced during this research work because it is a more frequently used count for blended yarn. Different parts of the Ring Frame influence the quality of yarn. Among them, the role of the spacer is significant as it controls the movement of fiber during drafting at Ring Frame. This study introduced three spacers of different sizes (2.3 mm, 3.1 mm and 5.1 mm) by keeping the same raw materials and setting parameters for mentioned yarn count. Spacer size 3.1 mm showed the outstanding properties of yarn in terms of unevenness, imperfections and hairiness compared to the other spacer sizes. There is no significant changes in the blend ratio for changing the spacer. This work has the potential to select the appropriate spacer size (mm) that will help textile technologists during decision-making.

1. INTRODUCTION

The demand for blended fabric is increasing day by day. To meet this demand, first, is needed to produce blended yarn. Yarn is a product of substantial length and a relatively small cross-section consisting of fibers or filaments with or without twist[1][2].

Ensuring the quality of the blended yarn is a great challenge to textile engineers. Different yarn counts are being produced for blended yarn (CVC). Among them, 30 Ne blended yarn count is more demandable[2]. A ring Spinning machine is used in the textile industry to convert staple fibres into yarn; a ring spinning machine is very important for converting roving into yarn. Approximately 85% of yarns are produced in ring spinning frames worldwide[3]. Machine parts are responsible for influencing the yarn properties with different setting parameters[4]. Among them, the size of the spacer is remarkable.

Every apron drafting system works with an apron, spacer, tensor bar or platform bar. They are in different shapes and designs, with the common objective of providing a certain gap or space between the top and bottom aprons so that the strands of fibers have some controlled freedom[5].

This research has tried to show how spacer size influences the properties of yarn and which spacer size is suitable for 30 Ne blended yarn (CVC) quality. To guide the fibers, the upper apron must be pressed against the lower apron with controlled force. For this purpose, a controlled spacing between the two aprons is needed at the delivery[6].

In the ring frame, the spacer controls the movement of fibres during drafting. It also maintains the proper distance between the top and bottom aprons to overcome the negative effect of short fibers.

The ring frame spacer sizes are to be decided according to the yarn count to be span because yarn count decides the bulk of fiber material between the two aprons during drafting. Generally, the spacer size is nearly proportional to the yarn count. Evenness and total imperfection index (IPI) could be improved by closing the apron spacing[3].

But before selecting the appropriate ring spacer size, different quality parameters such as IPI, U%, and hairiness should be considered. If U% increases, the quality of yarn decreases, creating problems for the fabric manufacturer. On the other hand, yarn hairiness is an important quality parameter. When yarn hairiness increases, fabric pilling increases as pills form due to the migration of fibres from the constituent yarns in the fabric[7]. The uniform mixing status of the produced yarns were assessed 70% H_2SO_4 Solution[10].

Figure01: Different spacers used in Ring Frame[8].

The main purpose of this research is to decide which spacer to use for bulk production of 30 Ne blended yarn (CVC) that is suitable for textile yarn manufacturers in terms of overall quality.

2. MATERIALS AND METHODS

Cotton and polyester fibres were used at the ratio of 60/40. CIS cotton and Polyester fibres were used to produce yarn. Then raw cotton was tested under the standard atmospheric condition at 20° ± 2° temperature and 65% ± 2% relative humidity on HVI (High Volume Instrument) machine. After that, cotton and polyester were mixed at the ratio of 60/40 and also produced roving by as usual spinning process used for the manufacturing of yarn (blended). Then yarn was produced from the ring frame by changing the different spacer but without changing the other setting parameters[9] All the produced samples of yarn were then tested in Uster Evenness Tester, and finally, it was possible to reach a clear conclusion by evaluating all the test results.

Table 01: Properties of raw cotton

Cotton Fiber Quality Parameters	Mean Value
Micronaire value (μ/inch)	4.54
Upper Half Mean Length(mm)	28.68
Strength (g/tex)	30.6
Uniformity Ratio (%)	81.8
Elongation (%)	6.71
Maturity Ratio	0.89
R_d	80.5
+b	10.2
SFI (Short Fibre Index)	8.2

Table 02: Specification of polyester

Fibre fineness	Cut length	Origin	Supplier
1.4 denier	38 mm	Thailand	Indorama Polyester

Table 03: Different setting parameters of Ring Frame for 30/1 Ne blended yarn (carded)

Setting parameters of Ring Frame	For 30/1 Ne blended yarn(carded)
Roving count	0.75 Ne
Draft	41.86
TPI (Twist Per Inch)	19.10
Average Spindle speed (RPM)	10000
Ring Diameter (mm)	40

3. RESULTS AND DISCUSSIONS

Table 04: Effect of different spacers on yarn quality:

S.L no.	1	2	3
Spacer Size (mm)	Yellow (2.3mm)	White (3.1mm)	Beige (5.5 mm)
Blend Ratio (cotton/polyester)	60/40	60/40	60/40
Avg. U%	11.15	11.41	11.47
Avg. CV_m%	14.29	14.61	14.67
Thin (-50%/ km)	2.8	1.8	00
Thick (+50%/km)	172.7	190.5	191.1
Neps	345.8	341.5	351.5

(+200%/km)			
(Imperfection Index)IPI	521.3	533.8	542.6
Avg. Hairiness	6.67	6.25	5.91
Actual Blend Composition	59.5:40.5	60.3:39.7	60.1:39.9

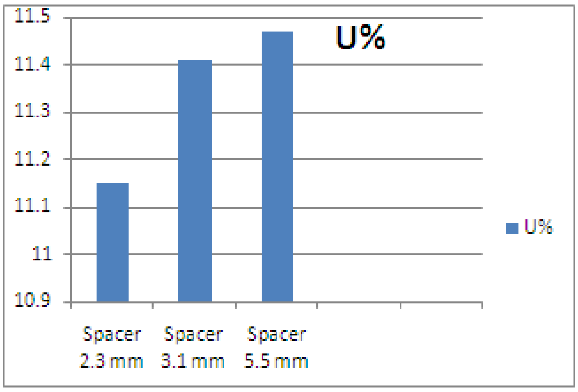

Figure 02: Spacer size Vs. U%.

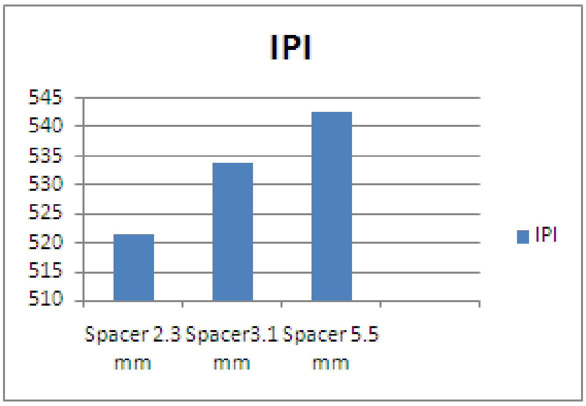

Figure 03: Spacer size Vs. IPI.

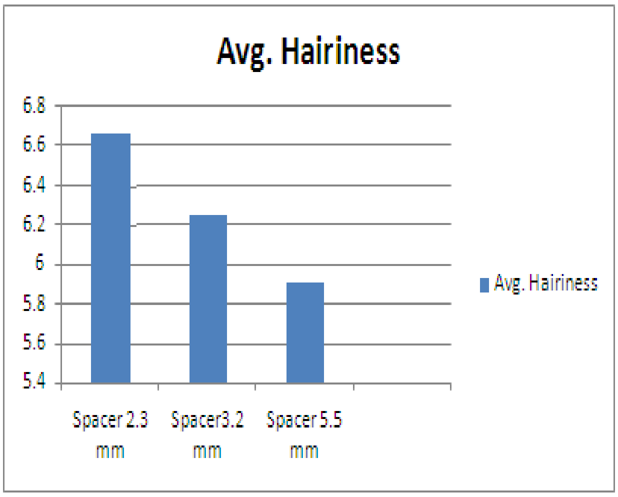

Figure 04: Spacer size Vs. Avg. Hairiness.

From figures 02 & 03, it is found that with the increase of spacer size, the U% and IPI values are also increasing. From that point of view, 2.3 mm is suitable. But from figure-04, it can be seen that the decrease in spacer size increases the hairiness value, which is detrimental to ensuring yarn quality. After all, when the spacer size 3.1 mm is used, the U%, IPI and Avg. hairiness value stays within acceptable limit. So a 3.1 mm spacer is more suitable.

4. CONCLUSION

This research paper directly reveals the influences of different spacer sizes on blended yarn (CVC) quality. The results confirm that a 3.1 mm spacer is more suitable for 30 Ne (CVC) yarn as it controls the movement of fiber strands, especially floating fibres, during drafting. It is also found that a 3.1 mm spacer size ensures the acceptable hairiness and regularity of blended yarn (CVC) of 30 Ne. This research deals with more frequently used yarn (blended) count. It will benefit textile technologists to ensure quick decision-making and acceptable quality and productivity.

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