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EFFECT OF DELIVERY SPEED OF WINDING MACHINE ON YARN HAIRINESS

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ABSTRACT

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The speed of winding machine plays a significant role on increase in hairiness. The increase in winding speed leads to direct increase in the hairiness. 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. We were processing the yarn on winding machine at different delivery speed and found that the low delivery speed caused less hairiness. The hairiness increases more and more with the increase in the winding speed. However it is not economically feasible to run the auto cone machine at slow speed just for achieving lesser hairiness.

***Key words**: delivery speed, yarn clearer, winding machine, yarn hairiness*

INTRODUCTION

Yarn hairiness is a complex concept, which generally cannot be completely defined by a single figure. The effect of yarn hairiness on the textile operations following spinning, especially weaving and knitting, and its influence on the characteristics of the product obtained and on some fabric faults has led to the introduction of measurement of hairiness. The yarn hairiness can either be a desirable or an undesirable property, so that its measurement and control are important (Barella 1966). Hairiness occurs because some fiber ends protrude from the yarn body, some looped fibers arch out from the yarn core and some wild fibers in the yarn. The number of protruding ends is independent of twist, whereas the number of loops decreases when the yarn twist increases because of a greater degree of binding between the fibers owing to twist (www.cottonyarnmarket.net). Hairiness keeps important role for producing quality yarn. Yarn hairiness is determined by the number of fiber ends that protrude from the surface of the yarn. Hairiness value difference influence the fabric appearance in similar way like weight variation. High hairiness causes pilling on fabric. The protruding fibers generally add to the pilling propensity of the fabric because the protruding ends have a tendency to get entangled and form a pill (Smith 2001). Yarn hairiness also affects fabric hand. The protruding ends may make the fabric rougher. Hairiness imparts fuzzy appearance to the yarn and reduces the luster of the yarn. Hairiness affects proper sizing of the yarn. Hairiness causes more end breakages during weaving.

The function of winding m/c is to wind the small size of yarn (40-50 grams approx.) from ring cops to cone by using yarn clearer for producing large size of finished cone (2083 grams approx.). To eliminate the objectionable yarn faults from ring cops to cone is the function of yarn clearer. The device that detects and removes yarn faults during winding is called a yarn clearer. Yarn clearer that are used with winding machine will detect only large defects that may adversely affect the quality of finished product. Those defects cut by yarn clearer as per setting. Delivery speed of winding machine and yarn clearer keep important role for minimizing yarn hairiness. A yarn may have a small number of long hairs or a large number of short hairs or indeed any combination in between. The problem is then which combination should be given a higher hairiness rating (Barella and Manich, 1993). So, it is required to minimize yarn hairiness for smooth running of knitting and weaving department. It has been found that the number of hairs of different lengths protruding from a yarn is distributed according to an exponential law (Ramaszeder 1988).

Ramaszeder (Hunter 1988) suggested that the single yarn could be weavable without application of sizing or doubling if a method could be found to reduce the effective length and the number of hairs on the yarn.

Hunter (www.uster.com) has stated that for cotton spun yarns the fiber parameters do not greatly influence on the yarn hairiness. Actually speed of spinning machineries greatly affect on the yarn hairiness. Delivery speed of winding machine is one of them.

The hairiness corresponds to the total length of protruding fibers within the measuring field of 1 cm length. For example hairiness 4.0, is therefore equivalent to a total fiber length of 4 cm relative to the measurement field length of 1 cm (Kalyanaraman 1992).

MATERIALS AND METHODS

The experiment was carried out at testing laboratory of Rahmat Spinning Mills Ltd., Dhaka, Bangladesh.
We have selected CIS cotton (Uzbekistan) for performing our study and tested the raw cotton by Uster High Volume Instrument (HVI) machine which are given in Table 1.

Table 1. The followings are the selected test properties of using cotton fiber: The test results were carried out at the temperature of 27±2^{0}C and R.H 65±2%

Properties	Mean value
SCI (Spinning Consistency Index)	142
Staple Length	29.5 mm
Micronaire	4.4
Strength	29.7 gm/Tex
SFI (Short Fiber Index)	6.6
CG (Color Grade)	11-3 (Good Middling White)

We have used same roving in Ring Frame machine for producing 30^S/1 Karded yarn. The ring cops were fed in winding machine for producing cone. These cones were tested by Uster tester 4.

RESULTS AND DISCUSSION

Uster test report of hairiness and other yarn quality of ring cops and cones are given in the Table 2 and 3 respectively.

Table 2. Experimental result of Uster test of ring cops and cones on Schalfhorst machine (winding machine) at the temperature of 27±2^{0}C and R.H 65±2%

Parameters	Cop Result	Winding Speed 1200 m/min	Winding Speed 1300 m/min	Winding Speed 1400 m/min	Winding Speed 1500 m/min	Winding Speed 1600 m/min
Nominal Count	30^S/1K	30^S/1K	30^S/1K	30^S/1K	30^S/1K	30^S/1K
Um%	11.68	11.65	11.65	11.34	11.58	11.51
CVm%	14.87	14.80	14.76	14.38	14.71	14.59
Thin/km (-50%)	3	5	6	4	6	7
Thick/km (+50%)	140	132	147	126	128	128
Neps/km (+200%)	180	176	168	139	187	147
Total IPI	323	313	321	269	321	282
Hairiness	3.68	4.15	4.65	4.49	4.34	4.51
Sh(-)	0.66	0.87	0.93	0.90	0.90	0.90

Table 3. Experimental result of Uster test of ring cops and cones on Savio Orion machine (winding machine) at the temperature of 27±2^{0}C and R.H 65±2%

Parameters	Cop Result	Winding Speed 1200 m/min	Winding Speed 1300 m/min	Winding Speed 1400 m/min	Winding Speed 1500 m/min	Winding Speed 1600 m/min
Nominal Count	30^S/1K	30^S/1K	30^S/1K	30^S/1K	30^S/1K	30^S/1K
Um%	11.47	11.61	11.41	12.07	11.47	11.49
CVm%	14.55	14.78	14.46	15.38	14.56	14.59
Thin/km (-50%)	5	3	4	5	3	3
Thick/km (+50%)	137	170	124	155	131	128
Neps/km (+200%)	178	197	177	171	181	168
Total IPI	320	370	305	331	315	299
Hairiness	3.84	4.18	4.38	4.36	4.39	4.39
Sh(-)	0.73	0.78	0.86	0.88	0.86	0.86

In case of Schlafhorst machine, we found from Table 2 that delivery speed of 1600 m/min increases the yarn hairiness more than that of 1200 m/min. We found from Table 3 that delivery speed of 1600 m/min of Savio Orion machine also increases the yarn hairiness more than that of 1200 m/min. So, it is clear that both types of auto cone machine increase the yarn hairiness at higher delivery speed and reduces the yarn hairiness at lower delivery speed. Actually, higher delivery speed increases yarn hairiness more due to high friction of the drum of winding machine to yarn and yarn path to yarn. So, to get better quality of yarn in respect of hairiness, auto cone machine should be run as minimum as possible.

CONCLUSION

From this study, we can conclude when delivery speed of winding machine was increasing, yarn hairiness was also increasing. So, we recommend here that delivery speed of winding machine should keep low for less hairiness but not optimum production. Yarn hairiness can be removed by following ways:

- Using longer fibers and higher twist.
- Controlling proper temperature and relative humidity during processing.
- Using proper type of ring and traveller.
- Avoiding high spindle speeds of Ring frame machine.
- Avoiding crack drafting roller and torn drafting aprons.
- Using correct setting of traveller clearer.
- Using coarse traveller instead of fine traveller.

Kalyanaraman has found that by increasing the pressure of air around the point of fiber twisting, the yarn hairiness can be significantly reduced.

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