Effect of Card Delivery Speed on Ring Yarn Quality

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Abstract

The carding process has a major influence on the sliver quality and the resulting yarn characteristics. The change in the carding process parameters directly influencing on the yarn quality and performance in fabric forming process. This study is conducted to justify the yarn quality by changing the card delivery speed. The effect of change in yarn quality analyzed by testing, the produced yarn at different delivery speed in SQC laboratory. The basic purpose of this study is to determine the carding delivery speed for normal fine yarns by using good fiber quality. Combed cotton was used to produce fine counts, i.e. Ne 60 normal yarns, spun on G331 Ring frame. Yarn produced by spinning process from the sliver collected at different delivery speed of card shows variable yarn properties w.r.t. change in delivery speed.

Keyword: Delivery speed, Count Strength Product (CSP), Single Yarn Strength (RKM), Imperfection Index (IPI), Yarn Hairiness and Elongation.

I. Introduction

The proverbs of the experts "The Card is the heart of the Spinning Mill" and "Well Carded is half spun" demonstrate the immense significance of carding for the final result of the spinning operation. [2] There is a strong relationship between an increase in production and reduction in quality: the higher the performance, the more sensitive becomes the carding operation and the greater the danger of a negative influence on quality. [3] The concept of carding machine is unchanged since 1770. Since 1965 production rate has been increased about 5 Kg/h to about 100 Kg/h, a rate of increase not matched by any other machine except the draw frame. [4] With the given set up of spinning machinery and available and raw material i.e. cotton. It is necessary for the spinner to spin best quality yarn. As all of us know that the effective and better carding means half of the good spinning. With this view in mind, a majority of the spinner wants to card at safe production rates. Does this really help? Carding is a very crucial machine where strict follow-up in terms of schedule replacement of wire and in maintenance activity like full cleaning and setting is of great importance. We know that in 3rd or 4th generation card because of the precision engineering and extra attachment like C cleaner, comb bar, licker-in carding plates, new type half closed and full closed cylinder under casing, reversal of flats and intermittent continuous removal of the waste has achieved much superior carding compared with conventional card at substantial higher production rate up to 75-100 kg per hour. In this card for better carding action cylinder speed are also maintained to the tune of 500 to 600 rpm. It was experimentally and theoretically "an increase in the liner speed of cylinder, result in an increase in the co-efficient of fiber transfer from cylinder to doffer and a decrease in the fiber lead on all section of the carding surface including flats". Carding action can be described as the combing of fibers between two surfaces, which carry a set of angled wires (card clothing) oriented in opposing directions when their relative speed is greater than zero. [1] Experiment was conduct with four different production rates, on set RIETER C60 Cards ranging from 44kg to 56 kg. The same cotton mixing processed from the blow room to ring frame.

II. Materials And Methods

The good quality cotton material (Table 1.) processed through Blow room sequence for opening, cleaning and then fed to card in lap form through Chute feed system. Card sliver collected at 4 different delivery speed keeping all other carding parameter constant. This card sliver was processed through Rieter breaker draw frame SBD-40, Unilap and comber and finisher draw frame RSB-D40. Then the single drawn sliver processed through roving frame Rieter F15 and ring frame Rieter G331; normal spinning frame operating at 20000 rpm average spindle speed. For normal spinning, both the 44 Kg/h, 48 Kg/h, 52 Kg/h and 56 Kg/h roving samples were spun into Ne 60 at a constant 33.69 TPI.

Table 1. Mixing Quality Parameters

MIXING	MECH-60 CW
Length	29.12 mm
Mic	3.42
Maturity	0.83
G/Tex	30.14
Elongation	5 %
RD	83.21
plus b	8.41
SFI	6.56

III. Process Parameters

Following tables shows spinning process parameters:

Tables 2. Shows spinning process parameters

BLOW ROOM	
Unifloc A11	
Take off roller	1500 rpm
Penetration	2 cm
Traverse speed	16 m/min
Take off depth	1.6 cm
UNIMIX B70	
Opening roller	100 rpm
Setting take off roller to lattice	26 mm
UNICLEAN B11	
Pin Roller Speed	590 rpm
Relative waste	7%
Uniflex B60	
Pin Roller Speed	590 rpm
Relative waste	7%
CARD C60	
Sliver Hk.	0.1
Cylinder / Licker speed	800/1200 mpm
F.R.Nipping distance	26 mm
Chute O/R Speed	830 rpm
Batt Wt.	500-600 g/m
Cylinder speed	800 rpm
Flat speed	0.35mt/min
Doffer speed	127,136, 147, 158 mpm
DRAW FRAME SBD 40	
Delivered Sliver Hk	0.13
Break Draft	1.4
Total draft	6.25
Delivery speed	550 mpm
Creel Tension	1.02
Funnel / Trumpet	10/4.2 mm
Doubling	5
UNILAP E32	
Lap Weight	66 kTex
Doubling	24
Full lap Length /Weight	300m /19.8 Kg
Main Draft	1.586
Break Draft	1.062
Bottom roller gauge	43/48 mm

COMBER E65	
Nipping rate/min	400
Noil	20%
Feed tension	9.10%
Feed	4.3 mm/nip
Feed plate setting	1.8 mm
Feed type	Backward
Top comb	26 needle/cm
Total draft / Break draft	14.25/1.37
Bottom roller gauge	44/51
Sliver Hank	0.13
DRAW FRAME RSB D40	
Sliver Hk	0.13
Doubling/draft	6
Break draft	1.15
Total Draft	5.74
Delivery speed	400 mpm
Creel Tension	1.02
Scanning roller mm	7
Funnel / Trumpet	8.0/3.8 mm
SPEED FRAME	
Roving Ne	1.43
Spindle speed	1200 rpm
T.M /TPI	1.35/1.617
Spacer	4.5 mm
Total Draft	9
Break Draft	1.145
Creel Tension	0.99
Floating Condenser	9 mm
False Twister - No. of Grooves / dia	12 G/ 8mm
RING FRAME	
Ring frame type	G331
Total Draft Number	45.2
BD Number	1.19
Spacer	3.0 mm
Bottom roller gauge	42.5/70, 50/72
Traveler Type	18/0CPFHRW
Spindle speed	20000 npn
T.M	4.35

IV. Result and Discussion

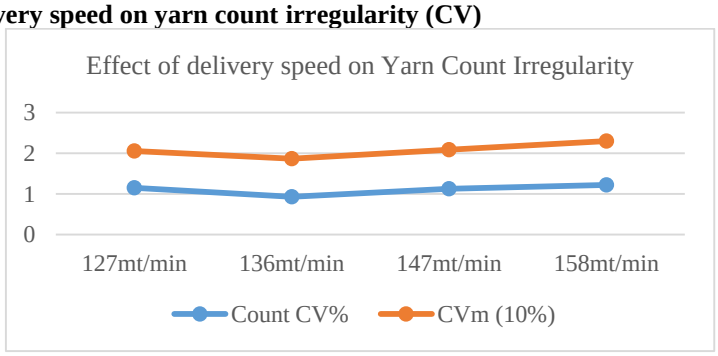
Now a day, machinery manufacturers and spinners both facing challenges for producing a fine count of yarn of high quality with high carding speed and low waste level. [5] It is more critical to achieving these challenges for cotton spinners as they have to gain this potential with significant profit. Various machine manufacturers helping to spinners for overcome challenges by proposing a unique set of developments in the technology. In this study, the effect of card delivery speed on yarn quality analyzed. The 60^s Ne count yarn produced and analyses for the

different yarn properties viz. count variation, lea strength, single yarn strength, imperfections, irregularity, and elongation. It was observed that the yarn quality data were very close to increasing card delivery speed. Comparative study of card delivery speed is shown in Table 3.

Table 3. Comparative Study of Carding Delivery Speed

Nominal count	**60^s Ne**			
Delivery speed	127mt/min	136mt/min	147mt/min	158mt/min
Count CV%	1.15	0.93	1.13	1.22
CVm (10%)	2.06	1.87	2.09	2.3
CSP	2612	2523	2630	2652
IPI	148.5	276.1	277.8	297.8
RKM	18.76	18.72	18.59	18.6
U%	10.7	11.08	11.04	11.27
Elongation	4	4.12	3.61	3.78
Hairiness Index	3.5	3.57	3.65	3.72

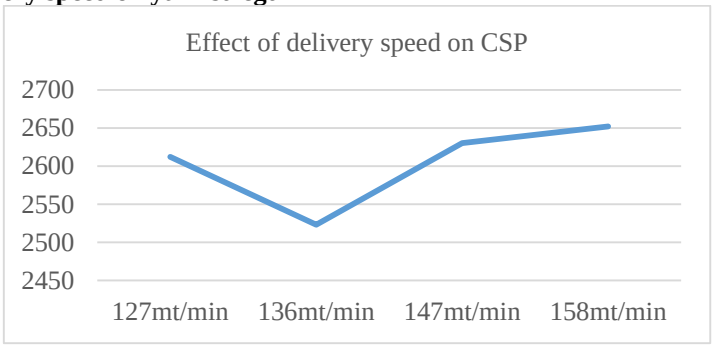
1] Effect of card delivery speed on yarn count irregularity (CV)



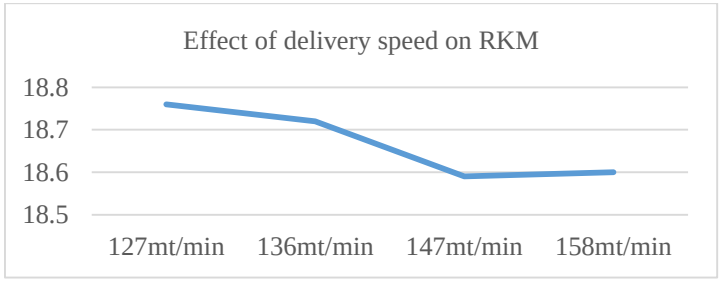
Graph 1. Effect of card delivery speed on yarn count irregularity

From the Graph 1 it is obseved that change in card delivery speed does not show any significant effect on yarn count ierregularity. Slight change is observed in yarn count irregularity. Basically, Deficiencies in machine operation or the drafting system is responsible for more or less pronounced change in cross section which leads to count variation in the resultant yarn.

2] Effect of card delivery speed on yarn stregth



Graph 2. Effect of card delivery speed on lea strength (CSP)

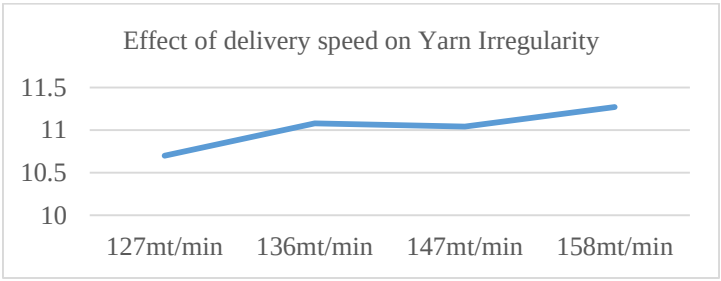


Graph 3. Effect of card delivery speed on single yarn strength (RKM)

Lea strength depends upon neither the production rate nor the doffer speed. [7] In this study, as initially increase in the speed of doffer, the CSP of yarn decreased further increase in the delivery speed leads to improvement in the lea strength. The lower delivery rate leads to poor carding action and poor collection of fibers from cylinder to doffer. Higher delivery rate improve the fiber transfer efficiency in the card. [8] From the Graph 3 it is concluded that the speed of doffer increased the RKM of yarn decreased. More fiber transfer efficiency leads to less fiber opening and parallelization in the sliver which further affect single yarn strength of the yarn.

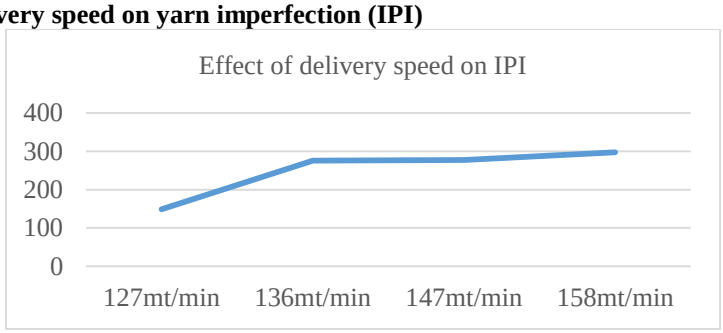
3] Effect of card delivery speed on yarn irregularity (U%)

Effect of card delivery speed and production rate does not any significant change in the yarn irregularity.[10] From the graph 4, it is conclude that yarn irregularity slightly increases with the delivery speed of the card. Increase in the doffer speed leads to deterioration of degree of random orientation of the fibre in the card web and sliver strand.



Graph 4. Effect of card delivery speed on U%

4] Effect of card delivery speed on yarn imperfection (IPI)

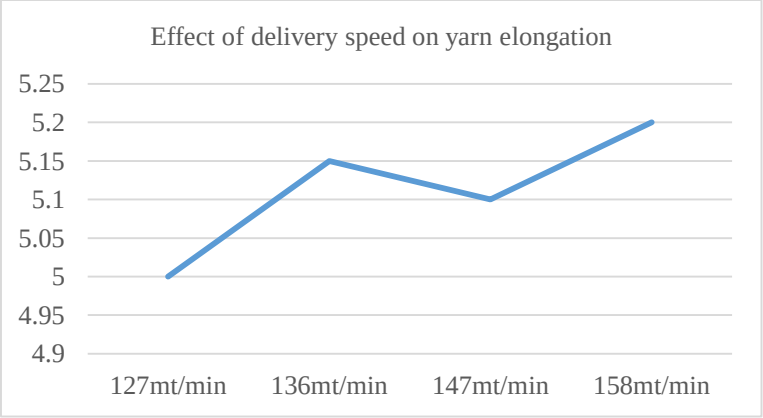


Graph 5. Effect of card delivery speed on IPI

Imperfection includes thick-thin places and neps. The Graph 5 shows that increase in delivery speed from 127 mpm to 158 mpm, there is continuous increase in the imperfections in the yarn. It is observed that neps percentage and thick-thin place in the yarn increases which results into increase in imperfection index of the yarn. Operational layer of fiber on the cylinder surface of card increases due to increased delivery rate of the card. At higher carding-cylinder speeds, better carding action results in a decrease in total yarn imperfections. [11]

5] Effect of card delivery speed on yarn elongation

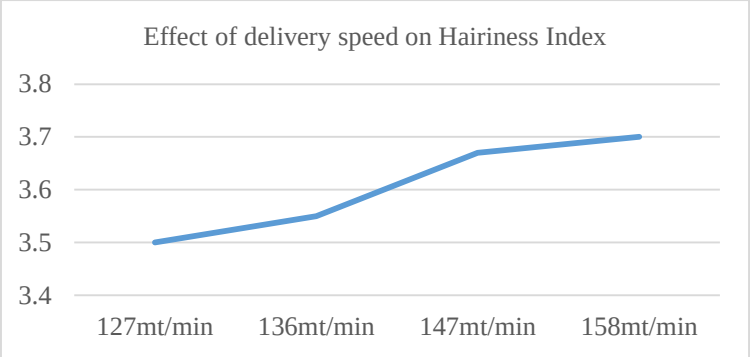
The Graph 6 depicts the effect of card delivery speed on yarn elongation. It observed that very less change in yarn elongation as an increase the delivery rate of the card. Hence, we can say the effect of delivery speed on the yarn elongation is not significant.



Graph 6. Effect of card delivery speed on yarn elongation

6] Effect of card delivery speed on Yarn Hairiness Index

The Graph 6 depicts the effect of card delivery speed on Yarn Hairiness Index. It observed that very less change in yarn hairiness index as an increase the delivery rate of the card. The slight change may be observed due to poor carding action. Hence, here also we can say the effect of delivery speed on the yarn hairiness index is not significant.



Graph 7. Effect of card delivery speed on Hairiness Index

V. Conclusion

A Lot of research have been done to study the carding machine performance on the yarn properties. In the study of effect of delivery speed on yarn quality it is observed that, change in delivery speed of card does not show significant effect on yarn count variation, yarn irregularity, yarn elongation and yarn hairiness index. Whereas, yarn lea strength, yarn imperfection index increases and single yarn strength decreases when delivery speed increased. It is also practically observed that, to satisfy the demand of high production with good quality of yarn, spinners always optimize both delivery rate and yarn quality.

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