Influence of Draft on Fibre Cohesion Characteristics

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Abstract - **An attempt has been made to study & analyze the arrangement of fibres in the yarn, and to examine the influence of draft distribution at every stage of yarn manufacturing on fibre cohesion, yarn structure and characteristics. The arrangement of fibres is through intermingling of constituent fibres, generated due to the draft, drafting system and level of twist. Fibre overlapping, fibre migration, packing coefficient, and longitudinal behavior of fibres also depend upon the draft distribution at different stage in spinning process. In a card sliver the fibres lie crisscross and entangled. They are either in the form of leading hook, trailing hook or hooked on both ends. The process of drafting reduces the number and extent of hooks.**

Higher fibre-to-fibre friction in a fibre strand need more drafting force this affects the fibre moment during drafting which influence the fibre orientation i.e. arrangement in a yarn. The change in fibre orientation ultimately affects the yarn quality. Keeping in view the above points, the present study has got significant findings on iInfluence of draft on fibre cohesion in terms of fibre orientation in sliver and tenacity of sliver and roving..

INTRODUCTION

Spun yarns produced by any technology is basically a linear assembly of fibres. The structure of the assembly is maintained either through interlacement of constituent fibres generated through twist, wrapping of a small percentage of binding in fibres or a combination of two. A clear understanding of the structure of yarn is essential since it not only affect appearance but also important properties.

To produce a quality yarn, it is established that before spinning is performed, the fibres must be made parallel to the axis of the sliver, the weight of sliver must be made uniform and the sliver must posses required number of fibres in its cross-section. Normally a final passage draw frame produces a sliver that already exhibits all the required characteristics for production of a yarn except the numbers of fibres. The spinning of a yarn consists in the drafting of a continuous strand from a suitably arranged source of fibres. Drafting is only possible if fibres can slide over each other, the fibre-to-fibre cohesion is the major factor in determining the yarn quality. Drafting reduces the number of fibres capable of providing the necessary number of frictional contacts, but the applied twist increases the normal force and hence the frictional force at each contact.

Carding and drawing are the processes which make the constituent fibers more parallel and straight, and this simultaneously reduces the fibre hooks. Fiber orientation is the characteristics which directly gives the idea about the path attained by the constituent fibers within sliver as the fibers may follow curvilinear path of any nature or may be longitudinal direction. Measurement of fibre orientation at various stages in processing would be very useful in evaluating the effectiveness of these operations. A number of indices characterizing various properties of fibres in slivers by using the Lindsley technique.

Lot of work has been done by the researchers on the effect of various fibre and process parameters on yarn structure and yarn characteristics but little work has been done on the influence of draft distribution on fibre cohesion, yarn structure and characteristics. The fibre orientation influences the quality of slivers, rovings and yarns. Numerous concepts have been introduced to characterize fibre orientation, namely, fibre straightness, fibre extent, coefficient of relative fibre parallelization, proportion of curved fibre ends, migration parameters etc. Several methods of investigating fibre orientation were also developed, such as the direct method in which traces fibres are viewed through a projection microscope and the indirect method, such as Lindsley (1951), Modified Lindsley (1964) method in which fibre orientation and parallelization (1971) in sliver and roving are quantified in terms of weight ratios. It also gives the information about the hooks (1964) presently in the sliver. Fibre Cohesion has a significant influence on yarn quality as the cohesion among fibres in a fibre assembly namely sliver, roving, yarn etc. develop resistance in slipping of fibres on application of load there by imparting mechanical strength to the assembly. The characteristics are further significantly influence by the twist The cohesion can be considered as a characteristic built up of the coefficient of friction between fibre surfaces and an unknown amount of mechanical interlocking of convoluted or crimped and hooked fibres. The measurement of the fibre cohesion and determination of the influence of draft on these parameters and there fore, it is extremely important to understand the role of fibre cohesion in textile processing.

REVIEW OF LITERATURE

Several researchers have studied the influence of draft at carding, draw frame, speed frame and ring frame machines on fibre orientation and characteristics of sliver, roving and yarns. But, most of them have taken an individual machine in spinning process for carrying out the optimization of yarn characteristics. The influence of process parameters of yarn spinning machines on fibre orientation was studied by some of the previous researchers. The relationship betweens fibre orientation parameters and characteristics of sliver, roving and ring yarn has also been dealt by few researchers.

Hence, this chapter gives a brief review of work done by some of the researchers for studying the effect of spinning process variables on fibre orientation and quality parameters of slivers, roving and ring yarn. In view of importance of fibre orientation in deciding characteristics of yarn, from last 60 years, quite a good number of researchers have attempted to measure the fibre orientation in sliver, roving and yarn.

2.1 Measurement of Fibre Orientatrion

The earliest method for study of fibre orientation was direct method, which was based on the use of optical traces fibre technique and ultra-violet rays for study of hooks. Later on, indirect methods, like Lindsley and modified Lindsley, which gives an indirect measure of fibre orientation in terms of few coefficients, were widely being used. The last among them was the method involving the use of digital fibre graph. The direct methods can be used for the study of fibre orientation in sliver, roving and yarn, whereas, indirect methods are mainly used for the study of fibre orientation in sliver and roving only.

2.2 Influence of Different Spinning Stages on Fibre Orientation

In order to understand the role of different spinning stages on fibre orientation and quality parameters, significant research work have already been carried out by several researchers. In subsequent sections a brief account of those contributions has been discussed.

2.2.1 Influence of Blow Room Process

In cotton fibre the purpose of the blowroom is to open the hard pressed bales into small tufts which provide new surface for cleaning the material. Whereas, in manmades, blowroom is mainly responsible for efficient opening of compact fibre mass in the bale form so that it can be process smoothly on subsequent process stages.

The efficient opening at blow room stage not only improves fibre cleaning but also improves yarn properties. In this context, Ishtiaque *et al.* (2003) reported that increase in fibre openness at blowroom, the yarn tenacity and total imperfections improve but with further increase in fibre openness these parameters deteriorate sharply. The increase in imperfections at higher openness is due to over beating than in necessary, fibres are stressed and damaged which than buckle and tend to form neps. The yarn hairiness remains almost unchanged initially with the increase in openness at blowroom but at higher level of openness it increases sharply. This is attributed to the overstressing of fibres at high values of openness with staple shortening and generation of short fibres. These short fibres could be the cause of increase in hairiness in yarn. frame and the ring frame. Thorough opening of fibres is also essential toward achieving a homogenous blend at the yarn stage.

2.2.2 Influence of Carding Process

Carding is the most important process affecting the fibre orientation in sliver, roving and yarn. Several researchers have studied the effect of carding process parameters on fibre orientation and quality of sliver, roving and yarn. There are various processing factors affecting the quality of carding operation.

Ishtiaque *et al.* (1994) reported the influence of lap hank and card draft on cleaning efficiency, neps per gm and fibre disorder in the sliver.

Simpson *et al.* (1974) reported that the cylinder-to-doffer fibre transfer decreased and cylinder load increased as sliver weight increased.

At low carding rate, increased sliver weight caused smaller increases in majority hooks (trailing) but definite decrease in minority hooks (leading).

2.2.3 Influence of Drawing Process

Drafting arrangement, in particular, increase unevenness very considerably. In order to achieve usable yarn characteristics, the process must include operations which given an equalizing effect. These can be doubling or leveling (drawing while simultaneously imparting twist). Doubling is still the most widely used, but leveling is becoming gradually more significant in woolen spinning mill only. Doubling is infact a process of equalizing. Several products are fed in together in sliver drafting arrangement where the thick places generally tend to distribute and compensate each other. In principle every doubling is a transverse doubling also because the feeds are united side-by-side (1987).

Klein (1987) concluded that drafting arrangement the fibre hooks may be embedded in the body of fibres either as leading or as trailing hooks.

A trailing hook for a certain period moves with remainder of the fibres strand at the speed of back roller towards the front roller.

Tallant *et al.* (1968) studied that the fibre configuration in slivers and rovings in terms of fibre hooks and fibre parallelization which showed that carding variables and drafting direction influenced the level of fibre hooks, which in turn had an appreciable effect on end breakage.

2.3.4 Influence of Roving Process

It is well known that the drafting of cotton sliver and roving is accompanied by increase in irregularity.

Balasubramaninan (1969) reported that the products drafted on apron drafting systems also exhibit drafting waves like roller drafting.

With cut staple fibre in particular the drafting wave could result from acceleration of leading hooked portion of the fibre Yarn produced from the roller drafting is more irregular and weaker than that from apron drafting, the difference in uniformity is more pronounced than that in strength.

Su (1998) later, we described a method to determine a suitable draft ratio for break draft in spinning to obtain the best yarn quality with technique of drafted roving uniformity

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2.3.5 Influence of Ring Spinning Process

During the formation of the ring spun yarn structure, fibres in the spinning triangle will be in one of the following four situations:

The leading end of a fibre is caught in the convergence point, buts its trailing ends free.

The leading end is free while the trailing length is still under the control of the front drafting rollers and subsequently becomes caught among other fibres being twisted at the convergence point.

Both leading and trailing ends are free.

The leading end is caught in convergence point while its trailing length is still under the control of the front drafting rollers.

Das *et al.* (2002) studied apron slippage in ring frame and concluded that apron to apron slippage exists in every spindle but different extent.

Due to the absence of positive means of motion transmission from bottom to top apron, the top apron always moves at a slower speed than bottom apron and this speed difference is higher when there is material in between them. This apron to apron slippage causes uncontrolled movement of fibres in the apron zone, resulting in poor yarn quality.

3. MATERIAL AND METHODS

Information regarding the cotton used, their properties, sample preparation and processing parameters at different stages of process and procedure adopted is summarized below. .

3.1 Material

Table 3.1 shows specifications of cotton fibres used for carrying out this study.

Fibre Properties Table 3.1

Type of cottons	J-34
Fineness of the cottons (micronaire value)	4.68
Bundle strength in g/tex(1/8 in. gauge length)	20.29
Mean fibre length (mm)	22
Trash (%)	4.80
Maturity coefficient	0.75
Span length (2.5%)	24.8
Span length (50%)	12.10
Uniformity ratio	50.25
Elongation (%)	4.90
Short fibre (%)	15.00

Prior to testing the cotton samples were conditioned for 24 hours under the standard conditions i.e. 270C $\pm$ 2 temperature 65% $\pm$ 2 R H.

Three Laps with different hanks, .0020, .0015, .0010; were prepared on same scutcher under identical conditions in succession.

These laps were then processed on same card, keeping card drafts 75, 100, 150; respectively in succession, making same hank of carded sliver, in all the cases. 75 is the practically lower range of card draft. 150 is the higher range of card draft under processing conditions. The values of trash %, 2.5% Span Length (S.L), 50% Span Length and uniformity ratio % (U.R %) of different laps and slivers have been shown in the Table-3.2. From the results given in Table 3.2 it has been seen that the trash percentage in case of all the laps was same as there was no or little change in the blow-room cleaning efficiency during the preparation of laps. When we look at 2.5% Span length, 50%Span length and Uniformity ratio% in laps and slivers, no change is noticed with lap hank and sliver hank, and is applicable for both the cottons. Therefore, it is concluded that change in lap hank at blow-room does not make change in the quality of lap, if the sequence of machines are maintained same.The blow room, carding , draw frame, speed frame and ring frame parameters used during preparation of sample is mentioned below

Table 3.2. Fibre properties in laps and slivers.

Lap hank	Card sliver	Card draft	Trash % (Cleaning Efficiency)	2.5%S. L.	50% S.L.	U.R %
0.0020	-	-	2.6 (45.8)	24.6	12.6	50.2
0.0015	-	-	2.6 (45.8)	24.0	12.2	51.0
0.0010	-	-	2.5 (45.8)	24.2	12.8	51.1
0.0020	0.150	75	0.924 (64.5)	24.4	10.8	44.4
0.0015	0.154	100	0.513 (80.3)	23.8	10.3	45.0
0.0010	0.152	150	0.342 (86.3)	23.9	10.9	46.8

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Blow Room Process Parameters Table 3.3

Make	Lakshmi Rieter
Scutcher model	B 6/1
Sequence of machine	Bale opener, step cleaner, ERM, Krishner Beater two in number.
Speed of bale opener	600 rpm.
Speed of step cleaner	570 rpm.
Speed of E R M	980 rpm.
Speed of krishner beater I	850 rpm.
Speed of krishner beater II	850 rpm.
Speed of krishner beater fan I	1430 rpm.
Speed of krishner beater fan II	1450 rpm.
Gauge between feed roller to E R M	3 mm.
Gauge between feed roller to krishner beater	6mm.

Draw Frame Process Parameters Table 3.5

Make	Laxmi Rieter
Model	Do 2/5
Drafting system	3 over 5
Drafting speed	180 mpm
Gauge	32/36
No. of passage	2

Carding Process Parameters Table 3.4

Make	Lakshmi Rieter
Model	C 1/2
Licker- in speed	650 rpm
Cylinder speed	250 rpm
Doffer speed	23 rpm
Gauge between cylinder to flate	12 thou
Gauge between licker-in to cylinder	10 thou
Gauge between cylinder to doffer	4 thou

Speed Frame Process Parameters Table 3.6

Make	Laxmi Rieter
Model	5 S
Drafting system	3 over 3 Apron
Spindle speed	650 rpm
Front Roller dia	30 mm
Guage (bottom roller)	45-50 mm
Gauge (top roller)	47-95 mm

Ring Frame Process parameters Table 3.7

Make	M.E.I.
Model	Mark-2
Spindle speed	12800 rpm
Drafting system	SKF PK-225
Twist multiplier	4.2
Spacer	3.5 mm
Roller Setting	Bottom- 42-65 mm Top - 55-110 mm

Measurement of Fibre Orientation

Lindsley's technique was used to study the fibre orientation in sliver and roving. The proportion of curved fibre ends (ρ) and coefficient of relative fibre parallelization (Krp) suggested by leonteva were calculated from the equations given below:

Proportion of curved fibre ends (ρ)= E/ (E+N) X 100 And

Coefficient of relative fibre parallelization Krp = (1- C/(C+N+E) X 100%

$$\text{Projected mean length} = \frac{t(W_f + W_r)}{T}$$

Where

T=(Cf + Nf + Ef) + (Cr + Nr + Er) + M

t = width of the three clamps = 2 inch.

C = weight of combed out fibres,

E = weight of fibre ends projecting over the line of cut after combing

N = weight of sliver proportion clamped under the cutting plate after combing.

M = Weight of material under the middle plate.

W = Weight of the material claimed by the edge plate after initial combing.

Since, combing is carried out in both the directions, the symbols 'f' for forward and 'r' for reverse are introduced here to denote the direction of combing. The forward direction corresponds to that in which the sliver was delivered from the machine concerned.

RESULT AND DISCUSSION

4.1 Fibre Orientation in Sliver

The fibre orientation in sliver was measured in terms of projected mean length, proportion curved fibre ends (ρ) and coefficient of relative fibre parallelization (Krp). The results of sliver orientation at card and draw frame draft with different variables are given in Table 4.1 and Figure 4.1(a), (b).

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Table 4.1 Fibre orientation in sliver

Sliver code No.	P.M.L	Proportion of Curved Fibre Ends (ρ)			Coefficient of relative fiber parallelization (Krp)			Difference (Forward & Reverse)	
		Forward	Reverse	Mean	Forward	Reverse	Mean	(ρ)	Krp
075CS	0.43	9.20	13.68	11.44	37.42	42.22	39.82	4.48	4.80
100CS	0.46	8.89	13.44	11.21	38.94	42.44	40.69	4.46	3.50
150CS	0.45	8.12	12.60	10.36	40.60	44.40	42.50	4.48	3.80
075DS6B	0.53	10.30	8.94	9.62	47.92	46.42	47.37	1.36	1.10
100DS6B	0.58	10.25	8.62	9.43	49.54	49.20	49.34	1.63	0.34
150DS6B	0.57	9.42	8.10	8.76	49.70	50.90	50.30	1.32	1.20
075DS6F	0.59	6.62	8.68	7.65	50.32	50.18	50.25	2.06	0.14
100DS6F	0.64	6.48	8.20	7.34	50.62	50.25	50.46	1.72	0.37
150DS6F	0.63	6.10	8.08	7.09	51.80	52.15	51.97	1.98	0.35
075DS8B	0.62	10.20	8.84	9.52	50.12	50.60	50.26	1.36	0.48
100DS8B	0.67	10.06	8.56	9.31	51.40	51.10	51.25	1.50	0.30
150DS8B	0.66	9.22	8.10	8.66	52.64	53.30	52.97	1.12	0.66
075DS8F	0.64	6.36	8.54	7.45	52.42	52.14	52.28	2.18	0.28
100DS8F	0.69	6.30	8.10	7.20	53.48	53.20	53.34	1.80	0.28
150DS8F	0.68	6.08	7.82	6.95	54.98	55.44	55.21	1.74	0.50

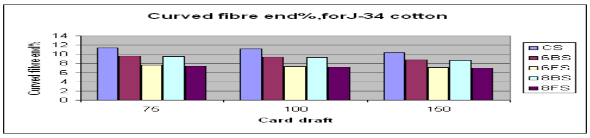

Fig.4.1(a) Influence of card draft on proportion of curved fibre ends (ρ)

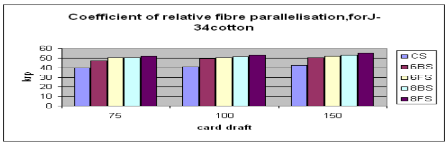

Fig.4.1(b) Influence of card draft on coefficient of relative fibre parallelization (Krp)

CS = Card Sliver
6 BS = 6 Doubling braker sliver
6 FS = 6 Doubling finisher sliver
8 BS = 8 Doubling braker sliver
8 FS = 8 Doubling finisher sliver

4.1.1 Influence of card draft on projected mean length, coefficient of relative fibre parallelization (krp) and proportion of curved fibre ends

It can be observed from Table 4.1 and Figure 4.1(a) and 4.1(b) that the value of projected mean length, initially increases with increase of card draft (75 and 100) and further increase in card draft (100 and 150) causes decrease in projected mean length. It has been further seen that there is marked increase in projected mean length at initial increase of card draft where as further increase in draft beyond 100 shows marginal reduction in projected mean length values.

It can be observed from Table 4.1 and Figure 4.1(a) and (b) that the average values of proportion of curved fibre ends (ρ)decreases and the coefficient of relative fibre parallelization (Krp) increases with the increases in card draft. It is further seen that an increase in card draft from 75 to 150; results in decrease in both forward and reverse direction values of proportion of curved fibre ends (ρ) and coefficient of relative fibre parallelization(Krp) increases in both forward and reveres direction and such a trend is seen in all the cases. The (ρ) in reverse direction is more in comparison to forward direction. This is due to formation of majority of hooks in trailing direction during the transfer of fibres from cylinder to the doffer as found by Morton (1949).

4.1.2 Influence of sliver doublings and draft at draw frame and on projected mean length and proportion of curved fibre ends (ρ) coefficient of relative fibre parallelization (Krp)

This evident from Table 4.1 and Figure 4.1(a) and (b) that the value of (ρ) decreases and value of proportion of curved fibre ends (ρ) of relative fibre parallelization (Krp) increases with the increase of number of draw frame passages. This can be explained on the bases of fibre straightening and parallelization during drafting.

Once we try to see the influence of number of sliver doublings and draft at draw frame on the value of proportion of curved fibre ends(ρ) and coefficient of relative fibre parallelization (Krp), it is evident from our results as we increase sliver doublings as well as draft at draw frame, the value of proportion of curved fibre ends (ρ) marginally decreases and coefficient of relative fibre parallelization (Krp) decreases. This clearly indicates that number of sliver doubling and draw frame draft slightly improves fibre straightening and parallelization at draw frame.

The difference in the value of proportion of curved fibre ends (ρ) and coefficient of relative fibre parallelization (Krp) for different experimental condition can be explained on the bases of direction of majority of hooks feed to the draw frame. It was found that both fibre parallelization and fibre hooks decreased as card sliver weight increased, indicating that there were less total hooks in the heavy than in the lightweight sliver, even though the fibres in the former were less parallel than in the latter. This finding is consistent with a study Ghosh (1968) where the tracer fibre technique was used.

The projected mean length is also increases as we increase the number of doublings and draft at draw frame.

In card sliver the value of proportion of curved fibre ends (ρ) decreases and the coefficient of relative fibre parallelization (Krp) increases with the increase in card draft. But projected mean length first increases and marginally decreases with the increase of card draft. There is a decrease in ρ and increase Krp in sliver from carding to

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breaker draw frame. However, higher draft/doublings marginally decrease ρ and increase in Krp in sliver.

Coefficient of relative fibre parallelization (Krp) increases with the increase in draw frame passages, doublings and draft at draw frame, but proportion of curved fibre ends (ρ) decreases. The projected mean length also increases as we increase the number of doublings and draft at draw frame.

4.2 Tenacity of Sliver and Roving

The tenacity, a major of fibre cohesion in sliver and roving is tested according to the ASTM testing procedure D2612. Specimen of lengths were cut from each sample and tested on CRE tensile tester.

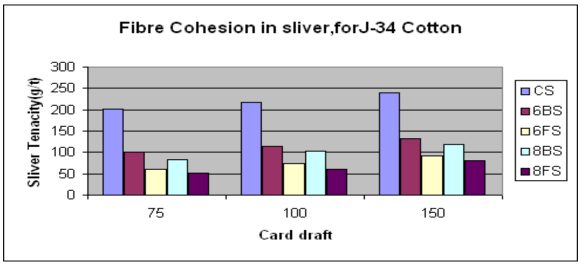

Fig.4.2(a) Influence of Card Draft on sliver Tenacity

Table 4.2(a) Sliver Tenacity and Elongation

Sliver Code (Total Draft)	Tenacity(g/t)x 10-4 (CV%)	Elongation Peak (m.m) (CV%)
C S o7 5 (75)	202 (14.06)	16.22 (22.12)
D S 6 6 B1 (450)	101 (20.03)	11.14 (17.20)
D S 6 6 F1 (2700)	61 (13.08)	8.80 (14.01)
D S 8 8 B1 (600)	82 (17.02)	9.02 (16.20)
D S 8 8 F1 (4800)	52 (12.06	8.04 (13.40)
C S 100 (100)	218 (16.04)	18.04 (23.12)
D S 6 6 B2 (600)	115 (21.00)	12.10 (18.21)
D S 6 6 F2 (3600)	75 (15.04)	9.06 (15.10)
D S 8 8 B2 (800)	102 (18.01)	10.14 (16.80)
D S 8 8 F2 (6400)	60 (13.02)	8.40 (14.16)
C S 150 (150)	239 (18.20)	20.60 (26.10)
D S 6 6 B3 (900)	132 (22.05)	14.12 (21.14)
D S 6 6 F3 (5400)	92 (15.22)	10.02 (16.04)
D S 8 8 B3 (1200)	118 (19.01)	12.00 (18.20)
D S 8 8 F3 (9600)	80 (14.06)	9.80 (14.20)

In the present study card sliver was produce of same hank, therefore coarse lap will require high card draft and under these circumstances, feed roller speed will be lesser at constant licker in speed. This will cause more number of beats per unit time on the fibre and thus responsible for better fibre opening and on the other side due to more thickness of coarse lap the penetration of licker-in wire will be lesser and will be responsible for less fibre opening.

But once we look the results of the value of ρ and Krp from Table 4.2(a). It is evident that higher card draft (coarser lap) reduces the value of ρ and increases the value of Krp. This is evident from our results that higher card draft improve the fibre straightening and parallelization which will be responsible to increase the fibre extent and therefore finally responsible for higher sliver tenacity. It has been shown that maximum fibre parallelization and hook reduction can be obtained at first drawing by drafting the majority hooks in the trailing direction. This may be accomplished through use of unit carding systems (150).Therefore, it may be concluded that an increase in draft at card associated with coarser lap hank, results more fibre cohesion amongst the constituent fibres of carded sliver.

4.2.2 Influence of draw frame doublings and draft on sliver strength

Comparison of the values of tenacity and elongation amongst card sliver, breaker and finisher draw frame slivers from Table 4.2(a) and Fig. No.4.2(a) show that the tenacity and elongation values decreases from card sliver to breaker sliver and further decreases from breaker sliver to finisher sliver. Thus, it is evident that breaker and finisher in successive stages decrease fibre cohesion. The main reason for this is that the draw frame process makes the fibre straight and parallel, and reduces the hooks during drafting at draw frame, this can be explained from the value ρ and Krp in this chapter. The explanation for such a trend is that in a card sliver most of the fibres are criss cross, not parallel to each other and less aligned, the drawing process make them parallel and straight initially at breaker and then further at finisher.

Therefore, it may be concluded that the fibre cohesion decreases when carded sliver is passed through breaker and further decreases when passes through finisher. Comparison of the values of tenacity of the draw frame slivers, belonging to the same number of doublings and drafting but produced from different card draft slivers show that the sliver produced at breaker draw frame with higher draft at card gives higher sliver tenacity in comparison to sliver with low draft at card and this trend is also valid up to finisher draw frame. This can be explained on the bases of better fibre opening at higher card draft as discussed early.

The values of elongation of sliver shows similar trend as of tenacity of sliver. This means the sliver produced on a card with higher draft and having better opening of fibres and thus higher fibre extent exhibit higher elongation too. Identical trend in elongation of sliver may be due to higher fibre cohesion, which must have caused due to predominating role of fibre extensibility rather than fibre slippage.

The comparison of the sliver tenacity values of draw frame slivers with 6 doublings and 6 draft, with the draw frame slivers of 8 doublings and 8 draft, shows that the slivers belonging to 8 doublings and 8 draft is having lesser value than the sliver belonging to 6 doublings and 6 draft and also finisher draw frame also gives lower sliver Tenacity.

It can be explained as number of sliver doubling increases at draw frame, the draw sliver will have less cohesion in between the ribbon of different sliver in comparison to fibre cohesion within the sliver of the non-intermingling of fibres between the sliver during drafting.

As such a trend is seen for 75,100 and 150 draft card slivers therefore, it is concluded that an increase in sliver doublings and draft at draw frame results in reduction of fibre cohesion and thus sliver tenacity.

4.2.3 Influence of card draft on roving tenacity

It can be observed from Table 4.2(b) and Fig 4.2(b) As we increase the card draft from 75 to 100 and 100 to 150, the roving tenacity first increases and then decreases. This is valid for all combination at draw frame and speed frame; this is evident that card draft has major influence on roving tenacity.

But once we try to look the results under different combination, one can observe that as we increase total draft from 16,200 to 27,000 roving tenacity decreases but total draft of 28,800 to 48,000, roving tenacity decreases but roving tenacity of later combination is found to be better then first combination. This is evident that increase number of doublings is responsible to improve the roving tenacity.The results with 100 card draft and different sliver doublings and draw frame draft with change in speed frame draft give the best results in terms of roving tenacity. It can be observed from the Table 6.1 as we increase total draft 21600 to 36000 roving tenacity drastically reduces but as we increase in total draft in second combination from 38400 to 64000 the roving tenacity definitely decreases with the increase of total draft but results of roving tenacity on better in comparison to first combination.

The results with the 150 card draft and change in draft and doublings with the increase in speed frame draft also indicate that with increase total draft 32400 to 54000 roving tenacity continuously decreases but once we look other combination of total draft from 57600 to 96000 the roving tenacity definitely reduces with increases of total draft. It is further evident that results of roving tenacity in second combination are slightly better than first combination.

Strength of the card sliver increases with the increase in draft at a card, when the same hank card slivers are prepared from different laps of varying hank. Strength in draw frame slivers reduces with the increase in draw frame passages and also with the increase in doublings and draft.

From our results it can be concluded that draft distribution at different stages of preparatory influences the roving tenacity. The change in card draft plays a significant role to decide the roving tenacity. It is further concluded that at 100 card draft, 6 of sliver doublings and speed frame and draw frame draft of value 6 gives value of highest roving tenacity.

Table 4.2(b) : Roving Tenacity and Elongation

Combination	Card Draft/ Draft/ Doubling	Total Draft	Tenacity (g/t) x 10-4 (CV%)	Elongation Peak (mm) (CV%)
606	75/6/6	16,200	773 (20.6)	6.8 (21.5)
608	75/6/6	21,600	240 (21.1)	7.2 (22.1)
610	75/6/6	27,000	180 (23.2)	7.9 (24.1
806	75/8/8	28,800	710 (16.4)	5.5 (16.8)
808	75/8/8	38,400	248 (18.5)	6.2 (18.9)
810	75/8/8	48,000	192 (19.3)	6.7 (20.3)
606	100/6/6	21,600	855 (18.2)	5.1 (19.4)
608	100/6/6	28,800	260 (19.4)	5.8 (20.4)
610	100/6/6	36,000	204 (20.6)	6.1 (21.6)
806	100/8/8	38,400	804 (12.8)	3.2 (13.8)
808	100/8/8	51,200	272 (13.0)	3.4 (14.2)
810	100/8/8	64,000	216 (14.2)	4.1 (15.6)
606	150/6/6	32,400	532 (22.8)	7.6 (23.8)
608	150/6/6	43,200	220 (24.2)	8.1 (25.6)
610	150/6/6	54,000	172 (26.4)	8.8 (27.8)
806	150/8/8	57,600	502 (20.1	6.7 (21.4)
808	150/8/8	76,800	228 (21.5)	7.2 (23.0)
810	150/8/8	96,000	180 (23.2)	7.7 (24.6)

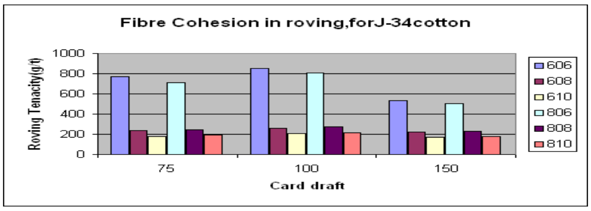

Fig. 4.2(b) Influence of card draft on roving tenacity.

606 - 6 doubling 6 draft at draw frame and 6 draft at speed frame
608 -6 doubling 6 draft at draw frame and 8 draft at speed frame
610 -6 doubling 6 draft at draw frame and 10 draft at speed frame
806 -8 doubling 8 draft at draw frame and 6 draft at speed frame
808 -8 doubling 8 draft at draw frame and 8 draft at speed frame
810 -8 doubling 8 draft at draw frame and 10 draft at speed frame

.CONCLUSIONS

The main conclusions drawn from the present study are mentioned below

There is no or little change in cleaning efficiency and lap trash percentage on changing the lap hank, when preparation of laps is from same cotton, same sequence of blow room machinery, same settings and gaugings; which is irrespective of cotton.

In card sliver the value of proportion of curved fibre ends (ρ) decreases and the coefficient of relative fibre parallelization (Krp) increases with the increase in card draft.

Projected mean length first increases and marginally decreases with the increase of card draft.

Coefficient of relative fibre parallelization (Krp) increased with the increase in draw frame passages, doublings and draft at draw frame. But proportion of curved fibre end (ρ) decreases.

Strength of card sliver increases with the increase in draft at a card, when the same hank card slivers are prepared from different laps of varying hank.

Strength in draw frame slivers reduces with the increase in draw frame passages and also with the increase in doubling and draft.

The change in card draft plays a significant role to decide the roving tenacity. At 100 card draft, sliver doubling of 6 and speed frame and draw frame draft of 6 gives highest roving tenacity.

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