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PROCESSING OF BULK OF POLYESTER BLENDED FIBRES THROUGH OPTIMIZATION OF CARDING VARIABLES.

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ABSTRACT :

The effect OF licker-in speed, cylinder speed and setting between flat-cylinder on PV blended fibres has been studied using the Box and Behnken's 3-variable factorial design method in this experimental work. The sliver samples were prepared from the blend of polyester viscose [Polyester → 65% 1.4D X 44mm & Viscose → 35% 1.4D X 38mm. It is observed that minimum level of neps is achieved at Licker-in RPM 950.0, cylinder speed 450.0 rpm and flat-cylinder setting 10.0 thou". It is also find out during study that card sliver unevenness is maximum at high licker-in speed, low cylinder speed and wider flat – cylinder settings.

KEY WORDS- Carding variables, Box and Behnken's 3-variable factorial design, U%.

1. INTRODUCTION

Carding is the process in spinning preparatory which also contributes the quality of yarn. Chiefly, the carding1should separate the flocks in to the individual fibres. Additionally the carding gives the reduction in neps, aligning, blending of fibres and elimination of short fibres. But even the card sliver contains a large number of fibre entanglements due to the chaotic arrangement of fibres in relation to the sliver axis and the presence of large number of hooks which impede individual fibre movement in subsequent drafting. Only after the majority of these hooks are removed during drawing and subsequent operations due to the substantial degree of parallelization of fibres, the card sliver is really ready for being made in to the yarn.

The carding parameters which are responsible for quality of delivered sliver could be either process or machine related. The process parameters can be classified in to speeds, settings between various interacting organs and linear densities of feed and delivered material. The machine parameters are mostly clothing related as the dimensions of various organs remain same. There are some studies [2-3] on the effect of licker-in speed on tuft size and subsequently the yarn quality. In the present work, an attempt has been made to study the effect of carding variables like licker-in speed, cylinder speed and flat-cylinder setting on neps in card web, card sliver unevenness and tenacity.

2. MATERIAL AND METHODS-

The present study was carried out in a modern industry and the same blend of polyester viscose [Polyester → 65% 1.4D X 44mm & Viscose → 35% 1.4D X 38mm] as used for the study. The blend was then processed in modern blow room line with MBO keeping the setting and speed unchanged for all the samples. The opened flocks were run through modern chute feed system of cards where three card parameters were changed to vary various fibre parameters. A three variable factorial design proposed by Box & Behnken[4] (Table-1.), was used to investigate the influence of carding parameters on processibility of fibres. The actual values of three variables and their coded levels are given in table-2.

2. I. SAMPLE PREPARATION –

The PV fibre flocks received from blow room were processed at card with altering the carding parameters at three levels like licker-in speed, cylinder speed, cylinder-flat setting. Sliver was produced for each of the fifteen combinations as shown in table-1. All these samples were placed very carefully for further testing.

2. II. FIBRE TESTING-

Fibres taken after the card were tested for fibre bundle strength on Premier HVI. Neps in card web were counted manually in form of neps/gm. Irregularity in card sliver was measured by using uster evenness tester (UT-3).

Table 1: Influence of Experimental combination on Card Nep & sliver unevenness

S.N.	X1	X2	X3	Card Neps/gm	Card U%
1.	-1	-1	0	0.9	3.7
2.	1	-1	0	0.89	3.5
3.	-1	1	0	0.85	3.0
4.	1	1	0	0.98	3.65
5.	-1	0	-1	0.93	3.15
6.	1	0	-1	1.0	3.75
7.	-1	0	1	0.93	3.65
8 .	1	0	1	0.89	3.35
9.	0	-1	-1	0.91	3.4
10.	0	1	-1	0.95	3.5
11.	0	-1	1	0.85	3.0
12.	0	1	1	0.81	3.32
13.	0	0	0	0.18	3.04
14.	0	0	0	0.19	3.12
15.	0	0	0	0.16	3.01

Table 2: Response Surface equations

S.N.	Stage	Equation	R2
1.	Card Neps/gm	Y=0.177-0.039X3+0.393X1X1+0.335X2X2+ 0.368X3X3	0.988
4.	Card U%	Y=3.199+0.270*X1*X1+0.213*X1*X2- 0.225*X1*X3	0.619

3. RESULTS AND DISCUSSIONS-

Table- 1 shows the Influence of experimental Variables on processibility of PV fibre and Table- 2 shows the response surface equations at 95 % level of significance.

3.1. EFFECT ON NEPS IN CARD WEB-

From response surface equation in Table-2 and contours in figs 1-2, it is observed that card neps initially decreases and then increases with the licker-in speed. The initial reduction in nep level is due to better opening of fibre and feeding of well opened tufts to the cylinder. However further increase in licker-in leads to damage of fibres as over stress on fibres takes place due to over processing of fibres. Since higher licker-in speed leads to increase in fibre damage. The increase in card neps may also be due to change in cylinder-taker-in surface speed ratio.

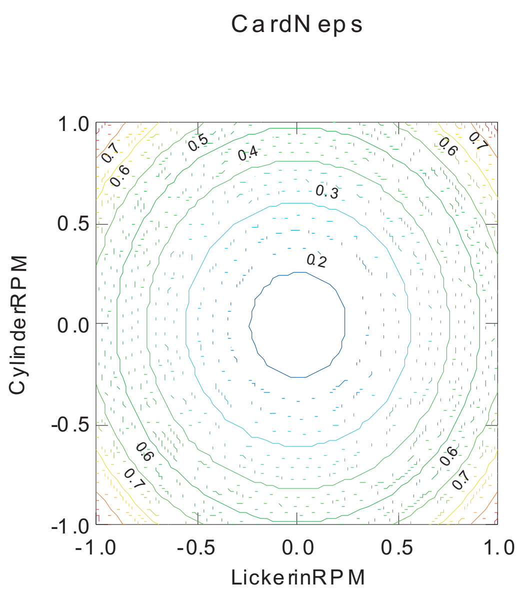

Fig 1: Card Neps / gm at Flat-cylinder setting (10thou)

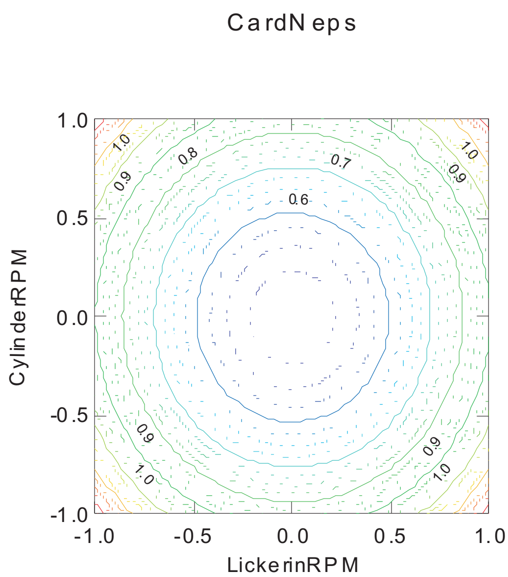

Fig.2: Card Neps / gm at Flat-cylinder setting (12 thou)

It is further observed from contours in figs 1-2 that the neps in card sliver initially decreases and then increases with the cylinder speed. Initial decrease in neps is due to negligible quantity of waste.

The increase in cylinder5 speed is known for reduction in cylinder load which facilitates nep reduction due to better separation of fibres in carding zone.

A further increase in speed of cylinder gives increase in nep level. This may be because of increase in carding force due to increase in momentum with which the fibre tufts collides against the flat wire.

It is also clear that initially on widening the setting of flat cylinder results in to reduction in nep level. This is due to improved opening of fibre tufts. Chattopadhyay et al. observed the too close setting is detrimental. The minimum level of nep is found at 950 rpm licker-in speed, 450 rpm cylinder speed and 10.0 thou flat cylinder setting. Response surface equation of very high correlation value (R2 =0.988) shows that the licker-in speed, cylinder speed and flat-cylinder setting are important factors in controlling the nep level at card.

3.2. EVENNESS OF CARD SLIVER-

It is observed from response surface equation in Table-2 and contours in figs.3-5 that card sliver unevenness in general initially decreases and then increases with the increase in licker-in speed. However it is continuously decreases with the increase in licker-in speed at wider flat- cylinder setting. The initial decrease in card sliver unevenness may be due to better opening of fibre tufts fed to cylinder and then fibres are more evenly distributed over the cylinder surface. Contours also shows that card sliver unevenness decreases with the increase in the cylinder speed at lower licker-in speed however reverse trend is observed for higher licker-in speed. At low licker-in speed fibres are not well opened however higher cylinder speed helps in reducing the tuft size and even distribution on cylinder surface. But at high licker-in speed fibre rupture increases and higher licker-in speed speed also influences the transfer of fibres from licker-in to cylinder. From the comparison of contours in figs 3-5 and response surface equation in Table-2, it is observed that card sliver unevenness is influenced by interaction effect of licker-in. speed and flat-cylinder setting.

It is also observed that card unevenness decreases with the increase in flat-cylinder setting at higher licker-in speed and increase at lower licker-in speed with the increase in the flat-cylinder setting. It may be due to the fact that at higher licker-in speed fibre tufts are well opened and thus fibres are more evenly distributed over the cylinder surface and wider flat –cylinder setting helps in reducing the carding force and opportunity for fibres even distribution over cylinder surface. However at lower licker-in speed fibres are not sufficiently opened and fibres are fed to cylinder in large lumps may lead to slightly higher card sliver unevenness. However minimum value of card sliver unevenness is observed at wider flat-cylinder setting, high licker-in speed and low cylinder speed.

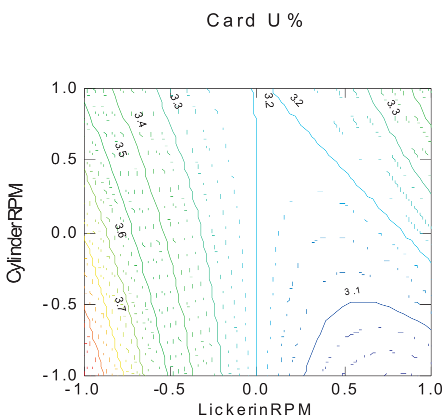

Fig-3: Card U% at Flat-cylinder setting (12 thou)

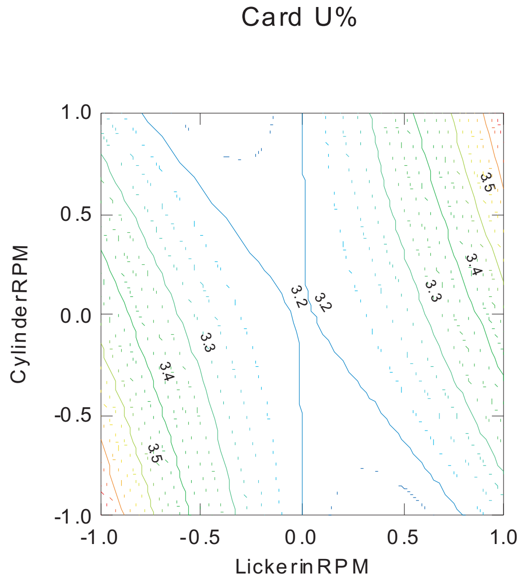

Fig-4.: card U% at Flat-cylinder setting (10 thou)

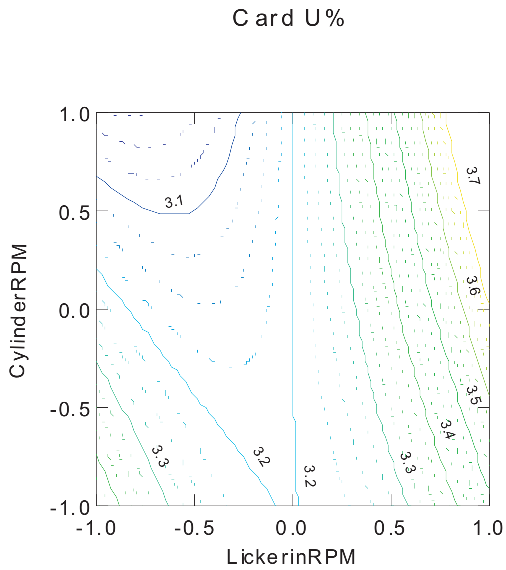

Fig-5: Card U% at Flat-cylinder setting (8 thou)

4. CONCLUSIONS-

From above results and discussion following conclusions have been drawn-

1. Neps in card web initially decreases and then increases with licker-in speed and cylinder speed. It is also concluded that wider setting of flat – cylinder is main cause of reduction in level of neps. The minimum level of neps is found at licker-in rpm 950, cylinder rpm 450.16 and flat-cylinder setting 10.0 thou.
2. Minimum value of card sliver unevenness is observed at high licker-in speed, low cylinder speed and wider flat – cylinder setting.

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