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Impact of Beater Speed of Coarse Cleaner on the Quality Parameters of Blowroom by Using Regression Analysis

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Abstract: *An effective cotton spinning requires efficient opening & cleaning of raw material. The beating point of coarse cleaning machine (Uniclean) influences neps generation, fiber length and short fiber content. By keeping this view, to change various setting, Cleaning Intensity (C.I) and Relative Amount of Waste (RAW) of cleaning machine which affects fiber rupture, cleaning efficiency, good fiber loss percentage in waste. The effect of beater speed of coarse cleaner was studied for quality characteristics of cotton. The results in respect of neps generation, fiber length and short fiber content showed highly significant differences in the mean values for different combination of settings as well as cleaning segments.*

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I. Introduction

The basic purposes of blow-room are opening, cleaning, mixing of cotton without increasing fiber rupture, fiber neps and broken seed particles and extracting more amount of trash without good fiber loss. The reduction of trash content which is necessary for improving cotton grade and unfortunately results in a higher neps content level. It is clearly noticeable that blowroom cleaning efficiency is increased with the increase of fiber openness. [1] In this project, emphasis given on Uni-clean machine setting change with respect to Cleaning Intensity and Relative Amount of Waste at various beater speed and grid angle.Cleaning Intensity and Beater speed is directly proportional. So, working with higher Cleaning Intensity can increase the fiber opening and thereby trash removal from feed cotton. At the same time higher beater speed also increases fiber stress, especially in case of longer, finer, cohesive but trashier in the mix. This can lead to excessive fiber rupture and nep formation. [2] Relative Amount of Waste (R.A.W.) is directly proportional to the grid bar angle. Higher the angle, wider will be the setting and correspondingly more waste gets extracted and vice versa. [3] If the amount of trash is increased, the degree of cleaning also increases & performance of cleaning efficiency percentages increase. [4]

II. Literature Review

Blow-room: The section where the supplied compressed bale is turned into a uniform lap of particular length by opening, cleaning, blending or mixing is called blow room section. It is the first step of spinning and consists of a number of machines. [5]

The task of the blow-room line is to:

• open the material into very fine tufts;
• eliminate most of the impurities;
• eliminate dust;
• provide a good blend

Basic operations in the Blow-room:

- Opening
- Cleaning
- Dust removal
- Mixing/ Blending
- Even feed of material to the card

Cleaning: In cleaning, it is necessary to release the adhesion of the impurities to the fibers and to give particles an opportunity to separate from the stock. This is achieved mostly by picking flocks out of the feed material and by rapid acceleration of these flocks over a grid. Dirt, dust, foreign matter, and neps should be eliminated. Cleaning was always an important basic operation, and it will become steadily more important. For one thing, owing to machine harvesting, cotton contains more and more impurities, which furthermore are shattered by hard ginning; for another, almost all new spinning processes impose substantially higher demands on the cleanliness

Possibilities for cleaning: The available possibilities for cleaning natural fibers can be divided broadly into three groups:
• Chemical cleaning;
• Wet cleaning (washing);
• Mechanical cleaning.

Degree of cleaning:

Whereas formerly the cleaning effect of a machine could only be estimated, today it can be established fairly exactly, reproducibly and so as to enable comparisons to be made. For this purpose, the cleaning index *C* is defined as:

$$C_F = \frac{D_F - D_D}{D_F} \times 100\%$$

Where D_F= the dirt content of the feed material
D_D= the dirt content of the delivered material; and C_T= total. [6]

Uni-clean machine: The cotton enters the beater chamber through an in-let in free condition. Immediately, the typically shaped beater spikes start acting on the cotton. The actual cleaning takes place when the material is struck against the grid bars. In the traditional beaters, this striking action takes place only once because the cotton is passed ahead along with the rotational direction of the beater itself. Whereas, in Uni-clean, like Axi-Flow, the cotton moves across the beater length and hence, during its journey, the striking spikes repeatedly strike it against the grid bars. The impurities thus released, are ejected through grid bar openings. [7]
The Uni-clean machine cleans the micro tufts in the first cleaning stage immediately after the Unifloc A11. This enables machine output of up to 1400 kgs/hr to be achieved. Cleaning is performed without nipping and is therefore very gentle to the fibres and at the same time efficient. Varioset enables waste volume and waste composition to be adjusted optimally at the push of a button.

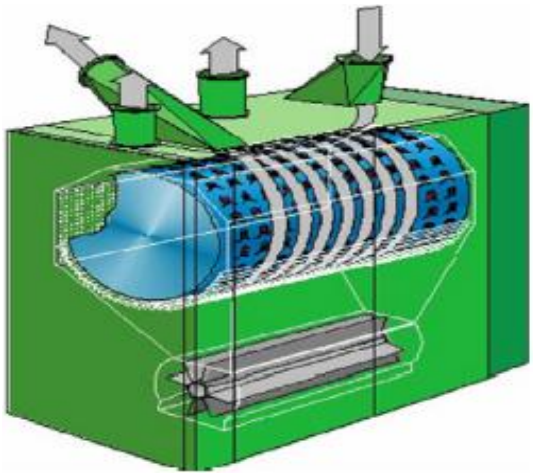

Figure 1: Uni-clean machine of Rieter

The machine is operated under 'Varioset Cleaning Field'. Thus, with only two settings are processing can be changed from gentle to intensive. This Varioset technique translates the desired operational characteristics in to value of machine settings. Two different values for – Cleaning Intensity (for speed of beater) and Relative Amount of Waste (influencing grid bar angle) can be chosen while working a particular variety of cotton. The opening and cleaning unit of Rieterblowroom line operate through Varioset Cleaning Field. In the cleaning field, the cleaning intensity (0.0 to 1.0) is plotted against the relative amount of waste percentage (1 to 10). The beater speed is directly proportional to the relative amount of waste, grid bar setting & its cleaning intensity. If relative amount of waste should be less then closer grid bar setting & less amount of trash extract form raw material. If relative amount of waste should be more then open grid bar setting & more

amount of trash extract with betterfibre loss from raw material (cotton). The cleaning Intensity controls both the speed of beater & compensatory setting of grid bars. Increasing the cleaning intensity increases the trash remove in raw materials. The waste rate changes the grid angle to remove more or less good fibre in trash particles. The material is blown to the Uni-clean & is circulated seven times inside the machine by the hooks on the drum. The clean fibres are sucked from the machine by transportation fan. The optimum cleaning means maximum cleaning performance, minimum loss of good fibres, a high degree of fibre preservation and minimum neps generation. [2]

III. Material and Methods

Indian cotton (Shankar-6) was used in this project work. The properties of raw cotton were given below:

Table No. 1: Fiber Properties

Properties	Value
MIC	4.24
Rd%	75.6
+b	9.7
Strength(g/tex)	28.5
UHML(mm)	27.3
Uniformity Index (%)	81.2
SCI	136
Neps(cnt/g)	266
SCN(cnt/g)	36
SFC(%)	8.6
IFC(%)	5.1

Spinning Process: Raw cotton was processed at Rieter blow room line with Uni-clean set-up, and following Cleaning Intensity & Relative Amount of Waste. After every possible combination of above variables at Uni-clean, setting samples from duct (Delivery of machine, Chute Feed and card sliver) has collected and tested for the basic fiber characteristics.

Method: Change setting of Uni-clean machine
1. Cleaning Intensity. (C.I.)
2. Relative Amount of Waste. (RAW)

Table No. 2: Setting parameter of Uni-clean machine

	Cleaning Intensity. (C.I.)	Relative Amount of Waste. (R.A.W.)	Beater Speed
Trial-A	0.5	5	725
Trial-B	0.6	6	770
Trial-C	0.7	7	815

IV. Result

Table No. 3: Trial-A (CI-0.5, and R.A.W.-5)

Trial-A									
C.I.	R.A.W.	Beater speed	Stages	Nep Cnt/gm	L(w) mm	UQL(w) mm	SFC(n)% >12.7mm	NGP%	Wastage%
0.5	5	725	Raw cotton	149	28.4	34.1	18.3	122.82	3.45
			Uni-clean delivery	151	28.7	34.5	19.7		
			Chute matt.	332	29.1	34.8	21.5		

Table No. 4: Trial-B (C.I.-06, R.A.W. 6)

Trial-B									
C.I.	R.A.W.	Beater speed	Stages	Nep Cnt/gm	L(w) mm	UQL(w) mm	SFC(n)% >12.7mm	NGP%	Wastage%
0.6	6	770	Raw cotton	153	28.4	34.8	19.2	130.72	3.59
			Uni-clean delivery	162	28.6	34.6	21.4		
			Chute matt.	353	28.9	34.7	21.6		

Table No. 5: Trial-C (C.I.-07, R.A.W.-7)

Trial-C									
C.I.	R.A.W.	Beater speed	Stages	Nep Cnt/gm	L(w) mm	UQL(w) mm	SFC(n)% >12.7mm	NGP%	Wastage%
0.7	7	815	Raw cotton	161	28.6	34.7	19.9		
			Uni-clean delivery	182	28.8	33.9	22.5		
			Chute matt.	383	28.7	33.8	23.7	137.88	3.73

Graphical representation of neps generation percentage in different stages at blow-room

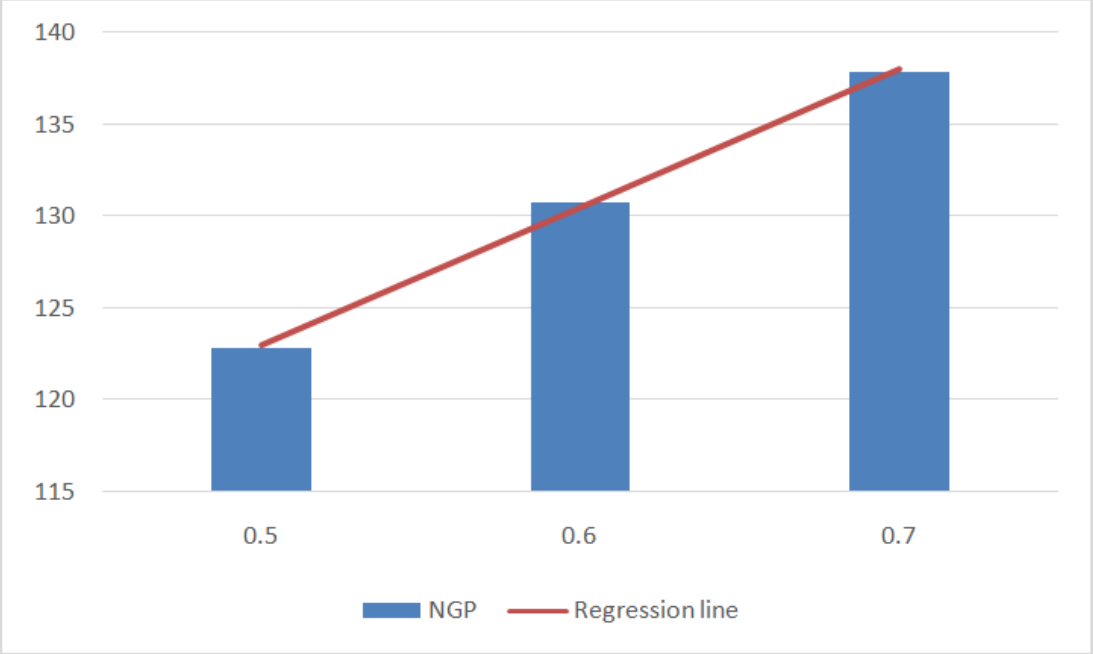

Figure 2: Neps generation in different stages at blowroom ($Y = 75.3X + 85.293,\ R^2 = 0.999$).

Graphical representation of short fiber content in different stages at blow-room

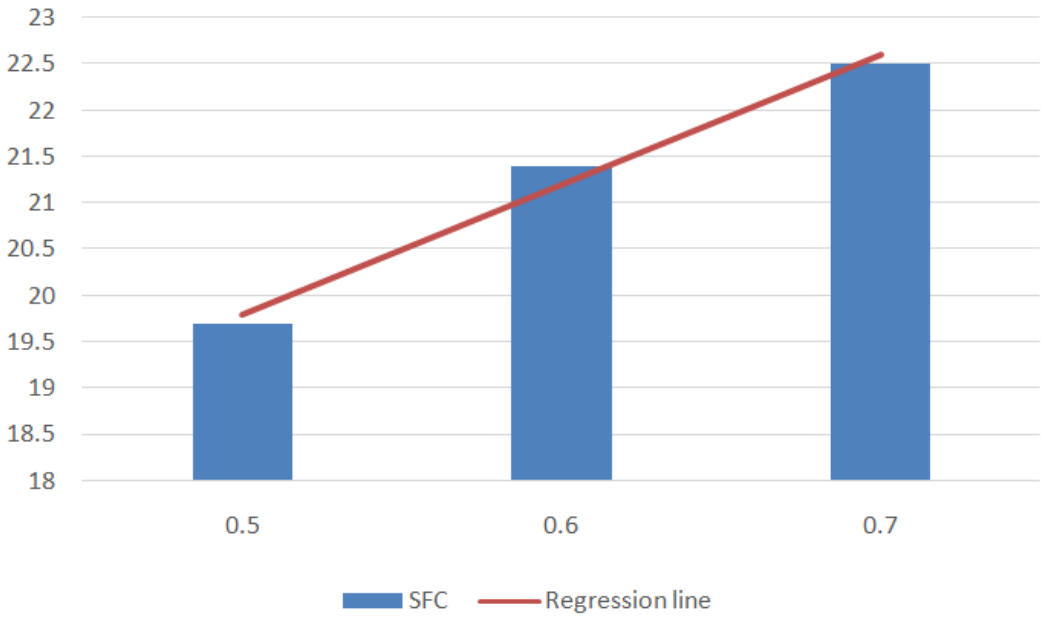

Figure 3: Short fiber content in different stages at blowroom ($Y = 14X + 12.8,\ R^2 = 0.992$).

Graphical representation of wastage percentage in blow-room

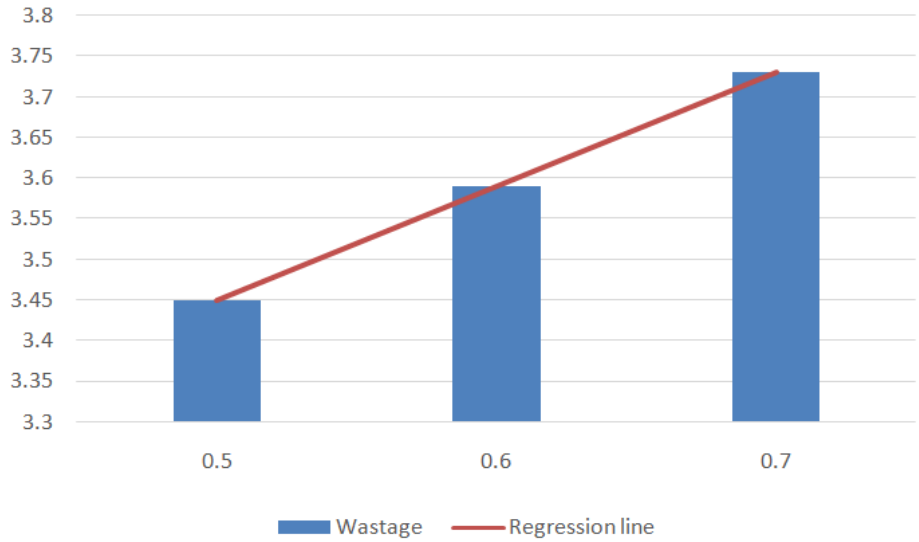

Figure 4: Wastage percentage for different trials ($Y = 1.4X + 2.75$, R^2 =1.0).

V. Discussion

It is clearly observed from the above figure that neps generation is high for higher beater speed. This can be explained by the fact that the fibers are stressed under more beater speed, causing breakage of fibers and hence the increase in percentage of neps. Cleaning Intensity (C. I.) is directly proportional to beater speed. So for higher C. I. neps generation percentage is high.

A regression line is also fitted from the given data set of cleaning intensity and neps generation percentage to see the relation between them, where the linear parametric values are 75.3 and 85.293 in getting least square fit. It is seen from the figure that the relation is between cleaning intensity and neps generation percentage is about linear and they are positively correlated with R^2 value 0.999.

It is clearly observed from the above figure that short fibre content is high for higher beater speed. This can be explained by the fact that the fibers are stressed under more beater speed, causing breakage of fibers.

A regression line is also fitted from the given data set of cleaning intensity and short fiber content to see the relation between them, where the linear parametric values are 14 and 12.8 in getting least square fit. It is seen from the figure that the relation is between cleaning intensity and short fiber content is about linear and they are positively correlated with R^2 value 0.992.

It is clearly observed from the above figure that wastage percentage is high for higher beater speed. Relative Amount of Waste (RAW) is directly proportional to the grid bar angle. Higher the angle, wider will be the setting and correspondingly more waste gets extracted and vice versa.

A regression line is also fitted from the given data set of cleaning intensity and wastage percentage to see the relation between them, where the linear parametric values are 1.4 and 2.75 in getting least square fit. It is seen from the figure that the relation is between cleaning intensity and wastage percentage is about linear and they are positively correlated with R^2 value 1.0.

VI. Conclusion

Blow-room cleaning efficiency increases with the increase in opening but falls after a certain value of openness. Fine settings at initial beating point can shatter trash particles, making their removal difficult at later stages. The cleaning Intensity is directly proportional to the beater speed of Uni-clean machine at particular relative amount of waste (Grid Angle). For the given mixing C.I.:0.5/R.A.W.:5 (Trial-A) shows better result in this work & its setting have implemented in the particular mixing with improved quality & less good fiber loss in waste at time of opening & cleaning of raw materials.

References

[1]. Ishtiaque, S. M., Chaudhuri, S., & Das, A. (2003). Influence of fibre openness on processibility of cotton and yarn quality: Part I-Effect of blow room parameters
[2]. Pujara, M. H. (2016). Effect of Cotton Fibers and Their Trash Characteristics on the Performance of Spinning Preparatory Processes. *International Journal of Engineering Research and Applications*, *6*(6), 42-45
[3]. Ratnam, T.V. and Chellamani, P., Norms for Spinning, 5th Edition, SITRA, Coimbatore, India, pp 1-9 & 30 -37, 2000
[4]. Chaouch, Walid & Hassen, Mohamed &Faouzi, Sakli. (2007). Evaluation of cleaning efficiency in blowroom& carding. The Indian Textile Journal. 54
[5]. Khan, A.N. (2009) *Principles of Short Staple Spinning*
[6]. Klein, W. (1986). *Technology of short-staple spinning*, Textile Institute
[7]. Khare A.A. - Element of Blow room and Carding, Pag. No. 53, 55, 58
[8]. Booth, J. E. (1970). Principles of textile testing

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