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ANALYSIS OF CHANGES IN FIBER PROPERTIES IN PROCESSES OPENING, CLEANING AND CARDING

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ABSTRACT

This article investigated and examined the change in the quality properties of cotton fiber and degree of purification. In the technological process of blowing, cleaning and carding. The basic purpose of this study determine the optimizing the technological parameters of blowing, cleaning and carding process for normal yarns by using fiber which is estimated as the average quality by the USTER®. Short fiber cotton was used to produce normal counts, i.e Ne 30 OE yarn spun on Autoconer 9 spinning frame. Yarn produced by spinning process from semi-finished products collected at different type technological parameters of spinning process shows variable yarn properties. The study of all these parameters plays important role to achieve better quality output of the spinning process.

KEYWORDS: *Fiber Properties, Blowing, Cleaning, Carding, Neps, Optimization*

I. INTRODUCTION

Cotton-spinning production has a number of features, which include the continuity of processes; a large number of interrelated and interdependent factors that determine the process; the presence of external and internal uncontrolled disturbing influences affecting the quality of raw materials, produced semi-finished products and yarn.

Depending on the degree of influence of each of these factors on the quality of raw materials, semi-finished products and yarn, and their interactions, deviations of the parameters of technological processes occur in time, which leads to fluctuations in their quality indicators.

Modern blowing and cleaning units blown cotton more finely, mix the components of the mixture better, more completely clean cotton from minor pollution, and create continuity of the production flow from a bale of cotton to the formation of a sliver on a carding machine.

Blowing and cleaning of fibrous material from trash impurities should be considered as two continuously connected and influencing processes, including several successive stages. A prerequisite for effective cleaning of raw materials with minimal damage to fibers is to ensure a high degree of blowing before entering the cleaners, since the latter can effectively remove only those minor pollutions and hard impurities that are on the surface of cotton shreds.

Blowing and cleaning of fibrous material is carried out on all machines of the production line, from the bale ripper directly to the carding machine. Many engineering firms in various versions produce modern blowing units. In the process of spinning, the technological systems for blowing, cleaning and carding of fibers are very diverse and the correct choice of maintaining the properties of the fiber in technological processes and maintaining the specified properties of the yarn is of great importance. In order to produce an even, clean yarn, the fibers must be completely separated from each other, sufficiently cleaned and evenly spaced in the product. In the production of textiles, the carding process is considered the most optimal and only technology for preparing fibers in the above form.

The carding process is carried out as a result of the interaction of a set of carding machines that cover the surfaces of the working parts.

The card clothing separates the fiber bundles into individual fibers, combing out small and tenacious impurities, as well as short fibers to waste, and in partial fiber orientation.

Therefore, the carding process plays an important role in determining the characteristics and properties of cotton yarns.

As a result of the fact that the rotational speed of the current carding machines has increased more than three times than that of the previous carding machines, that is, the main drum from 200 min^{-1} to 900 min^{-1}, the liker-in drum from 700 min^{-1} to 2700 min^{-1}, the speed of movement of the flats increased from 0.1 m / min to 0.4 m / min, respectively, in the technological transitions of the spinning process, changes in the qualitative properties of the fiber occur and, accordingly, the structure of the yarn also changes.

Therefore, the effective use of raw materials in the production of yarn and a thorough study of the effect of changes in the structural indicators of fibers on the structural indicators of the yarn during technological transitions has become an urgent problem.

In addition, optimization of technological processes based on the study of factors that affect the structure and properties of the yarn is essential in improving the spinning efficiency.

Despite the fact that the performance of spinning mills significantly grow, some key problems still await solution in the process of yarn production, including:

Identifying the cause of defects (IPI) on the yarn and ways to eliminate them;

An increase in the yield of yarn from fiber with an increase in production productivity;

In achieving, in terms of the quality of cotton yarn, a state of competitive high quality, corresponding to the demand of the world market.

As a solution to these problems, the need to identify the optimal parameters of the working parts of machines in the technological process of spinning is mentioned.

To date, there are no universal methods and recommendations for improving the quality of products manufactured by enterprises operating on modern equipment.

To accomplish these tasks, it will be necessary to determine the optimal parameters of the working parts of technological machines.

To ensure the rational use of raw materials, to ensure quality products and semi-finished products, it is necessary to conduct more and more scientific research, based on which to optimize the technological parameters of refueling equipment, to design new solutions that will effectively solve the tasks set for the cotton spinning industry. Today, the issues of studying the dependence of yarn properties on the raw materials used and technological parameters of machines are very relevant and in demand.

The study of changes in the properties of fibers and semi-finished products during production passing through the sequence of technological processes is the main direction of increasing the efficiency of not only spinning production, but also the production of finished textile products. Because the performance of subsequent transitions depends on the preservation of the natural properties of the fibers and the unevenness of semi-finished products, from blowing the bale to the production of finished fabric.

Cotton fiber, from the process of its collection to the production of finished products, passes through many processes, where it is constantly exposed to humidity, temperature, working parts of machines, which leads to damage to the cotton fiber [1].

Mechanical and biological damage to fibers ultimately leads to a decrease in the natural properties of the fiber, such as fiber length, strength, elongation index, elongation at break, an increase in the content of trash impurities, short fibers, which directly affects the quality of the yarn produced. A change in the structure of a fiber under biological action leads to a decrease in its strength characteristics, and under the action of the working parts of machines installed in the technological process; it increases the damage to the fibers. If we take into account that the fiber passes through several technological processes, where it is subjected to mechanical stress, then by the end of these processes it loses its original properties. Based on this, it can be concluded that in order to preserve the natural properties of the fiber, it is necessary to reduce the processes of exposure of the working parts to it in each technological process, and also the processes must be carried out in the optimal technological mode [2], [3].

The analysis of the research work carried out showed that with mechanical damage to the fiber, fine fractures appear on its surface the formation of these fractures on their surface leads to a decrease in the quality indicators of the fiber, such as strength and elongation at break.

As a result of our research, it was found that endless mechanical stress on the fiber leads to its damage. To determine the level of influence of the mechanical action of the working parts of machines on the properties of the fiber, we carried out experiments, as a result of which the degree of mechanical damage was determined by the transitions of the spinning industry.

II. MATERIAL AND METHOD:

During the experiment, we used medium-staple cotton of type 4, grade I, selection C 6524, which was processed in a Blowroom for blowing and cleaning and subsequent feeding for carding. The experiments were carried out using technological equipment from TRUTZSCHLER®(Blowroom line and Card TC-19i) [4].

III. TECHNOLOGICAL PART:

During the experiments, fiber samples were taken from each transition machine by random sampling. Cotton samples were tested on laboratory equipment AFIS [5]. The investigated properties of a cotton fiber sample are shown in Table 1.

TABLE 1 FIBER PROPERTIES BY TRANSITIONS, TESTING IN AFIS EQUIPMENT

ITEM of process	Tot Nep Cnt [cnt/g]	SC Nep Cnt [cnt/g]	SFC(w) %<12,7 mm	Maturity [mat1]	Fineness [mteks]	UQL(w) [mm]	Trash Cnt [Cnt/g]
Blendomat BO-A	211	35	6,9	0,91	169,0	30,5	39
SP-MF	203	21	7,4	0,90	164,0	30,4	45
CL-P	213	27	5,5	0,91	163,0	30,8	59
MX-I	689	15	5,5	0,90	161,0	30,9	29
CL-C3	298	31	5,5	0,89	158,0	31,2	51
SP-DX	307	27	4,9	0.89	160,0	30.6	32
Feed shute	337	33	5,8	0,89	157,0	30,8	26
CNUFT	293	19	5,1	0.89	159.0	30.8	33
CARDCHUTE-08L2	380	23	6,6	0,87	159,0	28,6	31
Liker-in	423	76	10,6	0,88	162,0	27,1	284
TwinToprear	1 095	202	37,8	0,79	149,0	22,6	467
Top flat	703	343	8,3	0,91	177,0	27,7	277
Twin top	549	60	46,0	0,79	156,0	20,8	63
TC -19i CARD sliver	103	12	5,7	0,95	176,0	29,4	1

Table 1 shows the results of changes in the properties of fibers obtained in the process of opening, cleaning and carding. Qualitative indicators such as the number of Neps in the initial stages of processing increase, the content of short fibers varies unevenly after each transition of cotton fiber processing. This can be explained by the influence of the dynamic and mechanical

effects of the working parts of the machines in the process of blowing, cleaning and carding the fibers.

An increase in Neps can lead to problems in the finished yarn, and affects an increase in the IPI value [5].

Which directly requires even more attention to research in these transitions of the spinning process.

To facilitate the analysis of the results obtained, histograms were drawn up on the change in the properties of the processed fiber in each transition.

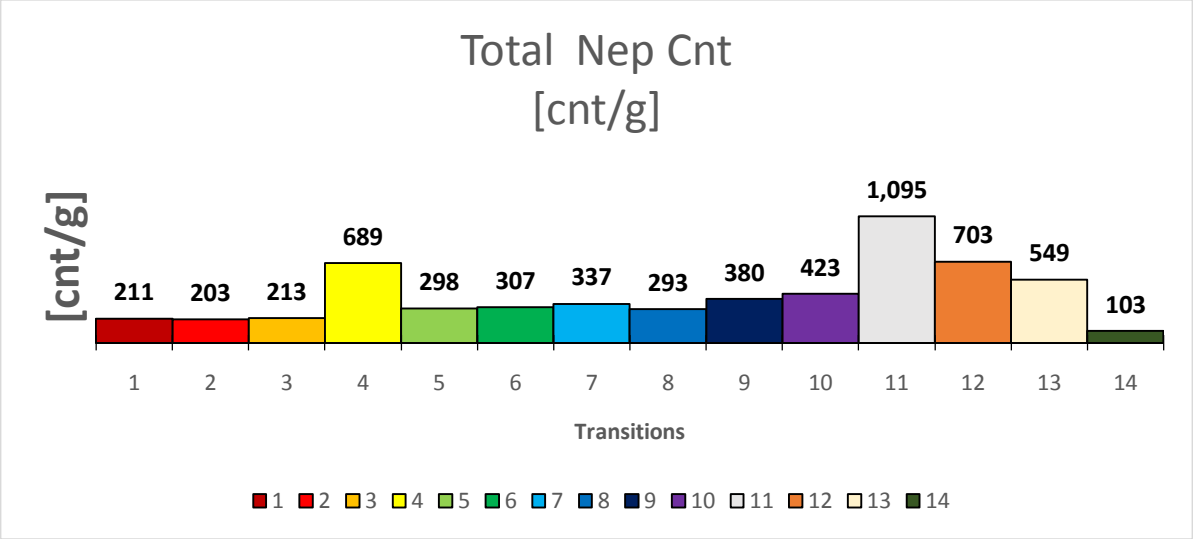

Fig-1. Change the q of Neps by transitions

Where is,

1- neps count after BLENDOMAT BO-A

2- neps countafter the SP-MF separator

3- neps countafter pre-cleaner CL-P

4neps countafter the MX-I mixer

5- neps countafter the CL-C3 cleaner

6- neps countafter the SP-PX separator

7- neps countto the receiving hopper of the carding machine

8- neps countafter CNUFT

9-neps countafter CARD CHUTE receiving hopper

10-neps countafter the liker-in drum of the carding machine

11-neps countafter the back segment of the card

12-neps countafter the carding machine

13-neps countafter the front segment of the carding machine

14- neps count in the carding sliver

TABLE 2 TECHNOLOGICAL PARAMETERS OF TC 19I CARDING MACHINES

Item of parameter	Parameters
Feed speed	500-600
Taker-in speed	1250
Cylinder speed	520
Flat speed	320
Delivery speed	200
Total number of flats in rotation	99
Cylinder to flat distance (in five different positions from back to front	Position 1: 0,250 position 2: 0,250 position 3: 0,220 position 4: 0,220 position 5: 0,200

From the Pic 1. onhistogram, you can determine what, the number of neps after cleaning processes on the CL-P machines. CL-C3, the take-up drum of the carding machine, where the serrated sets act on the fiber sharply, increases. Towards the end of the carding process, the number of neps decreases under the influence of fixed flat segments and a flat blade. From the constructed histograms, one can come to the following understandings: during the process of blowing, cleaning and carding, it is necessary to optimize the operating parameters of the working parts of the machines, such as distribution and speed, as well as the pressure of the air suction [6].

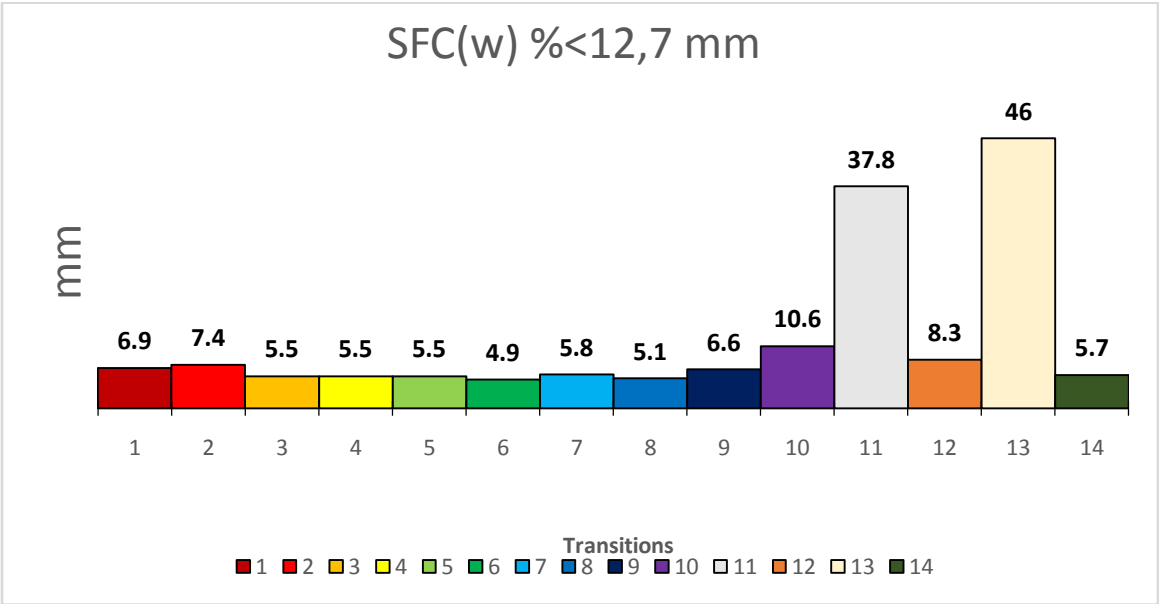

Fig-2. Change in the number of short fibers by transition.

As can be seen from the histogram in Fig-2, the number of short fibers increases in the process of carding the fibers on the back and front carding segments, since after the carding segments the proportion of short fibers should have decreased, but in our version the opposite happened, which leads to the idea that the fibers have places of mechanical damage and the card itself can become an object of improvement or decrease in the quality characteristics of fibers. That requires special attention to the establishment of the operating parameters of technological machines.

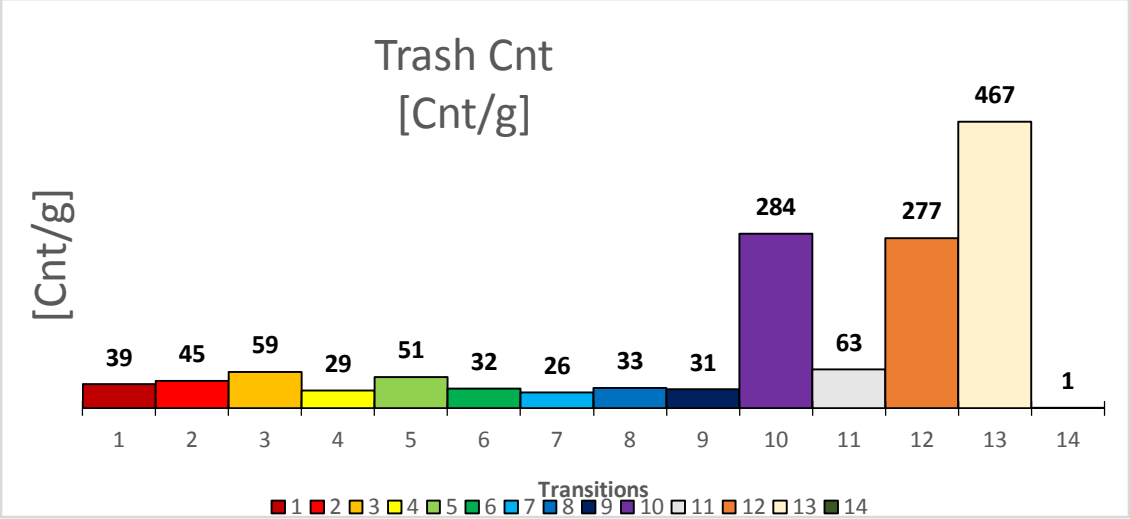

Fig-3. Change in the count of trash by passages

The results obtained show that each machine, depending on the type of set of working parts, affects the degree of cleaning of the processed material. It can be seen from the histograms in Fig-3 that the Blowing - cleaning unit has the greatest cleaning effect, while on these units, defects, neps, cotton waste, dust and fiber fluff, cotton leaves and non-spinning fibers are removed.

The final in-depth cleaning of the fiber is applied by carding machines. It was found that an increase in the speed of preliminary carding with the receiving drum leads to intensive separation of fibers and the impact of the teeth of the card clothing leading to grinding (in micron sizes) trash impurities. As our analyzes show, after the receiving drum (liker-in), the proportion of trash impurities increased. There is also an increase in fiber breakage and neps removal efficiency. The result is an increase in the IPI and hairiness of the yarn and also a decrease in the strength in a single yarn.

IV. CONCOLUTION:

1. In the course of the study, the influence of the settings of technological machines in Blow room and carding machines on the change in the main quality properties of cotton fiber, improving the indicators of neps and uneven quality indicators of the carding sliver was studied**.**

2. It has been determined that the carding process has a significant effect on the quality properties of cotton fibers and plays an important role in improving them.
3. The optimal technological parameters for the production of ribbons for yarn produced for weaving and knitting purposes have been developed, which allows increasing the productivity of carding machines up to 80-100 kg / hour.
4. The results of theoretical and experimental studies on increasing the efficiency of carding machines, improving the quality of combed fibers and optimizing the technological parameters of the fiber processing process are considered.

V. ACKNOWLEDGMENT

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VI. DECLARATION OF CONFLICTING INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES:

1. Д.Э. Казакова, К.Ж. Жуманиязов. Влияние различного смесового состава на механическую поврежденность и длину волокна по переходам прядильного производства.

2. Karch N.V., Malakane P.B., Cadole P.V. Studies on Fiber Migration in the Spinning Process // Artificial Textiles in India. – 46 (4), 2018. P. 123...126.

3. Gunaydin G.K., Soydan A.S., Palamutsu S. Evaluation of the properties of cotton fiber in spinning processes of compact yarn and the study of the properties of fiber and yarn // Fibers and Textiles in Eastern Europe. – 26 (3), 2018. P. 23...34.

4. Card TC 15-Brochure, Trutzschler Spinning, Trützschler GmbH & Co. KG Textilmaschinenfabrik, Mönchengladbach, Germany [Электронныйресурс]. – https://www.truetzschler-spinning.de/en/products/card/technical-highlights/

5. Sanjar, Tojimirzayev et al. "Influence of short fibers on the quality characteristics of the product, yield of yarn and waste of cotton fiber." *International journal of innovation and scientific research* 6 (2014): 44-49.

https://www.semanticscholar.org/paper/Influence-of-short-fibers-on-the-quality-of-the-of-Sanjar-Baxramovna/47df6e1e142c0da0a219345aefe02f1b7b7a1e19

6. TojimirzaevSanjarTurdialiyevich; ParpievKhabibulla. "The Influence Of Top Flat Speed Of Carding Mashine On The Sliver And Yarn Quality". *European Journal of Molecular & Clinical Medicine*, 7, 7, 2020, 789-797. https://ejmcm.com/article_3287.html

7. СТ Тожимирзаев, УХ Мелибоев, Х Парпиев -Исследование влияния скорости выпуска чесания на качественные свойства пряжи //EuropeanJournalofTechnicalandNaturalSciences, Volume 4, 2020 pp 7-14. https://www.elibrary.ru/item.asp?id=44206345

8. Парпиев Х. и др. Влияние микронейра хлопкового волокна на качество пряжи //Физика волокнистых материалов: структура, свойства, наукоемкие технологии и материалы

(SMARTEX). – 2017. – №. 1. – С. 358-362. https://smartex2.ivgpu.com/wp-content/uploads/2019/08/358-362.pdf

9. KorabayevSh.A; Mardonov B.M; Matismailov S.L; Meliboyev U.X "Determination of the Law of Motion of the Yarn in the Spin Intensifier", Engineering, 2019, 11, 300-306.

https://www.scirp.org/journal/paperinformation.aspx?paperid=92784

10. Korabayev Sh.A; Matismailov S.L; Yuldashev A.T., Atanbayev D.D. (2020) "Study Of Fiber Movement Outside The Crater Of Pnevmomechanical Spinning Machine", Solid State Technology. Vol. 63 : Iss. 6. Pages 3460-3466.

http://www.solidstatetechnology.us/index.php/JSST/article/view/3473

11. RuiyangLu .YucongYu .GafurovAdkhamjon .Wenli Gong. Xiaoqing Sun . Lin Liu. (2020) Bio-inspired cotton fabric with superhydrophobicity for high-efficiency self-cleaning and oil/water separation. Cellulose (2020) 27:7283–7296.

https://doi.org/10.1007/s10570-020-03281-9