CHANGES OF COTTON FIBER PROPERTIES IN THE GINNING AND AUTOMATIC BALE OPENER

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Abstract: This article examines the changes in the properties of cotton fiber as a result of impact action during ginning and automatic bale opening. Currently, in our country, the quality of yarn spinning in the spinning mills is determined by the length of the fiber, micronaire, strength (Str) and stiffness index of raw cotton. Moreover, the options for the introduction of fiber production and quality yarn production technology that meet the requirements of Uzbekistan state standards 604:2016 are presented in this article in relation with technologies in future processes. The paper deals with the study of the changes in the physical and mechanical properties of fiber in the process of ginning cotton, fiber cleaning, yarn spinning.Also, experiments were carried out at the Cotton Ginning Plant "Midasiatex Cluster" LLC. Samples in this experiment were taken from the fibers separated on a DP-130 roller gin machine in the sequence of processes.Theresearch paper describes some changes in the physical and mechanical properties of fiber in the processes of ginning cotton, fiber cleaning, and yarn spinning, pressing. Fiber properties of the product in each process were explored, and the research was conducted in the laboratory of the joint venture "Wakefield Inspection Services (Tashkent) Ltd" under Tashkent Institute of Textile and Light Industry the quality of cotton fiber using modern Uster® HVI 1000 system. As a result of the experiment, samples were obtained and analyzed. Thus, the author concluded that an opportunity would be created to achieve economic efficiency of the country. =

Keywords: Cotton fiber, fiber properties, detachment of fibers, automatic bale opener, Uster HVI 1000 system.

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INTRODUCTION

In the Republic of Uzbekistan, in order to establish the systematic development of industrial sectors, the Association "Cotton and Textile Clusters of Uzbekistan" was established. The introduction of optimal options of resource-saving technological lines for the efficient operation of cotton and textile clusters and the preparation of quality finished products is a topical issue and it is considered to be one of the important and topical issues [1].
Currently, traditional technologies are used in spinning yarn from cotton fiber. The analysis of the research is based on each side of the negative impact on the natural properties of cotton fiber in the organization of control of technological processes of primary processing of cotton, such as non-compliance with regulations on storage, drying, cleaning and ginning of cotton [2,3].
In the processes of spinning, the preservation of fiber length without damage, linear density is of great importance in yarn spinning thin, smooth and fluffy yarn. In a fibrous mixture, the decrease of long fibers, the increase of short fibers, fiber will be damaged, and its natural properties are reduced as a result of repeated mechanical effects in technological processes [4, 5].
When we conducted the research and analyzed, special attention was paid to the processing of cotton varieties of different lengths, especially to improve the quality of cotton fiber in the technological lines, the presence of non-compliant aspects will reduce the damage of cotton fiber in the technological process of primary processing reduce maintenance costs [6, 7].
In the production of yarn spinning, it has been found that when cotton bales are threshed in special automatic bale openers, strong repetitive mechanical effects are puton the cotton bales by the spinning openers.The deterioration of fiber quality under the influence of strong pressure used in the pressed into bale of cotton fiber has also been analyzed and proved in the research works [8].
Scientific research has been conducted to determine the effect of cotton fiber density to mechanical damage.As a result of the high pressure compaction of the cotton fiber during the spinning process, the number of injuries on the level ofstiffnessof the cotton fiber has been as in the following: working pressure was 12 at 16 MPa, the pressure strength was 28 at 32 MPa, and the increase in fiber damage has been scientifically justified [9].
As a result of the analysis of scientific research that was conducted, it has been proved that fiber and raw products in technological processes are subjected to various effects due to the large number of transitions that can lead to the deterioration of their physical and mechanical properties [10].
Furthermore, the aim of the research was to study the factors affecting physical and mechanical properties of fiber in the bale opening process, and to analyze changes in physical and mechanical properties of fiber in the laboratory under the initial processing of cotton fiber, and spinning.

METHODOLOGY

In this scientific research paper, experiments were conducted to study changes in the physical and mechanical properties of fiber in the process of ginning cotton, in the process of fiber cleaning, in the process of yarn spinning,in the spun fiber and pressing process.The experiments were carried out at the Cotton Cleaning Plant, which is part of "Midasiatex Cluster" LLC, from the fibers separated in the DP-130 brand ginning machine of the 1stquality high-grade cotton variety "Sultan" in the sequence of transitions. In the spinning workshop of "Boston Mega textile" LLC, near "Boston Cluster" LLC company, sorting of 1st quality "Sultan" selection cotton variety of type 4 and type 5, fiber samples selected from the opening process of automatic bale openerBlendomat BO-A 2300.In the analysis of the samples, much attention was paid to the change in the fiber properties of the product in each process.In the laboratory of the joint venture named "Wakefield Inspection Services (Tashkent) Ltd" under Tashkent Institute of Textile and Light Industry, the quality of cotton fiber was analyzed and studied employing the modern system Uster® HVI 1000.

PROCESS OF THE RESEARCH

Fiber samples were taken from the bale,the fiber cleaning process, and from the inside of the roller gin during the ginning process.During the spinning process, fiber samples were taken from the sorted composition during the spinning process, after the automatic bale opening process, and stored in special containers. Quality indicators of cotton fibers obtained from various processes were tested on laboratory equipment of Uster® HVI 1000 system, in accordance with the standards of UzDst (Uzbekistan state standards) 604-2016. For this purpose, three samples of 100 grams from each process sample were prepared and tested. The quality indicators determined by the average value of the obtained results are given in Tables 1 and 2 [11].

Table 1. Quality indicators of fiber samples obtained from the ginning process

N	Samples	Mic	Mat	Str cN/tex	LenDm	Unf%	SFI % (12,7мм)	Elg %	Rd%	+b %	SCI
1	1st sample (fiber from ginning)	5,13	0,88	32,7	1,121	84,0	6,8	6,3	80,3	8,3	140,8
2	2nd sample (fiber from cleaning)	5,06	0,88	32,1	1,109	83,0	7,9	6,3	81,0	8,2	134,5
3	3rd sample (fiber obtained from pressing)	5,49	0,89	30,7	1,103	83,8	7,2	6,9	81,6	8,5	130,9

Based on the results presented in Table 1, the changes in fiber quality indicators in each process were analyzed in the form of the histogram.

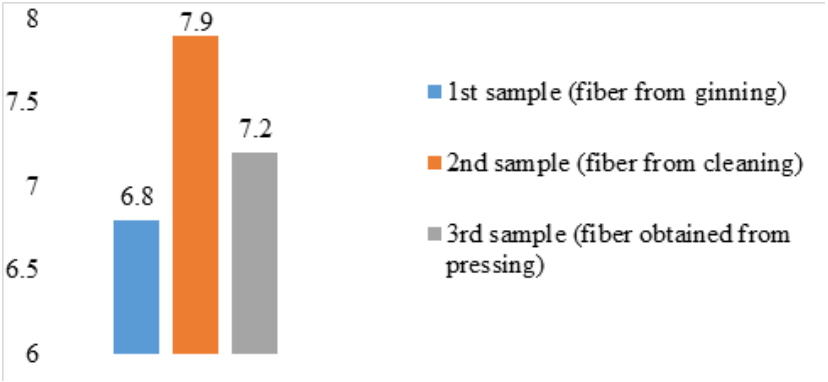

Figure 1. Changes in the short fiber index (SFI)

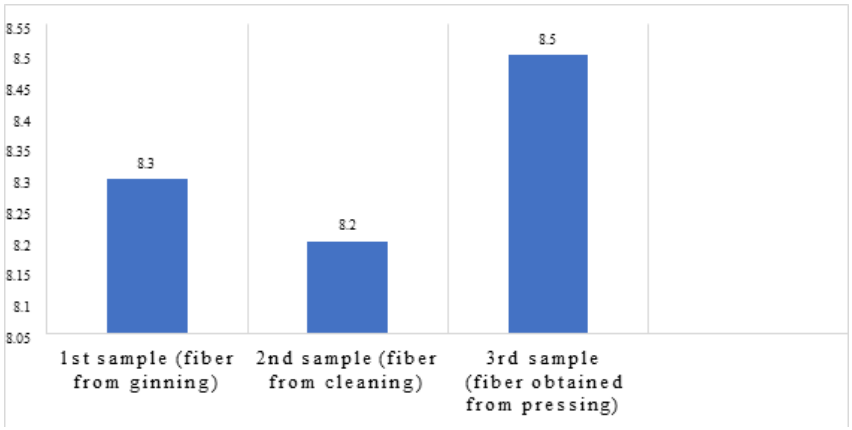

Figure 2. Variation in fiber yellowness (+ b%)

From the test results of the samples taken from the initial processing of cotton in the Uster® HVI 1000 system are analyzed, it can be seen that some quality parameters of the fiber have changed in the sequence of processes.For example, the short fiber index (SFI) increased by 1.1% in sample 2 (fiber from cleaning) and by 0.4% in sample 3 (fiber from pressing) compared to sample 1 (fiber obtained from ginning), the degree of yellowness of the fiber (+ b) in sample 2 (fiber from cleaning) decreased by 0.1%, in sample 3 (fiber from pressing) decreased by 0.2%, micronaire index (Mic) increased by 0.36 in sample 3 (fiber from pressing) can be observed.

Changes in the quality of some of the fiber properties in the sequence of processes in the initial processing of cotton can lead to wetting of the fiber during the pressingprocess by an increase of 0.2% in the degree of yellowness of the fiber during spinning. It can be understood that an increase in the short fiber index (SFI) in the process is caused by a decrease in the strength (Str) of the fiber [12].

Table 2. Quality indicators of samples taken from the opening process

N	Fibersinprocesses	Length	Mic	Strengt hcN/tex	Rd	+b	Trash code	SFI%	Uniformiy %	Elg %
1	1st sample (fiber sorted)	1,12	4,6	28,33	75,90	9,10	3,0	4,30	83,00	6,86
2	2nd sample (fiber obtained from bale opener)	1,12	4,6	27,86	75,36	9,10	2,6	4,63	80,20	7,23

Based on the results presented in the Table 2, the changes in the quality of fiberindicators from the bale opening process were analyzed in the form of the histogram.

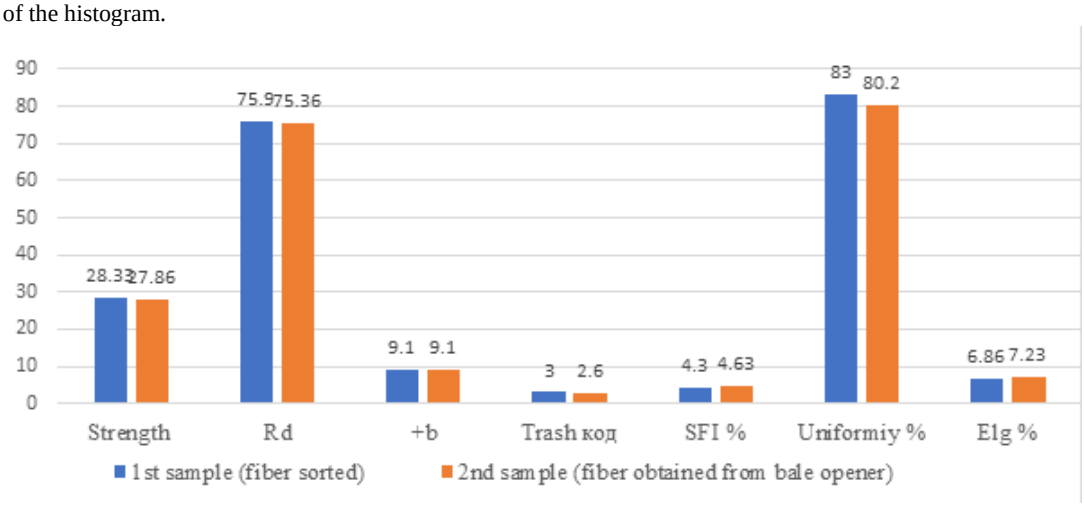

Figure 3. Changes in fiber properties in the opening process

When we analyzed the test results in the Uster® HVI 1000 system, samples taken from the automatic bale opening process in the yarn spinning system, it can be seen that the fiber quality indicators in the processes have changed. The short fiber index (SFI) increased under the influence of shocks, and therefore the uniformity index (Unf) along the length of the fiber decreased. As a result, it was found that the fiber elongation at break (Elg) has increased as the fiber uniformity index (Unf) decreased during the yarn spinning process. Furthermore, it can be observed that the stiffness strength (Str) of the fiber in the bale decreases as a result of the increase in tension in the fibers as a result of impacts during the opening process.

RESULTS AND DISCUSSION

In order to study the effect of technological processes on the properties of cotton fiber, samples were taken from production processes and the results of scientific research conducted in the laboratory were analyzed. It was observed that as a result of the increase in tension in the fiber bundles under the influence of repeated impact forces in the processes of cotton fiber, the formation of bumps and cracks on the fiber surface, fiber quality indicators have changed negatively. In particular, it was found from the geometrical properties of the fiber that the short fibers increase in the sequence of processes, while the uniformity index along the length of the fiber decreases.

As a result of the research, when we analyze the fiber quality indicators obtained, there is a high probability that the negative indicators change under the influence of more repeated shocks after the opening process, that is cleaning, short fiber growth, part of the fiber breakage. Such negative factors could lead to the waste of fibers during spinning and an increase in yarn unevenness and degree of fluffiness.Flexibility of fiber is one of the main statistical properties, as the damage to the fiber increases as a result of various biological and technological influences in the processes, and first of all there can be seen breaks in the damaged area of the fiber [12].

At present, the quality of ginning in spinning mills in the country is determined by the length of the fiber, micronaire, strength, and stiffnessindex of raw cotton from HVI.

Thus, taking into account these requirements, as a result of further reduction of repetitive technologies in the process, it can be possible to obtain fiber that meets the requirements of Uzbekistan state standards 604:2016, and to introduce high-quality yarn production technology [13].

CONCLUSION

Thus, based on the results of the research to determine the process of changes in the properties of cotton fiber, we came to the following conclusions and suggestions:

1. In traditional cotton spinning systems, in yarn spinning frompressed cotton, pressing and spinningprocesses, due to the length of the technological lines, the natural properties of the fiber deteriorate under the influence of repeated strokes, lead to a decrease in the quality of yarn spinning capacity;

2. In the example of cotton-textile clusters, as a result of the creation of an integrated supply system for the compact resource-efficient seed cotton spinning process, there will be created an opportunity to make yarn that meets the criteria of Uster Statictic 2018 and,economic efficiency can be achieved as well.

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