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RESULTS OF RESEARCH ON AN IMPROVED COTTON REGENATOR

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Abstract. The article presents the results of the research conducted on the application of the improved cotton regenerator to the Independence cotton cleaning technology. In the studies, the length uniformity index of cotton fiber (Unf), relative breaking strength - hardness (Str), the number of impurities of cotton fiber (Cnt), the amount of short fibers (SFI), the index of contamination with non-fiber impurities (T) of the technology installed in the enterprise were determined and changes in fiber quality indicators such as yellowness (+b) were investigated. According to the results of the conducted research, it was found that the quality indicators of cotton fiber produced in the improved cotton regenerator are better than the existing cotton regenerator.

Keywords. cotton, dirt, moisture, cleaning technology, regenerator, cleaner.

Introduction. In our republic, comprehensive measures are being taken to develop cotton-textile clusters, modernize and re-equip cotton ginning enterprises, increase the profitability of initial processing of raw materials, and, at the same time, the competitiveness of manufactured products, and certain results are being achieved. In the new development strategy of Uzbekistan for 2022-2026, among other things, "...continuing the industrial policy aimed at ensuring the stability of the national economy and increasing the share of industry in the gross domestic product, it is aimed to increase the production volume of industrial products by 1.4 times, in which the production of textile industry products to increase the size by 2 times". In the implementation of these tasks, among other things, it is important to create an effective technology for the regeneration of cotton pieces from the impurities released in the UXK cleaning line.

A lot of scientific research has been conducted on cotton cleaning techniques and technology and regenerator improvement. For example, in the research conducted by I. Madumarov [1], it was determined that the moisture content of cotton fiber is 5.5% during the cleaning process. It is emphasized that the moisture content of the fiber, not the cotton, is important during the cleaning process. Because the moisture content of cotton fibers with the same humidity is not always the same.

In the research carried out by researchers [2-5], it was found that the structural composition of cotton is important in the cleaning process, it has a positive effect on improving the cleaning efficiency and maintaining the natural quality indicators of the product.

In a number of studies [6-13], research was conducted on improving the cleaning efficiency and maintaining product quality by improving the working parts of cleaning equipment.

A new 2RX-M type cotton regenerator was developed by the scientists of "Pakhtasanoat Scientific Center" JSC [14, 15], in which instead of 480 mm saw drums used in RX regenerators, saws with a diameter of 300 mm from gin equipment were used with re-opening of the teeth.

In the technological process of cleaning cotton, we study the separation of impurities in it, the inclusion of cotton particles in the composition of impurities, and the effectiveness of cleaning it in a cotton regenerator.

Experiment methodology. A production sample of the improved cotton regenerator was prepared at "Cotton Gin KB" and installed on the cleaning line of the "Independence Cotton Refinery" enterprise (Fig. 1).

Figure 1. Overview of the improved cotton regenerator

The cleaning line consists of 2 lines, and each line is equipped with a cotton separator of the SS-15A model. The cotton ginning line is equipped with 1XK small dirt cleaning equipment with 8 pile drums, 4 consecutively installed UXK small and large dirt cleaning equipment, and 1XK cleaning equipment with 8 pile drums. 1 RX model equipment is installed for regeneration of cotton particles that have been added to impurities. The existing RX regenerator is powered by air. The improved cotton regenerator works mechanically.

The supply section of the proposed design, separator-conveying brush drum and cotton outlet throat and diverter are installed on top of the existing RX regenerator in cotton cleaning technology. Cotton mixed with impurities from the UXK cleaning stream is transferred to the shaft of the RX equipment by means of an inclined belt conveyor. The cotton falling into the mine is transferred to the saw drum with the help of a pair of supply rollers, and the cotton pieces are attached to the saw teeth with a gluing brush.

After cleaning the cotton from the colostrums, the saw drum throws the cotton towards the conveying brush drum. The conveying brush drum in turn moves the cotton up toward the rotating bevel guide. With the movement impulse received from the conveying brush drum, the cotton saw

drum is moved along this length by an average of 250 mm and passes to the next part of the saw drum. In this way, the cotton is cleaned 5-6 times, moving in a spiral form through the saw drum and colosniks. At the end of the regenerator, a cotton outlet is installed, and in this part, a guide is installed at the top of the transfer brush drum. The function of the guide is to move the cotton towards the exit hole. The cotton cleaned from the regenerator is mixed with the cleaned cotton in the UXK cleaning stream and sent to the ginning section.

In order to compare the results of the experiment, the quality indicators of the cotton produced in the technology with the existing RX regenerator were determined. Experiments were then carried out on the improved RX regenerator.

To determine the amount of moisture and dirt content of cotton, the methods specified in the state standards of UzDSt were used. Also, the quality indicators of cotton fiber were determined in the HVI system.

Based on the results of the research, the proposed cleaning technology works as follows: the cotton is dried to the desired moisture content, sucked into the cleaning section using the SS-15A separator, and transferred to the UXK cleaning line, which is located in two rows, through the dividing screw ShRX. In the UXK cleaning line, small impurities are first cleaned in 1XK equipment (with 8 pile drums), and small and large impurities are cleaned in 4 successive UXK equipment. After that, it is once again cleaned from small impurities in the 1XK equipment. In the UXK equipment, the cotton pieces that have been mixed with dirt from the saw sections are transferred to the shaft of the RX regenerator by means of collecting belt conveyors and an inclined belt conveyor. The cleaned cotton in the RX regenerator is sent to the gin or to the UXK cleaning line for re-cleaning when the dirt content is high.

Experimental test results. In the experiments, the humidity of Sultan selection cotton was 8.3; 8.7% and pollution level 5.65; 7.3% of raw materials were used.

The results of the experiment are presented in the form of a histogram in pictures 2÷7, in which the following technological stages are reflected: I - in the cotton gin; II – 1st line UXK after the cleaning line; III – 2nd line after the UXK cleaning line; IV – cotton fiber added to the impurities in the UXK cleaning lines; V – after RX cotton regenerator; VI - in the fiber in the fiber in the fiber bundle during the pressing process; VII – after improved RX cotton regenerator.

Analyzing the histogram presented in Figure 2, the length uniformity index (Unf) of the cotton fiber in the current technology is 86.9% in the cotton gin, 84.2% after the 1st line UXK cleaning line, 85.85 after the 2nd line UXK cleaning line. 3%, 84.0% in cotton fiber added to impurities in UXK cleaning lines, 83.4% after RX cotton regenerator and 82.4% in produced fiber. After the improved RX cotton regenerator, the length uniformity index was found to be 84.0%, which was 0.6% higher than that of the unimproved RX.

The length uniformity index of cotton fiber is 84.2% in 1st line UXK cleaning line but 85.3% in 2nd line UXK cleaning line. As a result, the lengthwise uniformity index of cotton fiber is observed to decrease in the 1st line of UXK line. Also, in the improved RX cotton regenerator, the length uniformity index is 84%, and it is achieved that the cotton entering the regenerator does not have a negative effect on the length uniformity index.

Current technology comparative breaking strength - toughness (Str)

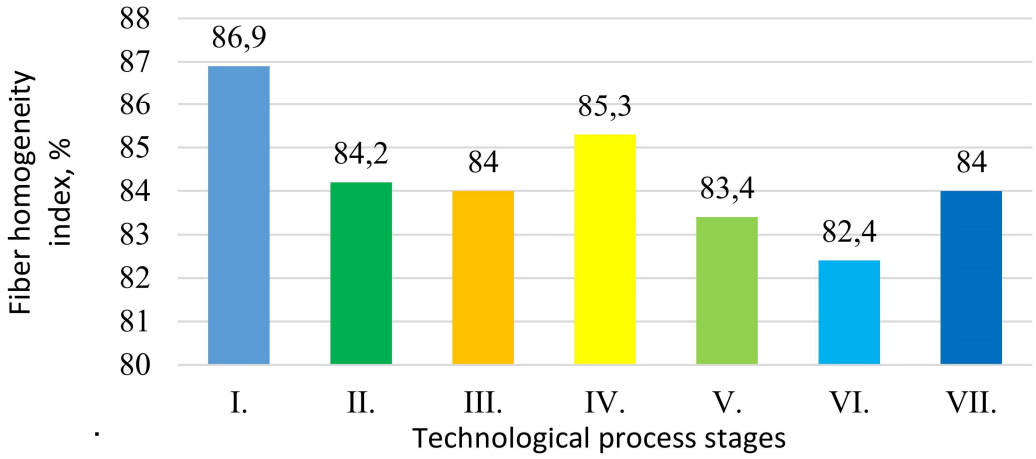

Figure 2. Histogram of changes in the length uniformity index (Unf) of cotton fiber in the technological process

(Fig. 3) 32.4 sN/tex in cotton yarn, 32.0 sN/tex after line 1 UXK cleaning line, 31.8 sN/tex after line 2 UXK cleaning line, 30. 1 sN/tex, 29.6 sN/tex after RX cotton regenerator and in the produced fiber It was 31.8 sN/tex. The stiffness of the cotton fiber cleaned in the improved RX cotton regenerator is 31.6 sN/tex, which is 2.0 sN/tex higher than the stiffness of the cotton fiber cleaned in the non-improved RX regenerator.

We can observe that the specific tensile strength of the fiber produced as a result of adding cleaned cotton to the general cotton flow in the cotton regenerator is 31.8 sN/tex. 2.2 sN/tex and 0.2 sN/tex higher than existing and improved RX cotton regenerators are achieved, respectively.

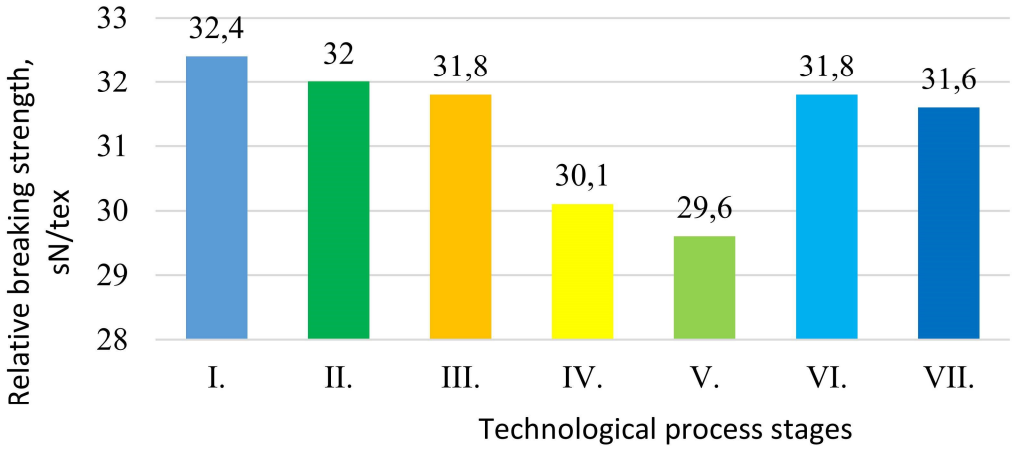

Figure 3. The histogram of the change of the relative tensile strength - hardness (Str) of the cotton fiber during the technological process

At current technological stages, the number of impurities in the cotton fiber (Cnt), that is, the number of individual dirt particles 0.01 inch (0.25 mm) in diameter and larger (Figure 4), is 32 in the cotton gin, 13 after the 1st line UXK cleaning line, Line 2 was 13 after the UXK cleaning line, 104 in the UXK cleaning line in the impurity cotton, 77 after

the RX cotton regenerator, and 30 in the produced fiber. In the improved RX cotton regenerator, it was 41, compared to the unimproved RX 36 is being achieved.

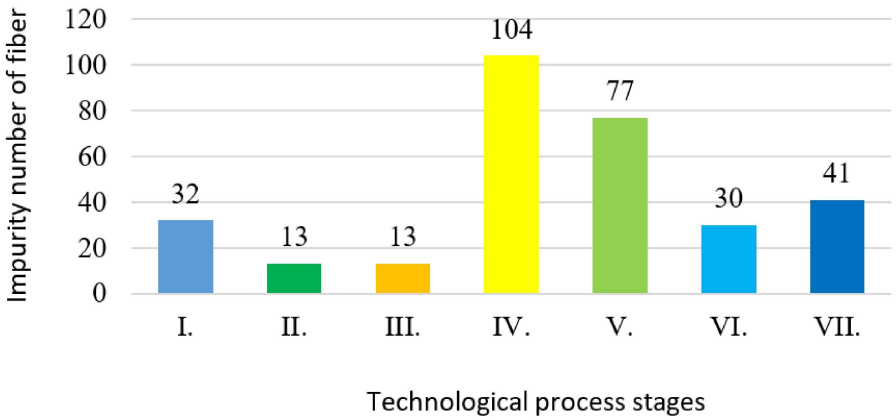

Figure 4. Histogram of changes in the impurity number (Cnt) of cotton fiber during the stages of the technological process

As can be seen from the histogram in Figure 4, the number of impurities in the cotton fiber added to the impurities from the UXC cleaning lines is increasing from 13 to 104. The impurity count of 104 in the unimproved RX regenerator drops to 77 after cleaning, while in the improved RX it drops to 41. Therefore, compared to the existing RX regenerator, the improved RX regenerator achieves 1.87 times less impurities in the cleaned cotton fibers.

In current technology, the short fiber content (SFI), i.e. fibers shorter than 0.5 in (12.7 mm), is 5.04% in the cotton gin, 7.9% after the 1st line SFI, 7.9% after the 2nd SFI 6.4% after the line, 7.6% in the cotton added to impurities in the UXK cleaning lines, 8.3% after the RX cotton regenerator and 9.3% in the produced fiber. In the improved RX cotton regenerator, it is 7.9%, which is 0.4% higher than the unimproved RX.

As can be seen from the histogram in Figure 5, the amount of short fibers in UXK cleaning lines 1 and 2 was 7.9% and 6.4%, respectively, after the existing RX regenerator it was 8.3%, and in the improved RX regenerator it was 7. 9% shows a positive effect of the new regenerator on the amount of short fibers.

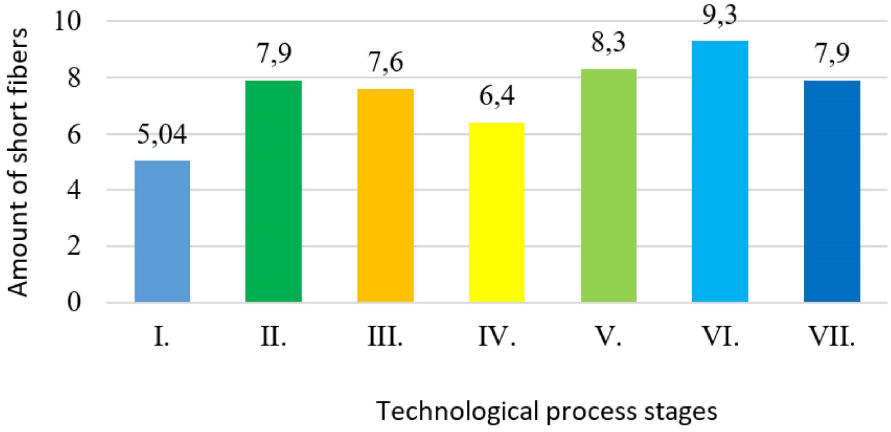

Figure 5. Histogram of changes in the amount of short fibers (SFI) in the stages of the technological process

The histogram of the change of the pollution index (T) with non-fiber impurities in the stages of the technological process is presented in Figure 4,2,5.

If we analyze the histogram presented in Figure 6, the pollution index with non-fiber impurities in the technological stages is 0.6% in cotton garam, 0.2% after the 1st line UXK cleaning line, 0.2% after the 2nd line UXK cleaning line, UXK was 0.8% in cotton added to the impurities in cleaning lines, 0.8% after RX cotton regenerator and 0.3% in produced fiber.

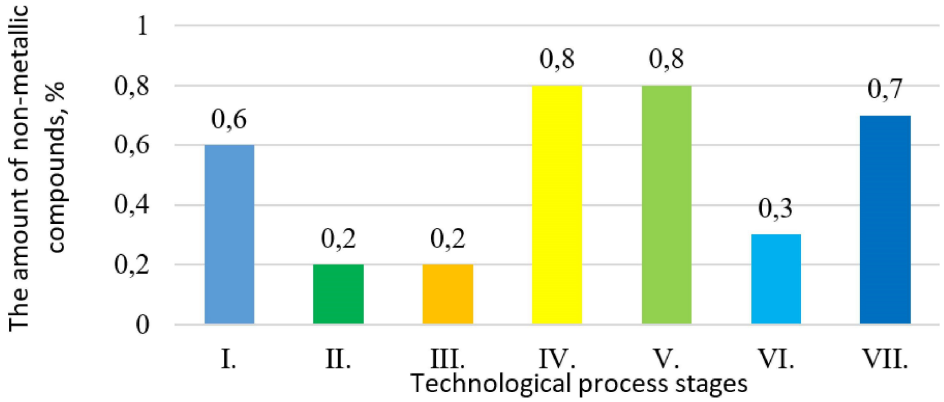

Figure 6. The histogram of the change of the pollution index (T) with non-fiber impurities in the stages of the technological process

In the improved RX cotton regenerator, it is 0.7%, and a reduction of 0.1% is achieved compared to the unimproved RX. Therefore, the improved RX shows that it works effectively in the cleaning of non-fibrous impurities in the cotton regenerator.

Analyzing the histogram presented in Figure 7, the degree of yellowness of the fiber in the technological stages is 7.8 in cotton gin, 8.5 after the 1st line UXK cleaning line, 8.4 after the 2nd line UXK cleaning line, the content of impurities in the UXK cleaning lines 8.0 in blended cotton, 7.8 after RX cotton regenerator, and 8.8 in manufactured fiber.

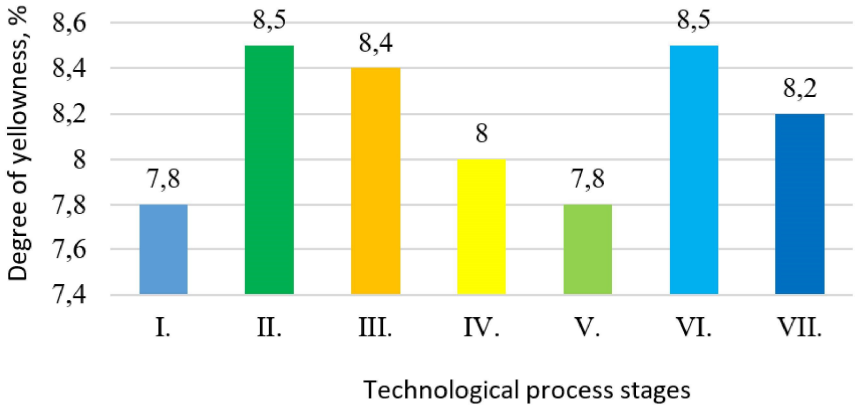

Figure 7. Histogram of the change in the degree of yellowness (+b) of the fiber during the stages of the technological process

The improved RX in the cotton regenerator is 8.2, which is 0.4 more than the unimproved RX. So, in the improved RX cotton regenerator, the degree of yellowness of the fiber is slightly increased due to 5-6 times cleaning in the drum with a cotton saw.

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