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Managed Technological Indicators during the Cotton Cleaning Process

M.G.DJURAYEV, SH.SH. KHAKIMOV, B.B.OCHILDIYEV,E.N.JURAKULOV.

Teacher Termez state university
Doctor of Technical Sciences, Associate Professor Tashkent institute of textile and light industry
Teacher Termez state university
Teacher Termez state university

ABSTRACT This article recommends a technological recycling process for the selection of cotton when it is accepted to a cotton processing plant and transmitted to a process-based process, taking into account the initial quality characteristics of fiber, such as dirt and moisture.

KEYWORDS: Pile sections, Abrush section, Section saw, Regenerated cotton, Waste after cleaning

When being admitted to the cotton processing enterprises, the total amount is collected separately as their industrial varieties. When transferring cotton to a technological process, it is vital important to choose a true technological process for the processing of cotton, taking into account its initial quality, namely the dirt and humidity.
Nowadays, in Uzbekistan a UCW cleaning unit has been put into operation for the removal of raw cotton from minor and major pollution.
The UCW unit consists of four sections, which in turn consist of two EN.178 pile sections, a brush section and a section saw EN.177. The number of units in the UCW has been increased by six for cleaning cotton which is picked by machines and hard-cleaning raw cotton. 1XK cleaner was installed at the front and the end of the unit to clean the raw cotton from minor impurities. The efficiency of the UCW unit differs from that of the GW cleaner, which is 7 t / h, and the efficiency of cleaning is 75-80%, depending on the moisture content and the initial dirt of the raw cotton. The UCW unit (Figure 1) works as follows: if it is not necessary to clean the raw cotton from major dirt, the raw cotton is then transferred to the next drum by using brush drums. In this section, the raw cotton is cleared from major impurities and then transferred to the next pile section by using a separating drum with a brush. This process is carried out in all departments of the UCW, in line with the initial pollution of raw cotton. The reversible moving brush drum structure is the same as the separation of drum with a brush. The structure of a drum with a saw, immovable brush, separator and reversible brush retained the same type of CH cleaners, which did not eliminate the technological disadvantages of the product, such as decreasing in efficiency of cleaning while increasing in productivity and proportional increase in the amount of raw cotton in the waste.

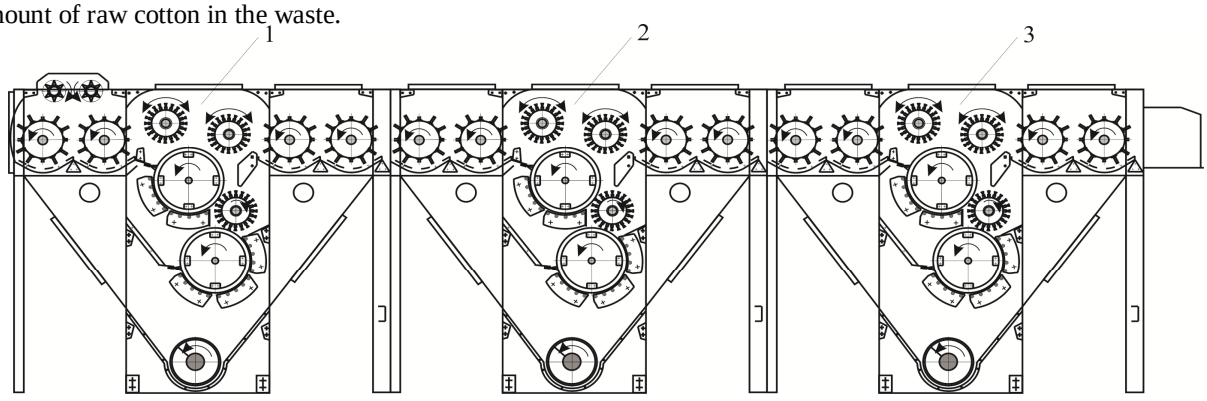

Figure 1) Cleaning stream based on the UCW unit

1- UCW. 01. Primary supply section,
2- UCW. 02. Intermediate section, 3- UCW. 03. final section

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The breaking down of working parts by the drum with a brush results in increased operational costs. Due to frequent congestion in the reversible drum with a brush part of the aggregate, the possibilities of changing flow of technological processes have been reduced, taking into account the quality of raw cotton. For this reason, the raw cotton of different quality indicators has to be gone through the same flow. This will result in losses in the purification of raw cotton and increased processing costs. In addition, a lot of electro-engines are used in the UCW cleaning unit. Currently, many cotton mills have two streams of these UCW units. It causes to an increase in the energy consumption of enterprises, the cost of production of fiber and the decrease in profitability of the enterprise.[1]

One of the main disadvantages of the UCW cleaning unit is the inability to control the frequency of the cleaning process during the cotton processing.

In the total amount of cotton, there are the different types of the industrial variety of cotton. Controlling the performance and technological parameters of the equipment involved in the treatment of cotton in accordance with the characteristics of the cotton provides gaining high grade fiber.

One of the most important technological parameters that can be controlled is the speed of rotation of the rollers, which ensures the efficiency of the cotton cleaning machines. It is defined by the following empirical formula [8]:

$$П = a \cdot n \qquad (1)$$

In this formula, П -productivity; n – the speed of supply rollers per minute; a -dimensionless coefficient related to experimentally determined physic-mechanical properties of cotton. The current coefficient "a" for the currently used 1CW, ChX-5 cotton sweepers and roller structures for normalized section EN.178.01: 0.76 for the first grades of medium-fiber cotton with a humidity of 7-9% and a dirtiness of 7-10%; for long fiber cotton - 0.98.

The efficiency of cotton ginning machines depends on the ability of the working bodies, which is generally determined by the following formula:

$$П = V \cdot L \cdot h \cdot \rho \cdot Ψ \cdot \varphi \qquad (2)$$

In this formula, П –the productivity of cotton ginning machines, kg/h;V -linear velocity of working parts, m/h;L- length of working drum, m;h - slides between working drums and stretchers or grid surfaces, or brushes, mm; ρ – bulk weight of cotton, kg/m^3 ;Ψ - the coefficient of filling the range between working drums, coils, different surfaces and brushs with cotton;φ -coefficient, indicating the velocity of cotton relative to the drum (for drums with saws $\varphi \approx 1$, for drums with pins$\varphi \approx$ 0,5 - 0,7).

Technological indicators of the UCW unit

Table 1

Managed technological indicators:	
Productivity, t / h	
Cotton in grade I-II	7
In grade III-IV-V	5
Rotation speed, r / min	
Supply rollers	0-14
A drum a pin	480
A drum with a saw	290
A drum with a brush	945
Waste plug	60
Regular technological indicators:	

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Technological holes, mm: the distance between a drum with a saw and the brush drum	0-2
The drum with the pin and the distance between the net surfaces	14-16
The distance between a furnace-bar grid and a saw drum	16-18
The distance between a screw conveyor and its bowl	12-15

The efficiency of cotton gin machines also depends on the condition and old of working bodies:

The productivity of the cleaning unit is influenced by the failure of the saws of the drum, the obsolescence of brush separator drum brushes and the malfunction of hanger brush.

The efficiency of cleaning cotton gin is determined by this formula:

$$K=100(C1-C2)/C1 \quad (3)$$

In this formula, K –the efficiency of cleaning, %; C1 and C2 – filth or productivity of cotton before and after cleaning % .

The efficiency of cleaning cotton gin depends on the contamination and humidity of the cotton and the productivity of the cotton ginneries. Being cotton in the high moisture condition will adversely affect the efficiency of cleaning.

The total efficiency of cleaning cotton complexes is determined by the following formula:

$$Kc=[1-(1-K1/100)(1-K2/100)\ldots(1-Kn/100)]\ 100, \quad (4)$$

In this formula, K1, K2…..Kn – the productivity of cleaning the serial cotton machines entering the complex, %.

When the number of cotton-cleaning machines involved in the cleaning process increases, the effect of work efficiency on the overall cleaning efficiency will decrease.

Some of the seeds are damaged during cleaning cotton, while some of fibers are "free", not stuck to the seeds.Damage to seeds and increase in the amount of free fiber in cotton are determined by the difference between the original and refined cotton.

The productivity of cleaning of the regenerator is defined by formula 2.3, and the efficiency of regeneration is determined by the following formula:

$$Kp=100(S1-S2)/S1 \quad (5)$$

In this formula, Kp -the efficiency of regeneration %, S1 and S2– amount of cotton in the waste of the cotton-cleaning machines and regenerator, %. The efficiency of regeneration should not be less than 95%.

If all the cotton machine wastes picks into the regenerator, then its cleaning efficiency is the efficiency of cleaning the entire cotton-cleaning machine.Loss of cotton products (cotton, seeds, free fiber, dead) by waste means their loss in the cleaning of cotton.

Furthermore, some of the losses are due to aspirate suction of air from cotton-cleaning machines.

Loss of cotton material and regenerator waste (cotton seeds, cotton, seeds, free fiber and dead) is calculated in percentages as compared the weight of cotton wool by the following formula:

$$\Pi = S2(C1 - C2)/(100-S2) \quad (6)$$

In this formula, S2 – the amount of fiber seeds (seeds, free fiber, dead) in the regenerator waste, %;C1,C2-the pollution of cotton before and after its cleaning, which its waste goes to the regenerator, %.

Cotton raw materials are divided into easy and difficult types of cleaning by their nature.The hard cleaning type of cotton differs from the easy cleaning type of cotton, with the relatively difficult separation of impurities in the fiber.

Difficulty of cotton clearance is determined after cleaning its sample in LKM device unit.In addition, some selections of hard cleaning cotton have high moisture content when it is insulated, which results in an increase in the number of crumbs and dirty fibers.[5]

The most selective and hard cleaning varieties of regionalized cotton are the follows: “An-Bayouut-2”, “Namangan-77”,“Lucky”, “Andijan-35”, “Andijan-36”, “S-6524” and “S-6541”

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For cleaning medium-fiber cotton varieties from dirty impurities, we use 1,1XK (SCh-02) cleaners and EN.178 pile blocks that are used to assemble four-drum 1XK cleaners that have increased or reduced the number of UCW cotton cleaning units or pile drums.

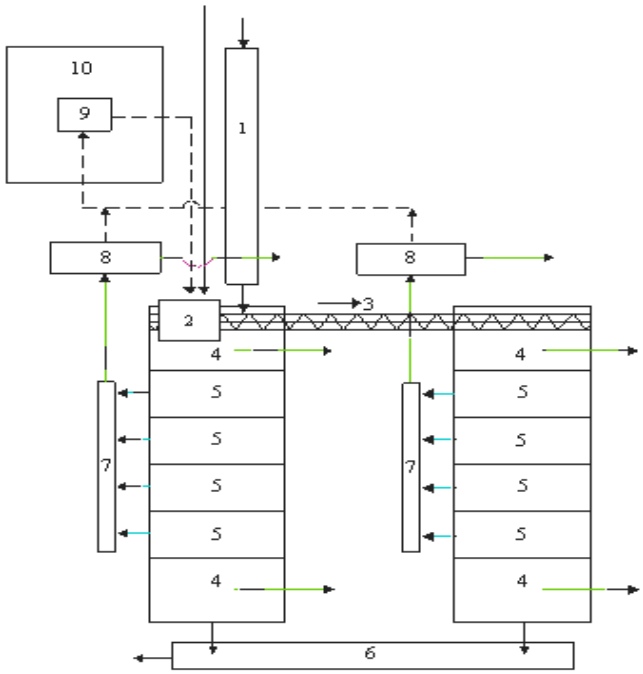
For cleaning cotton from dirty impurities, UCW consisting of Cotton ginneries with saw sections and CHX-5 (ChX-3M "Labor") units are used.At the same time, sections with a saw EN.177 are the main part in 1RX regenerators.

1RX (RX) regenerators are used for the regeneration of the fiber seeds in the wastes of the cleaners.

UCW cotton cleaning unit with one or two parallel componentsand the complex which is installed a set of 1XK pile cleaners or their sections (Figure 2.1).The UCW unit for the hard-to-clean cotton raw material has four consecutive UCW sections (5), each section has two EN.178 blocks with a pin and a section EN.177 with a saw UXK.01.010 installed between them.

1XK pile wiper is attached for the first part of the UCW unit, a 1XK pile cleaner FOR the last part of the TPC unit.For cleaning cotton varieties of normal cleaned, the sections EN.177, launched at the UCW unit, are reduced to two, with 1XK pile cleaners attached to it.

In the course of reconstruction and modernization of the cotton ginneries, APT-12 cleaners and two sloping XPN cleaners or horizontal XPM cleaners instead of the sections of 1XK and UCW units can be installed.[3]



1- TXL-600Bflexible, a carrier with a belt, 2- CC-15A separator, 3- ShX screw conveyor,4- 1XK cleaner, 5 -the section of UCW unit, 6- 8TXSB a horizontal carrier with a belt,7- 4TLSB a carrier with a belt, , 8- 1RX regenerator,9- KVM condenser, 10-assembly camera.

Cotton ——————▶

Regenerated Cotton – – – – – – –▶

Waste after cleaning ----------▶

A single regenerator 1RX (RX-1) is used for all units of linear flow or an aggregate of saw cleaners.

Transfer of cotton to the complexes is carried out with SS-15A separator or TXL-600B (8TXSB) slender carrier. Distribution of cotton into a parallel unit or cleaner is carried out by means of screw conveyor ShX. Transmission cotton to screw conveyor ShX is carried out via a THL-600B (8TXSB) carrier, EX-15M elevator or SS-15A separator, depending on the location of equipment installed on the CHX-5 (CHX-3M2) and 1XK cleaners.

Picking cotton from cleaners and complexes is carried out by using screw conveyor or 8TXSB transmitter.

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During the initial processing of one or more cotton balls, the cotton seeds are regenerated from the wastes of the machines, and the separated fibers are stored in special cells. After that, they will be passed through 1XK cleaners which clean as possible as from all minor impurities. Moreover, cleaning cotton should not be exposed to cleaners with saws and saw sections.

For collecting the regenerated cotton in the cotton cleaning gin or a place near it, a camera with a surface of up to 20 m2 and a height of 3-4 m will be mounted above it a KVM or KVVB condenser. The condenser suction pipe is attached to the 1RX (RX) regenerator output tube. A 250mm pipe is used to transfer the regenerated cotton to a cleaner. This tube is connected to the suction pipe of the separator SS-15 located on the screw conveyor. If cotton is transferred by using a carrier from a drying facility, then a KVM or KVVB condenser will be installed on it.

In separators, linear handrails which hold heavy waste is installed into the pneumatic system that supplies cotton to a set of cleaning equipment.

Plans for purification of medium-fiber cotton in piles and saws given by its grade, sort and pollution in Table 2.2.

In some ginneries, the recommended cotton cleaning plans are not being implemented to a certain extent. In this case, a plan closer to the proposed plan should be implemented. For a small number of large impurities in Table 2.2, It is advisable to install small dirt cleaners next to the cleaners listed above.

At the same time, the CHX saw cleaners will be replaced with 1XK saw wipers. The number of saw cleaners can be increased if the number of pile cleaners is low. Productivity of one-line cotton ginneries is 12 t / h for I-IV class in the first grade and in the second-grade I-III class, I-V class cotton of third grade-9 t. / h.

If the effectiveness of the actual process of cleaning the whole technological process is less than in Table 2, it is necessary to check the moisture content of the cleaned cotton for the recommended value then check the technical condition of the cleaners and distributors.

If the grade of fiber produced is lower than the recommended mode of initial processing of raw cotton [8], it is necessary to increase moisture absorption during drying, to reduce the moisture content of the purified cotton raw material, or to add additional CHC-5, 1XK or UCW subdivisions during the cleaning process.[2]

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The Cleaning Plan of the Recommended Medium Fiber Cotton

Table 2

Cotton			Cleaning plan	The productivity of cleaning,%
Grade	Sort (class)	Impurity, %	UCW the complex of cotton cleaning units	
For the selection of easy cleaning cotton				
1	I - II	5,0	1XK + UCW (1)*	84
	III	8,0	1XK + UCW (2)*	88
	IV	12,0	1XK + UCW (2)*	90
2	I, II, III	12,0	1XK + UCW (4)*	92
	IV	16,0	1XK + UCW (2)*	90
3	I, II, III	18,0	1XK + UCW (4)*	88
	IV, V	22,0	1XK + UCW (2)*	86
For the selection of hard cleaning cotton				
1	I - II	5,0	1XK + UCW (2)* + 1XK	80
	III	8,0	1XK + UCW (4)* + 1XK	84
	IV	12,0	1XK + UCW (2)* + 1XK	86
2	I, II, III	12,0	1XK + UCW (4)* + 1XK	88
	IV	16,0	1XK + UCW (2)* + 1XK	86
3	I, II, III	18,0	1XK + UCW (4)* + 1XK	82
	IV, V	22,0	1XK + UCW (2)* + 1XK	80

* UCW added number of saw sections in the unit

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