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ANALYSIS OF THE RESULTS OF RESEARCH ON THE PROCESS OF CLEANING AND SORTING COTTON SEEDS

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INTRODUCTION

The main raw material of world textile production is cotton fiber. According to the International Cotton Advisory Committee (ICAC), in recent years, 23.07 million tons of cotton fiber have been produced in the world, and its consumption is 24.55 million tons. It is expected that the consumption of cotton fiber and the demand for it will increase in the future due to the intensively growing population. The increase in demand for cotton fiber, in turn, requires a constant improvement in its quality and production efficiency. In this regard, much attention is paid to increasing the competitiveness of cotton fiber in the world market, modernizing new technologies and devices that allow the production of modern and technologically reliable and high-quality products. Particular attention is paid to the improvement of high-performance cotton cleaning machines and the creation of resource-saving technologies in the field of world cotton cleaning. One of the main tasks of the industry is to improve the technical and economic indicators of cotton ginning enterprises, increase production efficiency and prevent losses of the resulting textile raw materials to produce high-quality cotton fiber, lint and seeds.

Both a single seed and a mass of seeds have a number of properties that make it possible to determine the impact of transportation and storage technology on their processing, and this is called technological properties. The main part of these properties is of a physical-mechanical, largely biological nature, determined by the nature of the material and affects the technological process to varying degrees. Based on this, they can be conditionally divided into physical-mechanical, mechanical-technological and technological parts. At the same time, the physical and mechanical properties of seeds and seed mass in many cases differ from each other. In addition, unlike research centers, gins still use generally accepted measurement values.

MATERIALS AND METHODS

The physical and mechanical properties include the shape and size of seeds, the density of the seed mass, its density.

The straight and normal-looking seed is pear-shaped, with a large and rounded tip, tapering towards the tip, and a pointed beak. At its widest point, the blunt side of the seed is about a quarter of its length, and the shape of the seed is assumed to be spherical in most studies [1].

Cotton seeds from the cotton ginning process (separation of fiber from seed) are divided into technical seeds intended for work in oil and fat plants, and seed seeds used for sowing. Technical seeds are divided into different types of production. Ripe cotton contains 52-56% seeds, depending on its weight. In terms of weediness, veininess and moisture, seeds supplied to oil plants must comply with the standards established by UzRST 596-93, UzRST 603-93 (table 1).

As can be seen from table 1, when processing cottonseed, its total fiber and the amount of fibers remaining in it are determined.

1-table. The norm of characteristics depending on the type of seeds

Seed variety	Mass of damaged seeds %	Seed moisture %	Degree of hairiness of the seed %	
			In medium fiber varieties	In fine fiber varieties
1	1,5	10,0	5,0-10,5	2,0-6,5
2	3,0	11,0	6,0-10,5	3,0-7,5
3	11,0	12,0	7,0-11,0	4,0-8,5
4	33,0	13,0	8,0-13,0	4,5-9,0

For oil production and planting, seeds need to be less fibrous. Because if the degree of hairiness is low, more oil can be obtained and the seed germinates faster. Currently, elite seeds of the first (R1), second (R2) generation of zoned, new and promising cotton varieties are used for planting, which must meet modern requirements for varietal purity. If necessary, with the permission of the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan, seeds of generation R3 and later can be used for planting.

It is known that the separation process is divided into three methods:

- Separation by air flow;
- Separation in mechanical devices;
- Separation according to different properties of the surface of the material.

The separation of the seed mixture according to its aerodynamic properties is carried out with the help of an air flow. In this case, the air flow must be sufficiently uniform and constant. The seed mixture should be added to the stream evenly and continuously in a thin layer. In practice, separation devices are used that use vertical and inclined air flow. Lighter fractions or fractions with higher volatility are attached to the air stream (vertical airflow) and are thrown to a greater distance than heavier fractions. The same method is used for airflow suction.

Volatility separation can also be done in a wheat grader that throws the seed mixture into an open field at a high initial velocity. In this case, fractions with a greater mass and lower volatility are ejected farther than lighter fractions.

On fig. 1 shows a device for separating cotton fractions in a vertical air stream. This device works as follows. The mixture enters the receiver with a uniform air flow. There, under the action of the suction air flow, heavy impurities are separated.

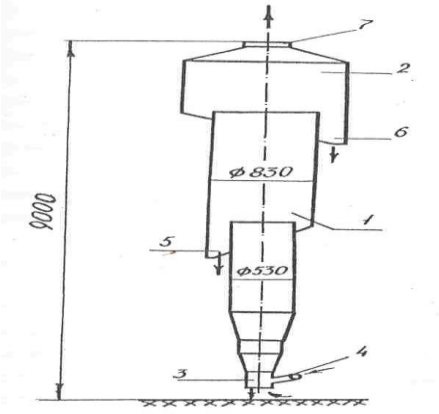

Figure 1. A device for separating fractions of cotton seeds in a vertical air flow

Captured seeds by volatility enter the collection chamber and are removed through the vacuum valve of the mine. Broken seeds and dirty mixtures with increased volatility are removed through a cyclone into the waste chamber. Seed fragments with almost the same volatility, pieces of cotton, and light impurities are released into the waste [2-3-4].

In addition, the separator SXA, USM is installed in the seed cleaners, which works according to the method of air separation of seeds. Horizontal or inclined airflow traversed by a free-falling mixture may not allow closely related fractions to be separated with sufficient accuracy. For example, seeds with high hairiness differ little in aerodynamic properties from seeds with low hairiness.

Another machine used to extract fibrous seeds is the PHC regenerator (Figure 2).

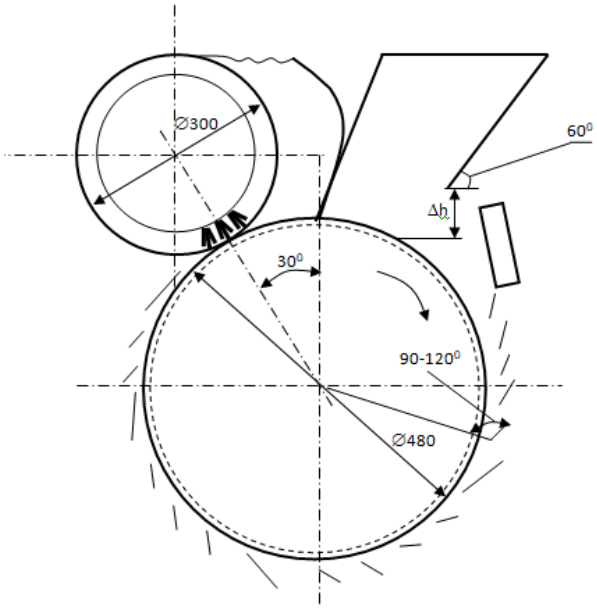

Figure 2. Technological scheme of the regenerator with a sawn working body

The task of this device is to separate the leaves (non-germinated seeds) from the seed mass using a sawtooth working body. In the regenerator, the separation of good non-germinated seeds in the seed mass entering the linter is carried out using a saw drum. In the regenerator, the separated fibrous seeds are sent back to the gin, and by ginning fiber suitable for spinning can be obtained. Despite the high efficiency of the device, it does not clean the various fine impurities contained in the seed, and causes damage to the seed due to the action of the saw teeth during regeneration using a working body with a saw. As a result, the quality indicators of the produced fiber and fluff are reduced [5].

RESULTS

In order to eliminate the observed shortcomings, many theoretical and practical studies have been carried out on cleaning and sorting seeds from the germination process.

Among them, H.T. Akhmedkhodjayev proposed a device for sorting seeds by passing them through the holes of an inclined grid of a vibration sorter. First of all, the shape and size of the seeds are of great importance in this process [6]. A special tool and method was created to determine the size of seeds with different pubescence. The measurements were carried out by

taking 200 pieces of cotton seeds with medium and fine fiber and repeated many times. (Table 2).

2-table. Sizes of the most common cotton varieties

selective variety	Seed size after germination			
	Length (D_1), mm	Diameter (D), mm	1000 the mass of the seed, g	number of short fibers, %
C-6524	8,0-12,25	5,5-8,75	138,2	14,2
C-6530	8,2-12,22	5,4-8,84	136,9	14,0
Наманган-77	7,25-12,3	5,6-9,0	125,8	14,9
C-9070	8,1-12,2	5,8-9,8	128,3	13,8
9871-И	8.1-10,2	5,1-6,8	117,3	-
Ан-60	8,1-9,8	4,5-5,3	108,1	-
9853-И	8,2-9,8	5,2-5,8	125,25	-

Studies have been carried out on the position of the centers of gravity depending on the size and shape of the seeds, for example, both for seeds with and without fiber. For calculations, two shapes were proposed - two semicircles on the sides, and a rectangle in the middle. Using the laws of mechanics, the centers of gravity of the seeds were determined by their components [7].

First of all, a study was made of the influence of the friction force. In this case, a single-mass system consisting of fibrous bodies (seed, profile) with the same degree of freedom and hitting the surface without friction is determined by the following equation:

$$m\frac{d^2y}{dt^2} + k \pm F = 0 \qquad (1)$$

here $k = cy$, c - coefficient of unity; m – lump mass; F – friction force or $F = N \cdot sign\dot{y}$; N – normal force.

The expediency of using this model was confirmed by R. Z. Burnashev.

(1) the equation can be written in the following form:

$$M\frac{d^2y}{dt^2} = -cy \pm F \text{ ёки } \frac{d^2y}{dt^2} + p^2y = \pm F \qquad (2)$$

Equation (2) can be written in the following form after some substitutions:

$$\frac{d^2y}{dt^2} + P^2y = \theta(t) \qquad (3)$$

In general, the force of friction changes its direction during the movement. The graph will look like this (Figure 3):

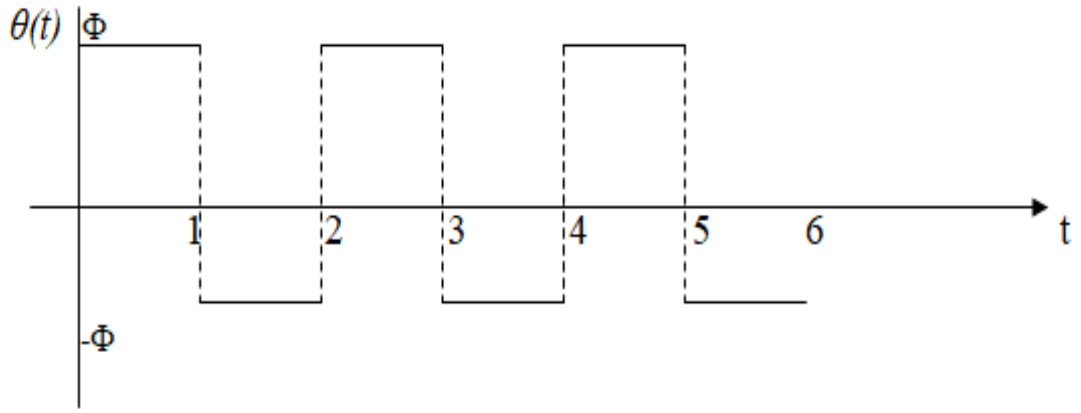

Figure 3. Variation of the magnitude of friction with respect to θ(t).

The solution of the equation of motion (3) is solved using integral Laplace transforms

$$y = V_0 \cos pt + \frac{y_0}{p^2}\sum_{n=1}^{\infty}\left\{\varepsilon^n(1-\cos(pt-n\pi))\right\} \tag{4}$$

$$\varepsilon^n = \begin{cases} 1 & a\text{ɔ}ap \quad n=1 \\ 2 & a\text{ɔ}ap \quad n\geq 2 \end{cases}$$

where r is the angular frequency of specific vibrations; V_0 – initial speed; y_0 is the initial strain.

A second type of model of a piece of cotton is a linear segmented model, the equation of motion of which is expressed as follows:

$$m\frac{d^2y}{dt^2} + cy = \pm\eta\cdot\left(\frac{dy}{dt}\right)^2 \tag{5}$$

This equation can be written in canonical form as follows:

$$\frac{d^2y}{dt^2} - \Delta\left(\frac{dy}{dt}\right) + P^2y = 0 \tag{6}$$

here: $P^2 = c/m, \qquad \Delta = \eta/m$ (7)

To solve this equation (7), the solution was sought in series form:

$$y = y_0(t) + \Delta y_1(t) + \Delta^2 y_2(t)\ldots = \sum_{n=0}^{\infty}\Delta^n y_n(t) \tag{8}$$

and the solution can be written as:

$$y = \xi\cos\omega_\Delta t + \frac{\Delta\xi^2}{6}(3-4\cos\omega_\Delta t+\cos 2\omega_\Delta t) - \frac{\Delta^2\xi^3}{72}(48-61\cos\omega_\Delta t + \\ +16\cos 2\omega_\Delta t - 3\cos 3\omega_\Delta t) \tag{9}$$

here:

$$\omega_\Delta = \frac{p}{\left[1+(\Delta^2\xi^2)/3\right]^{1/2}} \tag{10}$$

(9) in finding a solution Δ^3 we discarded the next ones as infinitesimally small.

Derivative with respect to time was taken from (9) to find the speed of movement of the piece of cotton under the influence of friction force. If the initial conditions are used, then

$$V = V_0\omega_\Delta \sin\omega_\Delta t + \frac{\Delta V_0^2}{6}\omega_\Delta(4\sin\omega_\Delta t - 2\sin 2\omega_\Delta t) - \frac{\Delta^2 V_0^3}{72}\omega_\Delta(61\sin\omega_\Delta t - \\ - 32\sin 2\omega_\Delta t + 9\sin 3\omega_\Delta t) \quad (11)$$

DISCUSSION AND CONCLUSION

The differential equation of mass motion in a system with several degrees of freedom in terms of nonlinear viscosity is derived from the Lagrange equations of the second kind, and the recovery coefficient depends on the jump and the jump speed. Energy consumption is determined by the interdependence of these speeds. The more mature the seeds, the higher the recovery rate. This natural factor is taken into account when selecting seeds by vibration, and with its help it can be seen that cotton seeds of the same variety differ from each other in their physical and mechanical properties.

However, technologies and equipment that can fully meet the requirements of the time remain relevant today. Because a universal technology has not been developed to prevent seed spoilage, completely clean them of impurities and increase fiber yield by sorting and regenerating seeds with fibers suitable for spinning.

Therefore, today it is advisable to conduct scientific research to improve the technique and technology of seed cleaning, to ensure efficient and high-quality production of fiber, pile and seeds.

REFERENCES

1. А.А.Обидов “Жинланган чигитларни тозалаш ва саралаш технологиясини такомиллаштириш” Диссертация техника фанлари номзоди 2007 й.

2. R.Muradov, A.Karimov, F.Rakhimov, H.Kasimov // Ways to increase the efficiency of the stone device // Scientific and technical journal of NamMTI. Issue 1, 2020. ISSN 2181-8622

3. F.Rahimov, N.Rajapova, R.Muradov. Use of cotton and treatment of cotton food // International Conference on sustainable development and economics // June 24-25 2019 icsde 2019 issn: 2622-3341 june 24-25, 2019 840 mount katahdin trail, alpharetta, GEORGIA, 30022, USA.

4. F.Rahimov, N. Rajapova, M. Salomova, R. Muradov Create a Device that can Remove Heavy Components from the Chassis Chamber // International Journal Advanced Research Science, Engineering and Technology // Of ijarset, volume 6, Issue 7 , July 2019 iz. ISSN: 2350-0328.

5. F.Rakhimov, M. Salomova, H. Kasimov // Improvement of elements of pneumatic transport device // Problems of mechanics 2019.

6. A.Sarimsakov, R.Muradov, B.Mardonov. Modeling Of The Process of Interaction of the Saw Cylinder with the Raw Material In The Process Of Ginning // TEST Engineering and Managemant (Scopus) May-June 2020 ISSN: 0193-4120 Page No.27386–27391 http://testmagzine.biz /index.php/testmagzine/article/view/12709.

7. R.Muradov, F.Rakhimov, H.Kasymov, A.Karimov “Theoretical Study Of The Movement Of New Impurities And Heavy Impurities” The American Journal of Engineering and Technology, Volume02 Issue07 July 2020. DOI: -10.37547 / tajet. ISSN (e): 2689-0984 DOI: https://doi.org/10.37547/tajet/Volume02Issue07-03.

8. R.M.Muradov, A.Karimov, S.T.Rejabboyev Theoretical study of the movement process of cotton seeds transported on a screw conveyor // Academicia AnInternational Multidisciplin ar Research Journal (Double Blind Refereed & Peer Reviewed Journal) DOI: 10.5958/2249-137.2021.00989.7, Vol 11, Issue 3, 2021, (05.00.00: IF:7.492).
9. R.M.Muradov, A.Sarimsaqov, S.Rejabboyev Residual fiber study in fiber – separated seeds // Asian Journalof Multidimensional Research, March 2021. DOI:10.5958/22784853.2021.00317.7, Vol 10, Issue 4, 2021, ISSN: 2249-7137. 783-787 page. (05.00.00: IF:7.699).