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THEORETICAL BASIS OF TECHNOLOGICAL PARAMETERS OF THE NEW PNEUMO-MECHANICAL GIN MACHINE

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Abstract: The researchers made a significant contribution to the theoretical development of the ginning process. Having studied the composition of the raw material roller, the nature and speed of ginning, the theory of seed separation from the working chamber, the shape of the gin working chamber and the saw teeth, the cause of defects in the ginning process, and the possibility of covering the saw teeth, they found out that not all of them are uniformly covered with fiber and not all of them participate in the work process. They believe that it is necessary to improve the shape of the raw material chamber in order to facilitate the rotation of the raw material roller, increase the number of revolutions of the saw cylinder to 700 ... 730 min-1, reduce the relative speed of the roller compared to saws, and accelerate the removal of seeds from the center of the chamber. It is also believed that one of the main ways to increase the efficiency of a saw gin is to increase the fibrousness of the raw roll, quickly remove the cleaned seeds and uniformly reduce its density. The widespread use of chambers with increased volume in the cotton gin industry has increased the productivity of gins to 10 kg/hour of saw and above.

Keywords: Ginning process, cotton processing, theoretical foundations, pneumatic mechanical gin, technological parameters, regression coefficient, variation interval, result, Fisher criterion.

Introduction. Today, it is becoming very important to deeply and seriously study the question of whether roller and saw gins used in the world cotton ginning industry for ginning fine and medium-fiber cotton cause mechanical damage to fibers. The results of the conducted scientific and practical studies show that the working element of saw gins is a cylinder made of saw disks, which, as has been established, negatively affects the quality of fiber and seeds in the process of joint operation of the grate with saw disks to separate fiber from seeds.

Main part. "Theoretical Foundations of the Technological Parameters of a New Pneumatic-Mechanical Gin Machine Providing High-Quality Separation of Fibers and Seeds from Raw Cotton" mainly presents the results of theoretical studies conducted when selecting a new device.

To create a model of one seed in existing gins, it is necessary to determine the volume of seeds for a given variety of cotton. We determine this using the following equation:

$$V_c = \frac{m_c}{\gamma_c}, \text{ m}^3$$

Where: M_c- seed mass, g;

γ_c – seed density, g/m^3.

Volume of compacted seed:

$$V_1 = \frac{m_1}{\gamma_1}, \text{ m}^3$$

Where: m_1 – mass of one seed, g;

γ_1 - density of one seed, g/m^3.

The volume of cotton fibers in one seed is determined by the following formula:

$$V_в = V_1 - V_c, \text{ m}^8.$$

During the cotton ginning process, the thickness (r) of the fibrous coating on the surface of the seeds can be determined based on the diagram shown in Figure 1.

Let the volume of fiber in one seed be equal to:

$$V = 4\pi \cdot r(ac + r)(bc + r), m^3$$

Where: a- length of one seed, мм; b- width of hollow part v- figurative seed, мм; c- width of the top of the seed, мм; r- thickness of the fibrous layer on the surface of one seed, мм.

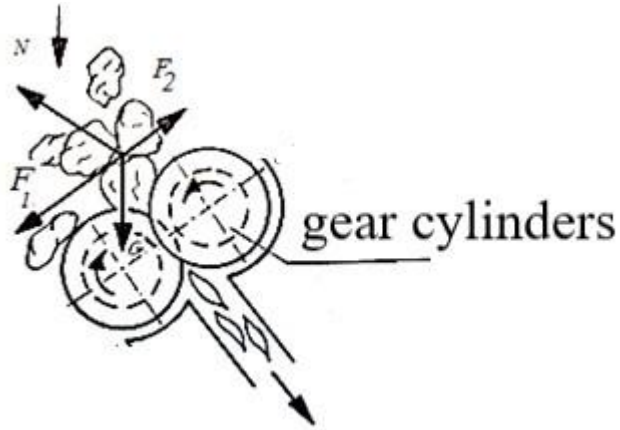
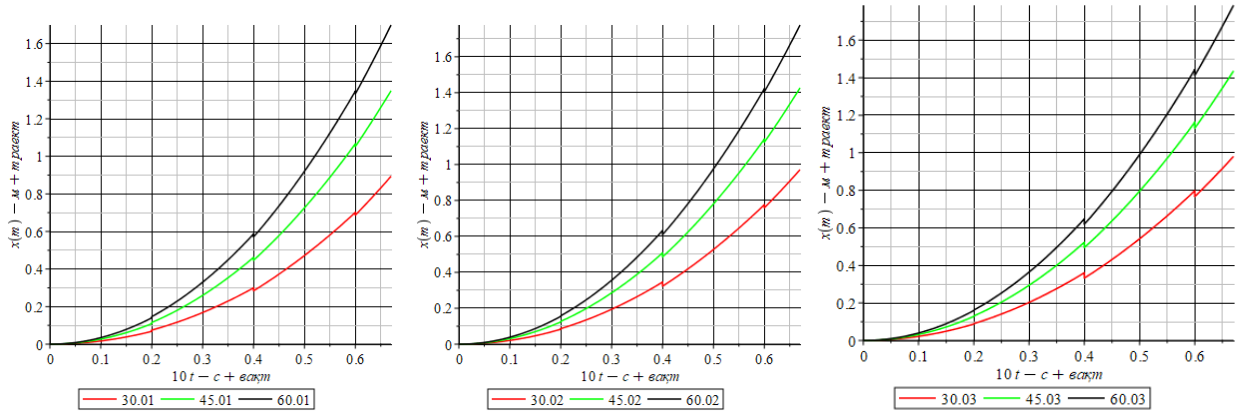


Fig. 1. Model of one seed

Graphs of the change in the traveled distance and speed of fibrous seeds during the ginning process along its surface depending on time at different angles of inclination of the ginning roller cylinder were obtained.

Initial conditions: $v(0) = v_0, x(0) = 0$.



а) б) в)

Fig. 2. Graphs of changes in the distance traveled and the speed of fibrous seeds during the ginning process, along its surface depending on time at different angles of inclination of the ginning toothed pair of cylinders

In the schedule: 1- - α=32^0, 2- α=45^0, 3- α=60^0, a) -m=0.01g; б)-m=0.02g; c)-m=0.03g;

It is known that when the analytical expression of the output function is unknown, this function can be expressed as a polynomial regression equation.

$$y = b_0 + \sum_{i=1}^{k} b_i X_i + \sum_{i=1}^{k} b_{ii} X_i^2 + \sum_{i<1}^{k} b_{ij} X_i X_j + \sum_{i<j<l}^{k} b_{ijl} X_i X_j X_l \quad (1)$$

Where: $b_0 = \frac{1}{N}\sum_{u=1}^{N} \bar{y}_u$, $b_i = \frac{1}{N}\sum_{u=1}^{N} X_{iu}\bar{y}_u$,

$b_{ij} = \frac{1}{N}\sum_{u=1}^{N} X_{iu}X_{ju}\bar{y}_u$, $b_{ijk} = \frac{1}{N}\sum_{u=1}^{N} X_{iu}X_{ju}X_{ku}\bar{y}_u$

Where: y - calculated value of the output parameter; x_i - an independent input parameter whose value changes during the experiment

b_0, b_i, b_{ij}, b_{ijkb}- regression coefficients determined from the results of the experiment. To construct a mathematical model in the form of equation (1), the output value "y" is selected. The variable xi factor is selected as an input parameter.

b_0, b_i, b_{ij}, b_{ijkb} - are considered as regression coefficients and the type of plan function is determined.

To write an experimental plan and process the experimental results, coded values of factors, indicated in small letters, are used X_1, X_2. Encoded Xi (dimensionless quantity) and physical (natural) variable Xi are related by the following relationship.

$$X_i = \frac{x_i - x_{i0}}{\Delta i} \quad (2)$$

Where: $\Delta_{ш} = \frac{x_{\max} + x_{\min}}{2}$ - interval of variation of natural value;

x_{i0} – natural value of zero degree;

$x_{i0} = \frac{x_{\max} - x_{i\min}}{2}$, $x_{i\max}$ $x_{i\min}$- natural value of the lower and upper levels of the factor.

o determine the regression equation, we construct a two-level (k=2) three-factor experiment matrix for each function based on the responses. Through $\bar{y}_{ui}$, we determine the corresponding values of the coefficient of variation for the amount of fiber y_{0ui}, obtained in parallel experiments, each of which was determined in ⅱ experiment. Thus, $y_{ui} = \frac{1}{n}\sum_{l=1}^{n} y_{0ul}$, ($l = 1.2...m$) was taken into account when conducting two experiments.

If you check by Fisher's criterion, F_{α,k_1,k_2} by tabular value, Here α- significant level, we find $k_1 = N - k - 1 = 4$, $k_2 = N(m-1) = 16$ from the table. If this is an inequality $F < F_{\alpha,k_1,k_2}$ is fulfilled, then the adequacy hypothesis is fulfilled.

Because $F_{\alpha,k_1,k_2} = 3.01$, Fisher's criterion is appropriate for both cases.

$$X_3 = -1(x_3 = 30^0)$$

Conclusions.

1. The factors influencing the efficiency of the gin, which is the main machine of cotton ginning plants, i.e. the density of the raw roller, its rotation frequency and the exit of exposed seeds from the chamber, various friction processes in it, were studied and effective recommendations were given. However, it can be considered that current problems, such as mechanical damage to fibers and seeds, relatively high energy costs for the ginning process, have not yet been resolved in the research work carried out.

2. To eliminate the existing problems in the ginning process, so that the fibers and seeds are not mechanically damaged, raw cotton must be separated from the fiber in a free state without any densities or obstacles.

3. In the process of roller gin, the thickness of the fibers located on the surface of the seed was theoretically determined.

4. During the process of separating the fiber from the seed, the cotton flow speed reaches 0.5 m/s in 1-2-section cylinders, 2.3 m/s in 3-4-section cylinders, which leads to full cotton feed and increased productivity.

5. Based on the polynomial regression equation, a graph of the polynomial regression equation was obtained for the dependence of the amount of separated fiber on the change in the speed of the cylinders and the distance between the cylinders.

Literature

1. Х.Т.Ахмедходжаев, А.А.Обидов, Р.К.Абдуллаев, М.И.Охунжонова. “Пахта толаси таркибидаги калта толалар фоизини камайтириш борасидаги олиб борилаётган илмий-тадқиқот ишлар ва натижалар таҳлили”. Наманган муҳандислик-технология институти Илмий-техника журнали Том 4 № 1сон 2019 3-7 б.

2. Р.К.Абдуллаев, Х.Т.Ахмедходжаев, М.И.Охунжонова, М.М. Султонов. “Пахтани жинлаш жараёнида жин машинасининг селекция навлар бўйича тола сифатига таъсирини таҳлил қилиш”. Наманган муҳандислик-технология институти Илмий-техника журнали Том 4 № 2 2019 21-27 б.

3. М.М. Султонов, Р.К.Абдуллаев. “Тўқимачилик кластери комплекслари технологик жараёнларида тола йўқотилишини кескин камайтириш чора-тадбирлари”. Наманган муҳандислик-технология институти Илмий-техника журнали Том 4 № 3 2019 66-69 б.

4. Abdullayev Ravshan, Azambayev Mukhammadjon. “Cotton fiber rating, innovation current developments, prospects for cooperation of farms and clusters.” Наманган муҳандислик-технология институти Илмий-техника журнали Том 8 № 1 2023 168-173 б.

5. Abdullayev Ravshan, Azambayev Mukhammadjon, Baxritdinov Sayfuddin. “Analysis of research results according to international standards.”. Наманган муҳандислик-технология институти Илмий-техника журнали Том 8 № 1 2023 163-168 б.

6. Р.К.Абдуллаев, Р.М.Мурадов, М.Н. Салохиддинова. “Пахта толаси сифатини оширилишида илм-фан ва ишлаб чиқариш интеграцияси истиқболлари”. Инновацион ривожланиш даврида интенсив ёндашув истиқболлари Халқаро анжумани Наманган, 2018 йил10-11 июл 246-247б.

7. Р.К.Абдуллаев, А.А.Обидов, Р.М.Мурадов “Пахтани қайта ишлаш инновацион технологияларин яратишида саноат ва илм-фан ўртасидаги кооперацияни йўлга қўйиш истиқболлари.” Инновацион ривожланиш даврида интенсив ёндашув истиқболлари Халқаро анжумани Наманган, 2018 йил10-11 июл 394-398 б.

8. Б.Т.Алиев, Р.К.Абдуллаев, Р.М.Мурадов. “Пахта толасини чигитдан ажратишда янги пневмомеханик жин машинасининг яратилиши ва тадқиқотлар таҳлили.” Халқаро илмий-техникавий анжуман “Тўқимачилик саноати корхоналарида ишлаб чиқаришни ташкил этишда илм-фан интеграциялашувини ўрни ва долзарб муаммолар ечими” (ЎзТТИТИ-80) Марғилон 2-қисм 2017 й 27-28 июл.

9. Р.К. Абдуллаев, Б.Т. Алиев, Ж.Б. Мамаджонов Анализ результатов исследований по международным стандартам. Universum: технические науки №4 (109), апрель, 2023 г Стр 40-44.

10. Р.К. Абдуллаев, Б.Т. Алиев, Ж.Б. Мамаджонов Влияние эффективности сушки, очистки и джинорования хлопка сырца на качество волокна. Universum: технические науки №4 (109), апрель, 2023 г Стр 44-47.

11. Р.К.Абдуллаев, Х.Т. Ахмедходжаев, Р.М. Мурадов, М. Сайдиллаева Пахта толасини сифат кўрсаткичларини аниқланишида замонавий лаборатория ускуналарини аҳамияти. НамМТИ “Замонавий ишлаб чиқариш шароитида техника ва технологияларни такомиллаштириш ва уларнинг иқтисодий самарадорлигини ошириш” илмий-амалий анжуман. Маъруза материаллари тўплами 24-25 ноябр 2016 йил, 261-263 бетлар.

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