ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

Volume 10
Issue 1
2025

UDK 677.21:021

THEORETICAL SUBSTANTIATION OF THE PNEUMOMECHANICS OF THE CZECH GIN FOR THE SEPARATION OF FIBER FROM SEEDS

ABDULLAYEV RAVSHAN
PhD, Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Phone.: (0891) 050-6210, E-mail.: rabdullayev@gmail.com

Abstract: The increase in the mass of the cotton pieces slows down the movement and the speed of movement. This, in turn, has a positive effect on the ginning process. From the graphs of the distance traveled and the speed, it can be seen that the ginning process in the first and second pairs of cylinders is more intense than in the third and fourth pairs of cylinders, i.e. 80% of the ginning occurs in the first and second pairs of cylinders. We can observe this situation by the parabolic law of the graph of the dependence of the distance traveled on time, and the graph of the dependence of the speed on time - by the law of the increasing straight line.

Keywords: raw cotton, pneumatic mechanical gin, theory, dependence, speed, percentage, time, graph, cylinder, movements.

Introduction. 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/m³.

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/m³.

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:

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

where: a is the length of one seed, mm; b is the width of the hollow part of the V-shaped seed, mm; c is the width of the upper part of the seed, mm; r is the thickness of the fibrous layer on the surface of one seed, mm.

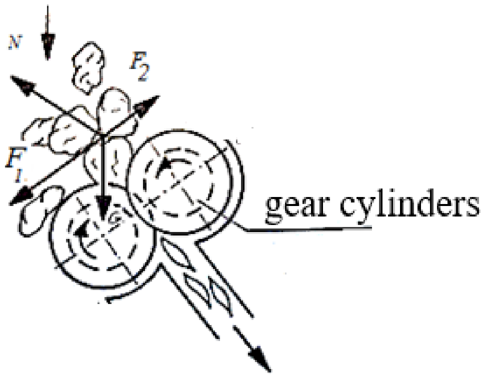
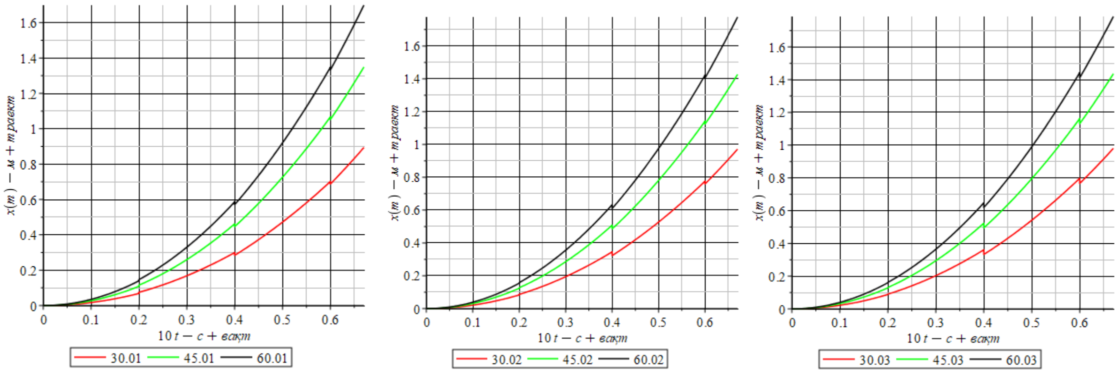


Fig. 1. Model of one seed

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.

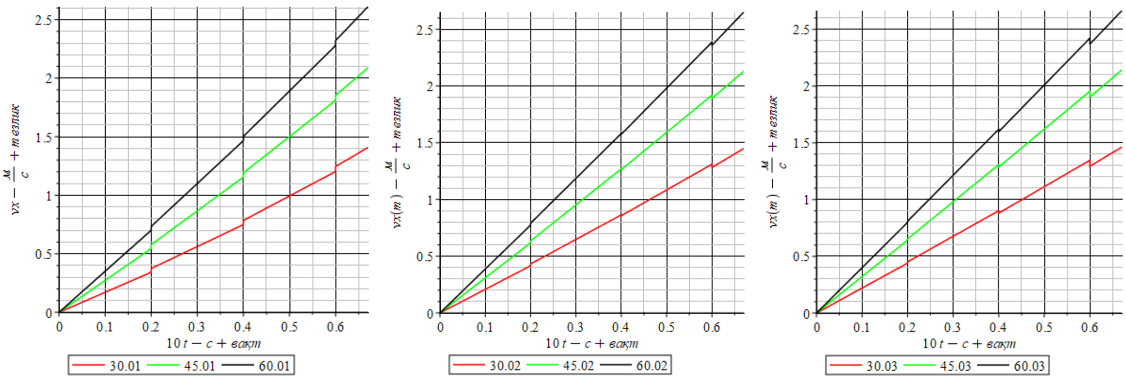
Initial conditions: $v(0) = v_0, x(0) = 0$.



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) $\alpha=32^0$, 2) $\alpha=45^0$, 3) $\alpha=60^0$, a) m=0.01г; б)m=0.02г; c)m=0.03г;



а) в) c)

Fig. 3. Graphs of the change in the speed of fibrous seeds during the ginning process, along its surface depending on time at different angles of inclination of the ginning cylinders

In the schedule: $\alpha=32^0$, 2- $\alpha=45^0$, 3- $\alpha=60^0$, a) -m=0.01г;б)-m=0.02г;
c)-m=0.03г;

Cleaning of cotton pieces starting from the first cylinder and continuing in subsequent cylinders depends on changing the tilt angle of the device (without changing the cotton speed). When changing the tilt angle from 320 to 600, cotton is fed to the first, second, third and fourth pairs of rollers within 4.5-5.5 seconds.

From the graphs in Fig. 2-3 a, b, c, it is evident that the increase in the mass of the pieces of cotton slows down the movement and the speed of movement. This, in turn, has a positive effect on the ginning process. From the graphs of the distance traveled and the speed, it can be seen that the ginning process in the first and second pairs of cylinders is more intense than in the third and fourth pairs of cylinders, i.e. 80% of the ginning occurs in the first and second pairs of cylinders. We can observe this situation according to the parabolic law of the graph of the dependence of the distance traveled on time, and the graph of the dependence of the speed on time - according to the law of the increasing straight line.

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 rollers, which leads to full cotton feed and increased productivity.

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

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

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 based on 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 the 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 power;

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

To determine the regression equation, we construct a two-level matrix

$(k = 2)$ three-factor experiment 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 the r 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 we check by Fisher's criterion, F_{α,k_1,k_2} according to the table 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.

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

Summary

1) The density of the cleaned seeds is higher than the total density of cotton pieces, and the resistance forces with the equipment are small, it falls under the action of its weight.

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

3) To write an experimental plan and process the experimental results, coded values of factors, indicated in small letters, are used. x_1, x_2.

References:

1. https://www.lex.uz/ru/docs/5731033, Пахта-тўқимачилик кластерлари фаолиятини тартибга солиш чора-тадбирлари тўғрисида.

Ўзбекистон Республикаси Президентининг Фармони, 16.11.2021 йилдаги ПФ-14-сон.

2. Р.К.Абдуллаев, Р.М.Мурадов, Б.Т.Алиев. Пахта чиқиндилари таркибидаги йигирувга яроқли толаларни ажратиш қурилмаси. Бухоро муҳандислик-технология институти. “Илмий тадқиқот ва кадрлар тайёрлаш тизимида инновацион ҳамкорликни ривожлантиришнинг муаммолари ва истиқболлари” мавзусида халқаро илмий-амалий анжумани материаллари. Бухоро, 24-25 ноябр 2017 йил, 102-105 бет.

3. Б.Т.Алиев, Р.К.Абдуллаев, Р.М.Мурадов. Пахта толасини чигитдан ажратишда янги пневмомеханик жин машинасининг яратилиши ва тадқиқотлар таҳлили. Ўзбекистон табиий толалар илмий тадқиқот институти, халқаро илмий-техникавий анжуман. “Тўқимачилик саноати корхоналарида ишлаб чиқаришни ташкил этишда илм-фан интеграциялашувини ўрни ва долзарб муаммолар ечими” (ЎзТТИТИ-80) материаллар тўплами. Тўқимачилик материаллари технологияси 2-қисм. Марғилон, 27-28 июл 2017 йил 106-111 бет.

4. Х.Т.Ахмадходжаев, А.А.Обидов, Р.К. Абдуллаев, М.И.Охунжонова.

Пахта толаси таркибидаги калта толалар фоизини камайтириш борасидаги олиб борилаётган илмий-тадқиқот ишлар ва натижалар тахлили. Наманган муҳандислик-технология институти илмий-техника журнали. “Ишлаб чиқариш технологияси муммолари” Том 4 №1 2019 3-7 бет.

5. Р.К.Абдуллаев, Х.Т.Ахмеджоджаев, М.И.Охунова, М.М.Султонов.

Пахтани жинлаш жараёнида жин машинасининг селекция навлар бўйича тола сифатига таъсирини таҳлил қилиш. Наманган муҳандислик-технология институти илмий-техника журнали. “Ишлаб чиқариш технологияси муммолари” Том 4 №2 2019 21-27 бет.

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 йил 10-11 июл, 246-247 бет.

7. Р.К.Абдуллаев, А.А.Обидов, Р.М.Мурадов. Пахтани қайта ишлаш инновацион технологияларини яратилишида саноат ва илм-фан ўртасидаги кооперацияни йўлга қўйиш истиқболлари. “Инновацион ривожланиш даврида интенсив ёндашув истиқболлари” халқаро анжумани. Наманган, 10-11 июль 394-398 бет.

8. М.М.Султонов, Р.К.Абдуллаев. Тўқимачилик кластери комплекслари технологик жараёнларида тола йўқотилиши кескин камайтириш чора-тадбирлари. Наманган муҳандислик-технология институти илмий-техника журнали. “Ишлаб чиқариш технологияси муммолари” Том 4 №3 2019 66-73 бет.

9. Р.К.Абдуллаев, Х.Т.Ахмедходжаев, О.Ш.Саримсоқов, М.И.Охунжонова. Пахта толаси сифат кўрсаткичларини халқаро универсал стандарт бўйича аниқланишида “сифат” сертификатлаш маркази билан ҳамкорлик интеграциясини мустаҳкамлаш истиқболлари. Наманган муҳандислик-технология институти илмий-техника журнали. НамМТИ, 2018 й. 4-сон 25-31 бет.

CONTENTS

CHEMICAL SCIENCES

TECHNICAL SCIENCES: MECHANICS AND MECHANICAL ENGINEERING

ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION