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ESTABLISHMENT OF THE DEVICE FOR SEPARATION OF FIBERS SUITABLE FOR SPINNING FROM THE WASTE OF THE COTTON CLEANING PROCESS

XURAMOVA XADICHA

Associate professor of Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Phone.: (0899) 725-8768, E-mail.: hadicha71@inbox.ru

Abstract: This article explored a device for the separation of cotton pieces from cotton waste that were separated from the cotton waste that was separated from the processes of cleaning cotton in its original processes. The factors affecting the processing of the separation device have been taught and suggestions are made. In the separation device, differential equations of mass movement are formed and appropriate graphics are obtained.

Keywords: separation device, regenerator, assembly, fiber, waste, cleaning, cotton, movement, productivity.

Introduction. Today, the demand for increasing the production of high-quality fiber, meeting the world standards, puts before the scientists and researchers of the field an important task of improving the existing techniques and technology. On the other hand, in the period when the level of improvement of spinning and weaving equipment is increasing, great attention is being paid to obtaining quality products through waste processing and rationally using limited resources to achieve economic savings.

The process of initial processing of cotton consists of a number of technological processes, i.e. placing, storage, transportation, drying, cleaning, separation of fibers and silting form a unique technological system. Here, cotton cleaning is of special importance, it has a significant impact on the quality of the product. Taking this into account, it is necessary to pay great attention to cotton cleaning devices and products from it. [1].

Cotton cleaning enterprises clean cotton from various impurities. According to their origin, dirty compounds are divided into organic and mineral, active and passive according to their separation, and small and large types according to their size. At the same time, cleaning devices also have different designs. It should be noted that the more cotton is passed through the cleaning equipment, the higher the fibering efficiency. But at the same time, the level of fiber and seed damage also increases. Therefore, in the process of cleaning cotton, work is performed at an optimal value, and it is observed that a certain amount of cotton is added to the waste composition. To solve this problem, many scientists T.I. Boldinsky, R.G. Makhkamov, Y.F. Budin, R.V. Korabelg'nikov, I.T. Maksudov, T.M. Kuliev, R.Z. Burnashev, G.D. Djabbarov, S.D. Baltabaev, B.G. Kadqrov, I.K. Khafizov, R.M. Kattakhodkhaev, A.D. Djuraev, D.A.Kotov, V.I.Kuzmin, M.M.Djamalova, R.M.Muradov, M.J.Koshakova, V.N.Guseynov, K.Abdullaev, D.A.Usmanov have proposed various designs, regenerator devices have been developed and effective results have been achieved [2,3]. However, as technology advances, so does technology. At the same time, it was proposed to further improve the process of extracting a piece of cotton containing fibers suitable for spinning from the waste in the process of spinning cotton [4,5].

A regression model was built on the efficiency of separating cotton pieces during the regeneration process and its adequacy was determined. According to it, two factors - the distance between saw drum and colosniks (mm) and rotation speed of saw drum (rpm) - were selected for the regeneration process, and with this plan we will carry out the following experiment. Two trials were conducted for each option. The test results in the first experiment - 95%, 96%, in the second experiment - 93%, 92%, in the third option - 93%, 93% and in the fourth experiment - 91%, 90% efficiency of separating cotton pieces was obtained. .

Table 1 shows the natural distribution of the plan, Table 2 shows the experiment grid, and Table 3 shows the planning matrix.

Table 1. Natural giving of the plan.

Factors	X_{min}	X_{max}	Δ	X_0	Conditional Symbol
The distance between sawed drum and columns, mm	10	20	5	15	X_1
Rotational speed of saw drum, grm	250	300	25	275	X_2
x_1 and x_2	-1	+1		0	

Table 2. The net of experiments.

Variant number	1	2	3	4
x_1	10	20	10	20
x_2	250		300	

Table 3. Planning Matrix.

Variant number	Factor level		$\bar{y}_{u1}$, %	$\bar{y}_{u2}$, %	$\bar{y}_u$, %	S_u^2	$\hat{y}_u$, %	R_{0u}, %
	x_1	x_2						
1.	-	-	95	96	95,5	0,5	95,4	0,13
2.	+	-	93	92	92,5	0,5	92,6	0,14
3.	-	+	93	93	93,0	0,0	93,1	0,13
4.	+	+	91	90	90,5	0,5	90,4	0,14
					371,5	1,5		

In the table S_u^2, $\hat{y}_u$, R_{0u}, y_u we explain the parameters and give them how to identify them. $S_u^2 - m$ a dispersion describing the spread m of test results by each option to verify the implementation of parallel tests with the same number (proving the same variety of them), defined as follows:

$$S_u^2 = \frac{\sum_{p=1}^{n}\left(\bar{y}_{up} - \bar{y}_u\right)^2}{m-1}, \qquad (1)$$

here u – the order number of the option;

$p = 1, 2, \ldots;$

m – the order number of the test;

n – the number of tests in each variant;

$\bar{y}_u = \frac{1}{n}\sum_{p=1}^{m}\bar{y}_{up}$ – the average number of tests per option.

The average number of parallel experiments without us $m = 2$, so

$$\bar{y}_u = \frac{\sum_{p=1}^{n}\bar{y}_{up}}{m} = \frac{(y_{u1} + y_{u2})}{2}$$

$$S_u^2 = (\bar{y}_{u1} - \bar{y}_u)^2 + (\bar{y}_{u2} - \bar{y}_u)^2$$

$$S_1^2 = \left((\bar{y}_{11} - \bar{y}_{1u})^2 + (\bar{y}_{21} - \bar{y}_{1u})^2 / (m-1)\right) = 0{,}5$$

$$S_2^2 = \left((\bar{y}_{12} - \bar{y}_{2u})^2 + (\bar{y}_{22} - \bar{y}_{2u})^2 / (m-1)\right) = 0{,}5$$

$$S_3^2 = \left((\bar{y}_{13} - \bar{y}_{3u})^2 + (\bar{y}_{23} - \bar{y}_{3u})^2 / (m-1)\right) = 0{,}0$$

$$S_4^2 = \left((\bar{y}_{14} - \bar{y}_{4u})^2 + (\bar{y}_{24} - \bar{y}_{4u})^2 / (m-1)\right) = 0{,}5$$

In all variants of the experiment, the Kochren criterion is calculated according to the following formula to verify the same sex (uniformity) of dispersions. If

$$G < G_{\alpha;k_1;k_2} \qquad (2)$$

Here, α – the level of importance, k_1, k_2 – the level of freedom;

If inequality is not observed, the same-sexness of dispersions is deniable and the processing dispersion is calculated as the mean in all directions. Without us

$$G = \frac{S_u^2(\max)}{\sum_{u=1}^{N} S_u^2} = \frac{0{,}5}{0{,}5 + 0{,}5 + 0{,}0 + 0{,}5} = 0{,}333$$

$G_{0,05;k_1;k_2}$ In our case $k_1 = N = 4$, when there $k_2 = m - 1 = 1$ is a level of importance $\alpha = 0{,}05$, it is determined by the table on [1], $G_{0,05;4;1} = 0{,}91$.

$G < G_{0,05;4;1}$ Since $(0{,}33 < 0{,}91)$ the hypothesis about the same sex of dispersions is undeniable and can then be S_u^2 applied to evaluate the adequacy of the model.

Now we determine the regression coefficients.

$$b_0 = \frac{1}{N}\sum_{u=1}^{4}\bar{y}_u = 371{,}5/4 = 92{,}9$$

$$b_1 = \frac{1}{N}\sum_{u=1}^{4}(x_{1u}\bar{y}_u) = \frac{1}{4}(-y_1 + y_2 - y_3 + y_4) = -1{,}4$$

$$b_2 = \frac{1}{N}\sum_{u=1}^{4}(x_{2u}\bar{y}_u) = \frac{1}{4}(-y_1 - y_2 + y_3 + y_4) = -1{,}1$$

$$b_{12} = \frac{1}{N}\sum_{u=1}^{4}(x_{1u}x_{2u}\bar{y}_u) = \frac{1}{4}(y_1 - y_2 - y_3 + y_4) = 0{,}13$$

So we have the use of a 2-order incorrect polynomial

$$\breve{y}_1 = 92{,}9 - 1{,}4x_1 - 1{,}1x_2 + 0{,}13x_1x_2 \qquad (3)$$

The St'yudent criterion is used to evaluate the importance of polynomial regression coefficients, initially the same reliable interval is determined for all regression coefficients by formula Δb :

$$\Delta b = t_{0,05;k}\frac{Sy}{\sqrt{N}} \qquad (4)$$

here, $t_{0,05;k}$ "St'yudent criterion, he k depends on the level of freedom ([1] is determined by the table, $k=4$ and $t_{0,05;k} = 2{,}78$);

$S_y = \sqrt{S_y^2}$ – the average square difference determined by the formula;

$k = N(m-1)$the N number of freedom levels for options and for the number of tests (m number of measurements in a single test). m

Regression coefficients that exceed the reliable intervals by module are significant:

$$|b_0| \geq \Delta b,\ |b_i| \geq \Delta b,\ |b_{ij}| \geq \Delta b \qquad (5)$$

We have it $N=4$, $m=2$ in this case $f = 4(2-1) = 4$, $t_{0,05;4} = 2{,}78$

$$\Delta b = 2{,}78\sqrt{\frac{0{,}38}{4}} = 0{,}85;$$

$b_0 = 92{,}9 > 0{,}85$; $b_1 = 1{,}4 > 0{,}85$;

$b_2 = 1{,}1 > 0{,}85$; $b_{12} = 0{,}13 < 0{,}85$.

Accordingly, (3) b_{12} in addition to the coefficient in the equation, others will be significant.

$$\breve{y}_1 = 92{,}9 - 1{,}4x_1 - 1{,}1x_2. \qquad (6)$$

When using such a condition, of course

$$R_{0u} = |(\bar{y}_u - \breve{y}_u)\cdot 100/\bar{y}_u|$$

Using the help of calculating the error in the regression equation adopted, you will need to determine the level of relative discrepancy. In some cases, unheeded excesses can greatly affect the level of error, and as a result, the level of accuracy in the account may not meet the requirements. Using the above three-hadi regression equation, the largest relative discdipancy is 0.14% (table 3).

To verify the adequacy of the linear model (6), we determine the dispersion or residual dispersion by the Fisher criterion by the following formula:

$$S_{na}^2 = \frac{\sum_{u=1}^{N}(\hat{y}_u - \bar{y}_u)^2}{N-k-1} \qquad (7)$$

here, $\hat{y}_u - u$ - the value calculated using the formula in the variant (3);

$\bar{y}_u$ - u the current value of the indicator in the variant;

N – the number of options;

k – the number of input factors.

The Fisher criterion itself is determined as follows:

$$F = \frac{S_{na}^2}{S_y^2}, \qquad (8)$$

here, S_y^2 – processing or residual dispersion found by formula;

$$S_y^2 = \frac{1}{N}\sum_{u=1}^{N} S_u^2 = \frac{1}{N(m-1)}\sum_{u=1}^{N}\sum_{p=1}^{m}(\bar{y}_{up} - \bar{y}_u)^2$$

We have,

$$S_{na}^2 = \frac{\sum_{u=1}^{N}(\hat{y}_u - \bar{y}_u)^2}{N-k-1} = 0{,}06$$

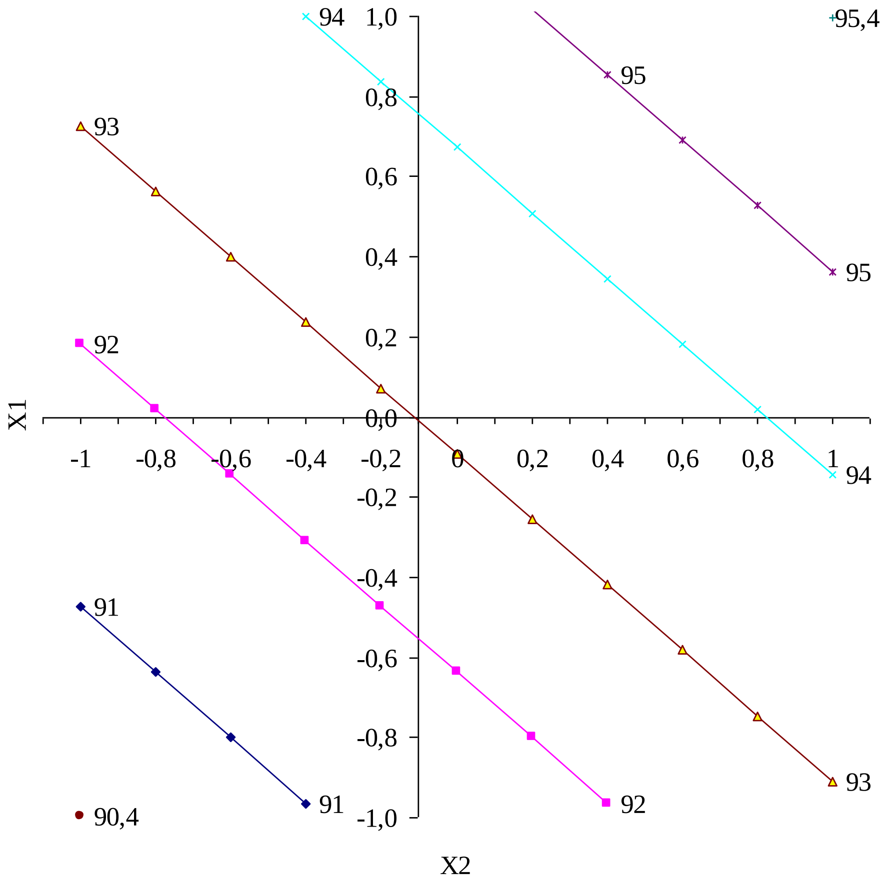
$$S_y^2 = \frac{1}{N}\sum_{u=1}^{N} S_u^2 = \frac{1{,}5}{4} = 0{,}38$$

$$F = S_{na}^2 / S_y^2 = 0{,}06/0{,}38 = 0{,}17$$

If calculated for $F_{0,05;k_1;k_2}$ parameters $k_1 = N-k-1 = 4-2-1 = 1$ $k_2 = N(m-1) = 4$ for the Fisher criterion $F_{0,05;k_1;k_2} = 7{,}71$ (defined from the table on [1]). $F < F_{0,05;k_1;k_2}$ $(0{,}17 < 7{,}71)$ the hypothesis of a linear link is not denied because inequality is performed. Thus, with a warranty of 0.95, a dysfunctional regression equation (3) can be replaced by (6) a regression equation.

x_1 Against (6) we solve the equation and have the following:

$$x_1 = \frac{-y + 92{,}9 - 1{,}3x_2}{1{,}25} \qquad (9)$$



Through this formula, we will have the following graffiti.

It's 1, 000m. Graph of the output parameter of the regression line y (efficiency of separating cotton pieces, %) at different values.

Conclusion. In conclusion, it was found that significant results could be achieved by implementing a cotton regeneration device. Modeling the reganration process and obtaining relevant graphics, which determined the high efficiency of the separation process.

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