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PRACTICAL AND THEORETICAL ANALYSIS OF THE RESULTS OBTAINED IN THE PROCESS OF CLEANING COTTON FROM IMPURITIES

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Abstract:

Objective. In the article, the cleaning efficiency of the machine in the equipment for cleaning seed cotton from small and large impurities, the main control developments and calculation processes in the selection of the technological parameters of the cleaners are considered.

Medhods The main essence of the cleaner is to reduce the binding force between the waste particle and the fiber under the influence of dynamic force, and the theoretical aspects of its separation from the raw material mass have been determined.

Results. Experiments were conducted at different speeds to determine the performance and cleaning efficiency of pile drum and saw drum.

Conclusion. Calculation of forces acting on pile drum and pile, calculation of technological parameters of cleaning machines; Calculation of the productivity of the drum with a pile, calculation of the drum with a saw, calculation of the drum with a brush that separates cotton from the drum with a saw; It is carried out according to the method of calculation of the working rollers of the cleaning drum.

Keywords: cotton, technology, impurity, theory, equation, forces, model, fiber.

Introducation. The main tasks of cleaning machines, their classification, the main technical requirements for cotton cleaning machines, the main working bodies of the technological process; Calculation of forces acting on pile drum and pile, calculation of technological parameters of cleaning machines; Calculation of the productivity of the drum with a pile, calculation of the drum with a saw, calculation of the drum with a brush that separates cotton from the drum with a saw; It is carried out according to the method of calculation of the working rollers of the cleaning drum.

Medhods. Experiments were conducted at different speeds to determine the performance and cleaning efficiency of pile drum and saw drum. In the test

S 6524, cotton raw material grade was used, its initial quality indicators: 2 industrial grade, 2nd class, moisture 9%, dirtiness 5.16%, coarseness 1.5%, degree of mechanical damage to the seed 2.17%. A selected sample of cotton raw material was transferred to the new ginning equipment, samples of cleaned cotton raw material were taken and laboratory analysis was carried out.

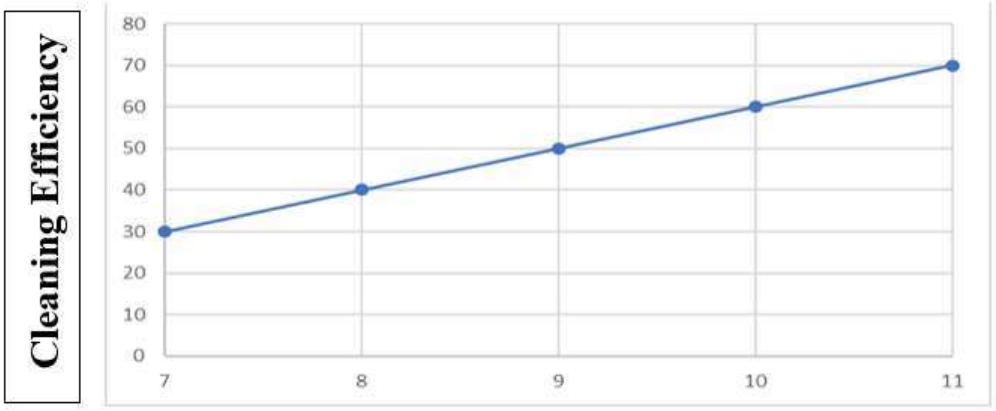
Results. The results of these analyzes of the effect of cleaning frequency on cleaning performance at different performance levels are presented in Table 1. As can be seen from the table, when the work productivity is 4 t/h in the cleaning of highly contaminated cotton raw materials, the cleaning efficiency increases from 45.8% to 65.1%. given in the table.

Table 1

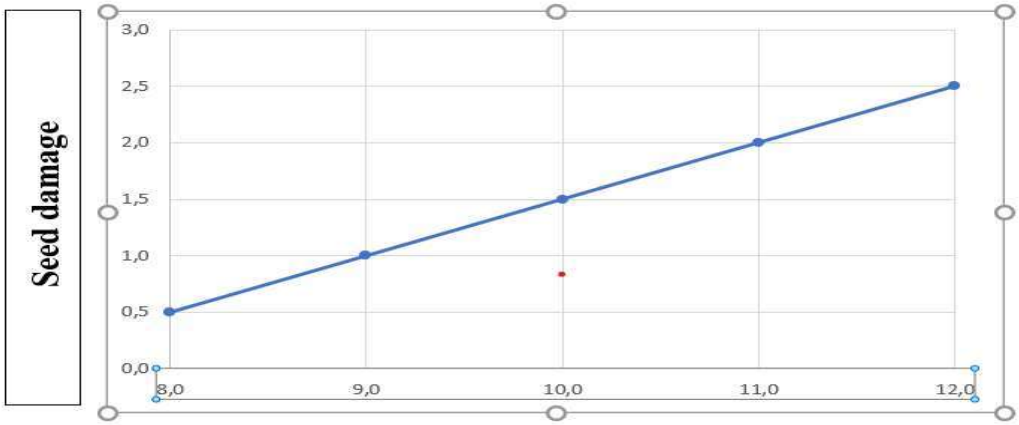
Experiment plan

Selection variety	Angle speed	Cotton x/a soiling		The seed Injury		Free fiber		Clean Efficient	
		Before cleaning	From cleaning after	Cleaning before	Cleaning after	From cleaning after	Cleaning after	General	Йи-рик ифл
				Free fiber 9.14 %					
C-6524	7,8,	5,16	2,86	2,17	2,17	0,16	0,17	45,8	23,8
	8,9,	- /-/ -	2,23	- /-/ -	2,20	- /-/ -	0,18	56,9	33,1
	9,10,	- /-/ -	1,96	- /-/ -	2,25	- /-/ -	0,20	63,2	36,1
	10,11,	- /-/ -	1,84	- /-/ -	2,32	- /-/ -	0,18	65,6	41,9
	11,12,	- /-/ -	2,03	- /-/ -	2,45	- /-/ -	0,17	62,0	47,6
				Hand skin cotton moisture 8,23 %					
C-6524	7,8,	2,69	1,41	0,02	0,02	0,14	0,14	48,5	22,6
	8,9,	- /-/ -	1,08	- /-/ -	0,03	- /-/ -	0,15	60,8	30,3
	9,10,	- /-/ -	0,92	- /-/ -	0,08	- /-/ -	0,17	66,7	34,0
	10,11,	- /-/ -	0,87	- /-/ -	0,20	- /-/ -	0,15	63,2	35,2
	11,12,	- /-/ -	0,96	- /-/ -	0,40	- /-/ -	0,14	65,1	30,7

Table of growth of cleaning efficiency due to differential change of pile drum speed



The pile drum in the cleaner is highly differentiated determine the spee



Linear speed of pile drum, m/s

1) Incoming parameters
2) X1-Supplier speed
X2-Pile drum rpm
X3-Saw drum rpm

table 2

Experiment plan 1

Factors	X_{Max}	X_{Min}	$\Delta = \frac{X\max - X\min}{2}$	$Xcp = \frac{X\max + X\min}{2}$
1.Provider speed	25	15	5	20
2. Pile b-n speed	500	400	50	450
3. Arrali b-n speed	350	250	50	300

Table 3

Experiment plan -2

Factors	X_{Max}	X_{Min}	$\Delta = \frac{X\max - X\min}{2}$	$Xcp = \frac{X\max + X\min}{2}$
1.Provider speed	25	15	5	20
2. Pile drum speed	500	400	50	450
3. Saw drum speed	400	300	50	350

An outgoing parameter:

Efficiency of U1-purifier, t/s;

4 Table

№ т/р	X_1	X_2	X_3	Y_{u1}	Y_{u2}	Y_{ucp}	S_u^2	$\bar{Y}_u$	$R_u(\%)$
1	-	-	-	2300	2400	2350	5000	4.25	4.25
	+	-	-	2500	2700	2600	20000	1.68	1.68
3	-	+	-	2400	2500	2450	5000	4.08	4.08
4	+	+	-	3100	3300	3200	20000	1.37	1.37
5	-	-	+	2700	2900	2800	20000	3.58	3.58
6	+	-	+	3400	3650	3525	31450	2.04	2.04
7	-	+	+	3200	3400	3300	20000	3.03	3.03
8	+	+	+	3800	4100	3950	45000	1.11	1.11

We process the obtained test results in a separate statistical method for each factor in a certain sequence.

1) In the same number of parallel tests, we check the homogeneity of the dispersion, the dispersion of the results: S_u^2

$$S_u^2 = \frac{\sum_{p=1}^{m}(Y_{up} - Y_{ucp})^2}{m-1} = \frac{\sum_{p=1}^{2}(Y_{up} - Y_{ucc})^2}{1}.$$

Here u - variant serial number ($u = 1.2..N$).

$p = 1.2.3..m$ - sequence number of parallel experiments, m =2 $\bar{y}_u = \frac{1}{m}\sum_{p=1}^{m}\bar{y}_{up}$ -

Average number of trials in each option.

Statistics ($S_{u(\max)}^2 = S_8^2 = 45000$ - maximum value in options):

$$G = \frac{S_{u(\max)}^2}{\sum_{u=1}^{N} S_u^2} = \frac{45000}{166250} = 0{,}271 \qquad (4.4)$$

Check the Cochrane criteria: G_{α,k_1,k_2} - values are taken from table data. α - significant level ($0 < \alpha < 1$), $k_1 = N$, $k_2 = m-1$ number of degrees of freedom. In our case $\alpha = 0.05$, $m = 2$, $N = 8$, $G_{\alpha,k_1,k_2} = G_{0.05,8,1} = 0.68$, $G < 0.68$ because it is appropriate, the homogeneity of the variance is fulfilled in all variants of the parallel experiment, then the average value of the variance can be chosen $S_y^2 = \frac{1}{N}\sum_{u=1}^{N} S_u^2 = \frac{166250}{8} = 20781$

(4.6)

2) We calculate the regression coefficients using the following formula:

$$b_0 = \frac{1}{N}\sum_{u=1}^{N}\bar{y}_u,\ b_i = \frac{1}{N}\sum_{u=1}^{N}X_{iu}\bar{y}_u,\ b_{ij} = \frac{1}{N}\sum_{u=1}^{N}X_{iu}X_{ju}\bar{y}_u,\ b_{ijk} = \frac{1}{N}\sum_{u=1}^{N}X_{iu}X_{ju}X_{ku}\bar{y}_u \quad , \quad (4.7)$$

The numerical coefficients of the regression coefficients have the following form:

$b0 := 3021.875000$ $b1 := 296.8750000$ $b2 := 203.1250000$ $b3 := 371.8750000$

$b12 := 53.1250000$ $b13 := 46.8750000$ $b23 := 28.1250000$ $b123 := -71.8750000$

We determine the coefficients using the table values and write the regression equation: $\hat{y} = b_0 + \sum_{i=1}^{k} b_i x_i + \sum_{i<1}^{k} b_{ij} X_i X_j + \sum_{i<j<l}^{k} b_{ijl} X_i X_j X_l$

$$y := 3021.875000 + 296.8750000\ X1 + 203.1250000\ X2 + 371.8750000\ X3 + 53.1250000\ X1\ X2 + 46.8750000\ X1\ X3 + 28.1250000\ X2\ X3 - 71.8750000\ X1\ X2\ X3$$

(4.8)

3. We check the significance of the regression coefficients according to the Student's criterion. Initially, all regression coefficients in the same confidence interval must meet the following condition:

$$\Delta b = t_{\alpha,k} \frac{S_y}{\sqrt{N}} \quad ,$$

Here $t_{\alpha,k}$ - Student criteria, α - level of importance, $\alpha = 0.05$, $k = N(m-1)$ - number of degrees of freedom.

If the regression coefficient is above the confidence interval, then the coefficients are significant:

$$|b_0| \geq \Delta b, |b_i| \geq \Delta b, |b_{ij}| \geq \Delta b, |b_{ijk}| \geq \Delta b \qquad (4.9)$$

Let's look at the following $t_{0.05,8} = 2.78$, $\Delta b = 2.78 \frac{S_y}{\sqrt{N}} = 2.78 \frac{\sqrt{20781}}{\sqrt{8}} = 141.69$

(4.9) significant coefficients in the regression equation according to inequality b_0, b_1, b_2 ва b_3 is written as the regression equation

$$y := 3021.875000 + 296.8750000\ X1 + 203.1250000\ X2 + 371.8750000\ X3 \qquad (4.10)$$

Conclusion. If the regression equation is taken in the form (4.8), the variance test is equal to zero. In this case, everyone $N = 2^k$ regression coefficients were calculated N significant model fit is fully achieved. Such planned experience is said to be saturated. If some insignificant coefficients (4.8) are removed from the regression equation, the model should be checked for adequacy again. Compatibility experimental values are input parameters (Y_{cpu}) with the book value ($\bar{Y}_u$) When the level of various output factors is different from each other, it is determined by the following formula: $R_u = 100 \left| \frac{Y_{cpu} - \bar{Y}_u}{Y_{cpu}} \right|$

$(u = 1....8)$ (4.11)

If the full regression equation (4.8) is replaced by the reduced (4.9), then (4.11) is the largest difference. Add two terms to the regression equation to reduce variance b_{12} and b_{13} we write keeping

$$y := 3021.875000 + 296.8750000\ X1 + 203.1250000\ X2 + 371.8750000\ X3 + 53.1250000\ X1\ X2 + 46.8750000\ X1\ X3 \qquad (4.12)$$

4. We enter the values obtained using the obtained regression equation and the value of the resulting differences in Table 3

To check the adequacy of the regression equation (4.12) according to the Fisher criterion, we use the residual variance formula ($k = 3$ -number of incoming factors):

$$S_{oc}^2 = \frac{\sum_{u=1}^{N}(\bar{Y}_u - Y_{cpu})^2}{N-k-1} = = \frac{\sum_{u=1}^{8}(\bar{Y}_u - Y_{cpu})^2}{8} = 12727$$

Let's look at these statistics: $F = \frac{S_{oc}^2}{S_y^2} = 0.612$. Fisher's criterion F_{α,k_1,k_2} is accepted here α - аҳамиятлилик сатҳига қараб $k_1 = N-k-1 = 4$, $k_2 = N(m-1) = 8$, we find from the table: $F_{\alpha,k_1,k_2} = 3.01$ $F < F_{\alpha,k_1,k_2}$ since the inequality holds, the concordance hypothesis is valid.

Table 5

Y_2 - cleaning efficiency of cotton,%;

№ т/р	X_1	X_2	X_3	Y_{u1}	Y_{u2}	Y_{ucp}	S_u^2	$\bar{Y}_u$	$R_u(\%)$
1	-	-	-	37	41	39	0.765	38.12	2.243
2	+	-	-	39	44	41.5	1.890	48.87	3.313
3	-	+	-	38	42	41	0.391	40.62	1.562
4	+	+	-	44	49	46.5	1.265	45.37	2.419
5	-	-	+	41	46	43.5	1.410	43.87	0.862
6	+	-	+	46	53	49.5	1.265	48.37	2.272
7	-	+	+	42	51	46.5	0.015	46.37	0.268
8	+	+	+	47	54	50.5	0.391	51.12	1.237

Statistics ($S_{u(\max)}^2 = S_8^2 = 40.5$ - the maximum value of the variance in options):

$$G = \frac{S_{u(\max)}^2}{\sum_{u=1}^{N} S_u^2} = \frac{40.5}{143} = 0{,}283$$

$G_{\alpha,k_1,k_2} = G_{0.05,8,1} = 0.68$, $G < 0.68$ since it is reasonable that the homogeneity of the variance is fulfilled in all variants of the parallel experiment, then the mean value of the variance can be chosen

$$S_y^2 = \frac{1}{N}\sum_{u=1}^{N} S_u^2 = \frac{143}{8} = 17.785$$

The numerical coefficients of the regression coefficients have the following form:

$b0 := 44.62500000$ $b1 := 2.375000000$ $b2 := 1.250000000$ $b3 := 2.875000000$

$b12 := .250000000$ $b13 := .125000000$ $b23 := -.250000000$ $b123 := -.750000000$

We determine the coefficients using the table values and write the regression equation:

$$y := 44.62500000 + 2.375000000\ X1 + 1.250000000\ X2 + 2.875000000\ X3 + .250000000\ X1\ X2 + .125000000\ X1\ X3 - .250000000\ X2\ X3 - .750000000\ X1\ X2\ X3$$

All regression coefficients in the same confidence interval must meet the following condition:

$$\Delta b = t_{\alpha,k}\frac{S_y}{\sqrt{N}} = 2.73\frac{\sqrt{17.785}}{\sqrt{8}} = 4.55 \quad ,$$

(4.9) is a significant coefficient in the regression equation according to inequality is written as the regression equation

$y = b_0 = 44.625$

If the full regression equation is reduced

$y = b_0 = 44.625$ then the biggest difference is 14.42%.

Add two terms to the regression equation to reduce variance b_1 , b_2 and b_3 we write keeping

$$y := 44.62500000 + 2.375000000\ X1 + 1.250000000\ X2 + 2.875000000\ X3$$

We enter the values obtained using the obtained regression equation and the value of the resulting differences in table 4

Using the residual variance formula ($k = 3$ -number of incoming factors) let's find out:

$$S_{oc}^2 = \frac{\sum_{u=1}^{N} (\bar{Y}_u - Y_{cpu})^2}{N - k - 1} = = \frac{\sum_{u=1}^{8} (\bar{Y}_u - Y_{cpu})^2}{8} = 1.531$$

Statistical value $F = \frac{S_{oc}^2}{S_y^2} = 0.0566$

$F < F_{\alpha,k_1,k_2}$ since the inequality holds, the concordance hypothesis is valid.

References

1.A.G.Sevostyanov.Metodi i sredstva issledovaniye mexanikotexnologicheskix prot sessov tekstilnoy promishlennosti.Moskva»Legkaya promishlennost» 1980.g

2.G.I..Miroshnichenko. Osnovi proyektirovaniya mashin pervichnoy obrabotki xlopk a. M. Mashinostroyeniye, 1972.

3.F.B. Omonov tahriri ostida. Paxtani qayta ishlash spravochnigi. Toshkent 2008 y.

4.Lebedev D.A. i dr. Nelineynaya model vozdeystviya na sornuyu chastitsu pri ochistke volokna. Jurnal «Texnologiya tekstilnoy promishlennosti», №5(320), 2009 g.

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