



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 2, February 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512

 9940 572 462

 6381 907 438

 ijirset@gmail.com

 www.ijirset.com



Theoretical Studies of Factors Affecting the Rewinding of Raw Silk

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ANNOTATION: The concentration, temperature of the emulsion with a new composition and the effect of the processing time of raw silk on the rewinding capacity and the yield of rags were studied. As a result of the research, the factors influencing the yield of raw silk rags were checked and analyzed using statistical processing, checking the adequacy of the linear model according to Fisher's criterion. The intervals of changing the factors were determined and a schedule was obtained to ensure the selected technological mode.

KEYWORDS: raw silk, rewinding, rags, silk twists, emulsion, concentration, emulsion temperature, pupa, mathematical model, statistical analysis.

I. INTRODUCTION

As a result of the introduction of the cluster method in the existing cocooning enterprises in the country, the production of finished products from pure natural silk and silk blends is being launched. The production of pure natural silk and silk blend products requires the preparation of raw silk for re-wrapping and the selection of alternative modes in the re-wrapping process [1].

In addition to mechanical processes in the production of spun silk, chemical processing processes are carried out by applying various emulsions, temperature and humidity to the yarns. Depending on the type of raw material and the use of spun yarns, yarns are produced according to different spinning plans [2-3].

The raw materials brought to the processing plants are brought in the form of yarn and emulsified to increase their chances of further use, i.e. to soften the glued areas and increase their flexibility. The yarns are divided into three groups according to the degree of adhesion: hard glued, medium glued and loose glued. The substances used for soaking must have certain properties. The main quality indicator of the emulsion is that it is homogeneous and stable and does not separate into layers. This condition depends on the balance between the oil and the soap. Emulsion composition and concentration, temperature, processing time are important indicators in the processing of raw silk emulsion [4-9]. The use of a new emulsion in the preparation of raw silk for rewrapping and its statistical analysis were performed.

II. METHODOLOGY

Synthetic soaps are often used in processing plants, and the raw materials for their production are mainly imported. The use of local raw materials instead is a pressing issue.

Research has been conducted in this area and new composition emulsions based on sponge oil have been obtained to increase the recycling ability of raw silk by effectively using sponge, which is a local raw material.



The obtained results were analyzed. It is known that when the analytical expression of a response function is unknown, it can usually be expressed in the form of a regression equation with a polynomial of the response function.

$$y = b_0 + \sum_{i=1}^k b_i x_i + \sum_{i=1}^k b_{ii} x_i^2 + \sum_{i<j}^k b_{ij} x_i x_j + \sum_{i<j<l}^k b_{ijl} x_i x_j x_l \tag{1}$$

Here: y – the calculated value of the optimization parameter, x_i - independent unwanted parameters, which vary during the experiment, $b_0, b_i, b_{ij}, b_{ijk}$ - regression coefficients determined from experimental results. (1) to build a mathematical model in the form of an equation “ y ” the optimization criterion is selected; independent variable x_i - factor is selected; $b_0, b_i, b_{ij}, b_{ijk}$ regression coefficients are calculated, and the appearance of the response and plan function is determined.

Small for writing an experiment plan and processing the experimental results X_1, X_2 the coded values of the factors denoted by the letters are used. . . X_i coded (dimensionless size) and X_i The physical (natural) variable is interconnected in the following proportions.

$$X_i = \frac{x_i - x_{i0}}{\Delta_i} \tag{2}$$

Here Δ_i – natural value variation interval; x_{i0} – the natural value of the zero level, $X_{i0} = \frac{x_u - x_l}{2}$, x_u, x_l – the natural value of the lower and upper levels of the factor.

Factor coding is equivalent to moving the coordinate head to the point of the main factor level (the central O point of the experiment) and changing the scale.

All coded factors are dimensionless and normalized quantities. They are in the process of experimentation –1, 0, +1 values.

These values are called factor levels. (1) The coefficients in the independent variables of the approximate polynomial indicate the degree of influence of the factors. If the coefficient is positive, the output factor also increases as the factor increases, while the negative coefficient increases as the factor increases.

III. RESULTS AND DISCUSSION

A full factor is an experiment in which the levels of possible combination (cumulative) factors take place. If “ k ” the factors vary on two levels, all possible sets – $N_2=2^k$. If “ k ” in which case the factors vary by three levels $N_3=3^k$.

We construct the regression equation for the fractions. Initially two-tiered ($k = 2$), we create a three-factor experimental plan, the first factor in this X_1 emulsion concentration, the latter X_2 - coded emulsion temperature, the third is the processing time in the emulsion X_3 coded are two parallel experiments that determine the ability to rewind [10-12].

Table-1. In the first experiment ($p = 1$) ability to rewind raw silk, pcs

Factors	x_{max}	x_{min}	Δ	x_0
Emulsion concentration	0,5	0,1	0,3	0,2
Emulsion temperature	45	42	43,5	1,5
Emulsion processing time	55	30	42,5	12,5



Table-2. In the second experiment ($p = 2$) ability to rewind raw silk, pcs

Factors	x_{max}	x_{min}	Δ	x_0
Emulsion concentration	0,5	0,1	0,3	0,2
Эмульсия ҳарорати	45	42	43,5	1,5
Emulsion processing time	60	40	50	10

Two levels for each function on the answers to determine the regression equation ($k = 2$) we construct a matrix of three-factor experiments. \bar{y}_{ui} , through m obtained in parallel experiments, each n the ability to rewind raw silk as determined experimentally y_{0ui} we determine the values of the corresponding responses for the coefficient of variation on. Thus $y_{ui} = \frac{1}{n} \sum_{l=1}^n y_{0ul}$, ($l = 1.2...m$) considered in conducting two experiments. The number of packages in each option $N_2 = N = 8$ yes $m = 2$ and enter their values in Tables 3-4.

Table 3.

№	Factor range			Output parameter rewind capability, pcs					
				Deviation					
	X_1	X_2	X_3	y_{i1}	y_{i2}	\bar{y}_u	S_u^2	\hat{y}_u	$R_0(\%)$
1	-	-	-	12	11	11,5	0,5	11,81	2,71
2	+	-	-	8	8	8	0	7,56	5,46
3	-	+	-	11	10	10,5	0,5	10,06	4,16
4	+	+	-	6	5	5,5	0,5	5,81	5,68
5	-	-	+	12	12	12	0	12,06	0,52
6	+	-	+	6	5	5,5	0,5	5,56	1,13
7	-	+	+	12	12	12	0	12,6	0,52
8	+	+	+	6	5	5,5	0,5	5,56	1,13
							2,5		

Table 4.

№	Factor range			Output parameter (number of rings, %)					
				Deviation					
	X_1	X_2	X_3	y_{i1}	y_{i2}	\bar{y}_u	S_u^2	\hat{y}_u	$R_0(\%)$
1	-	-	-	0.6	0.6	0.6	0	0,51	10.93
2	+	-	-	0.25	0.25	0.25	0	0,24	26.25
3	-	+	-	0.4	0.3	0.35	0	0.34	2.67
4	+	+	-	0.2	0.1	0.15	0	0.06	6.25
5	-	-	+	0.35	0.3	0.325	0	0.36	8.76
6	+	-	+	0.22	0.1	0.160	0	0.20	16.79
7	-	+	+	0.35	0.32	0.335	0	0.38	8.76
8	+	+	+	0.2	0.15	0.175	0	0.21	16.78

A - ability to rewind raw silk.

B - the amount of raw silk rings.

We statistically process the experimental results for each answer in the following order:



1) Parallel experiments, their kind m characterizing the distribution of their results in the number S_u^2 we

examine the reproduction of the dispersion in one category.
$$S_u^2 = \frac{\sum_{p=1}^2 (\bar{y}_{up} - \bar{y}_u)^2}{m-1}$$
 (3)

Hereof u - option sequence number ($u = 1.2..N$), $p = 1.2.3..m$ - serial number of parallel experiments,

m - the number of each parallel experiment, $\bar{y}_u = \frac{1}{m} \sum_{p=1}^m \bar{y}_{up}$ - average of parallel experiments. Results S_u^2 we enter

the values in the table and calculate these statistics for both cases

$$G = \frac{S_{u(\max)}^2}{\sum_{u=1}^N S_u^2}$$

(4)

Here: $S_{u(\max)}^2$ - the maximum value of the variance in parallel experiments,

(3) calculate the value according to the formula.

$$S_u^2 = (\bar{y}_{u1} - \bar{y}_u)^2 + (\bar{y}_{u2} - \bar{y}_u)^2, (u = 1,2,3,4,5,6,7,8),$$

A. $S_1^2 = 0.5, S_2^2 = 0, S_3^2 = 0.5, S_4^2 = 0.5, S_5^2 = 0, S_6^2 = 0.5, S_7^2 = 0, S_8^2 = 0.5$

We accept $S_{u(\max)}^2 = S_3^2 = 0.5, \sum_{u=1}^8 S_u^2 = 2.5$ if we calculate the statistics

$$G = \frac{S_{u(\max)}^2}{\sum_{u=1}^N S_u^2} = 0.2$$

Б. $S_1^2 = 0., S_2^2 = 0, S_3^2 = 0.005, S_4^2 = 0.005, S_5^2 = 0.0125, S_6^2 = 0.00720, S_7^2 = 0.00045, S_8^2 = 0.00125$

We accept $S_{u(\max)}^2 = S_3^2 = 0.005, \sum_{u=1}^8 S_u^2 = 0.02015$

if we calculate the statisti

$$cs G = \frac{S_{u(\max)}^2}{\sum_{u=1}^N S_u^2} = 0.248$$

2) A) Let's check the Koxren criterion, G_{α,k_1,k_2} - values are taken from the table data, α - significant level ($0 < \alpha < 1$), $k_1 = N, k_2 = m - 1$ - the number of degrees of freedom, As we look $\alpha = 0.05, m = 3, N = 8, G_{\alpha,k_1,k_2} = G_{0.05,8,3} = 0.52, G = 0.2$.

If the following inequality is observed

$$G < G_{\alpha,k_1,k_2} \tag{5}$$

Koxren The criterion is reasonable. The homogeneity of the variance is all m these equations can be used

because the parallel experiment was performed on all variants.

$$S_y^2 = \frac{1}{N} \sum_{u=1}^N S_u^2 = 0.3125$$

(6)



That is, this variance is used to assess the adequacy of the model.

If (5) the inequality is not complied with, the variance by variants is of the same category and is not averaged, and the following measures must be taken: a) to determine the maximum variance of the measurement data in the variant; b) in each variant m increase the number of experiments; c) perform more accurate measurements of output parameters.

B. Koxren check the criterion, G_{α,k_1,k_2} - the values are taken from the table data, α - significant level ($0 < \alpha < 1$), $k_1 = N$, $k_2 = m - 1$ - the number of degrees of freedom, As we look $\alpha = 0.05$, $m = 3$, $N = 8$, $G_{\alpha,k_1,k_2} = G_{0.05,8,3} = 0.52$, $G = 0.2.48$

If the following inequality is observed

$$G < G_{\alpha,k_1,k_2} \tag{5}$$

Koxren The criterion is reasonable. The homogeneity of the variance is all m these equations can be used because the parallel experiment was performed on all variants.

$$S_y^2 = \frac{1}{N} \sum_{u=1}^N S_u^2 = .002518750000 \tag{6}$$

That is, this variance is used to assess the adequacy of the model.

If (5) the inequality is not complied with, the variance by variants is of the same category and is not averaged, and the following measures must be taken: a) to determine the maximum variance of the measurement data in the variance; b) in each variant m increase the number of experiments; c) perform more accurate measurements of output parameters.

A. 3) We calculate the regression coefficients by the following formula.

$$b_0 = \frac{1}{N} \sum_{u=1}^N \bar{y}_u, b_i = \frac{1}{N} \sum_{u=1}^N X_{iu} \bar{y}_u, b_{ij} = \frac{1}{N} \sum_{u=1}^N X_{iu} X_{ju} \bar{y}_u, b_{ijk} = \frac{1}{N} \sum_{u=1}^N X_{iu} X_{ju} X_{ku} \bar{y}_u \tag{7}$$

Once the coefficients are determined, we write the coded variable regression equation.

$$\hat{y} = b_0 + \sum_{i=1}^k b_i x_i + \sum_{i<j}^k b_{ij} X_i X_j + \sum_{i<j<l}^k b_{ijl} X_i X_j X_l$$

$$b_0=8.812500000 \quad b_1= 2.687500000 \quad b_2=0.4375000000 \quad b_3=0.0625000000 \quad b_{12}=0.1875000000$$

$$b_{13}=0.5625000000 \quad b_{23}= 0.4375000000 \quad b_{123}=0.1875000000 \quad y=8.812500000 - 2.687500000 \quad X_1-0.4375000000$$

$$X_2-0.0625000000 \quad X_3-0.1875000000 \quad X_1 X_2 - 0.5625000000 \quad X_1 X_3 + 0.4375000000 \quad X_2 X_3 + 0.1875000000 \quad X_1 X_2 X_3$$

B. 3) We calculate the regression coefficients by the following formula.

$$b_0 = \frac{1}{N} \sum_{u=1}^N \bar{y}_u, b_i = \frac{1}{N} \sum_{u=1}^N X_{iu} \bar{y}_u, b_{ij} = \frac{1}{N} \sum_{u=1}^N X_{iu} X_{ju} \bar{y}_u, b_{ijk} = \frac{1}{N} \sum_{u=1}^N X_{iu} X_{ju} X_{ku} \bar{y}_u \tag{7}$$

Once the coefficients are determined, we write the coded variable regression equation.

$$\hat{y} = b_0 + \sum_{i=1}^k b_i x_i + \sum_{i<j}^k b_{ij} X_i X_j + \sum_{i<j<l}^k b_{ijl} X_i X_j X_l$$

$$b_0=0.2931250000 \quad b_1=0.1093750000 \quad b_2=0.04062500000 \quad b_3=0.04437500000 \quad b_{12}=0.1937500000$$

$$b_{13}=0.02812500000 \quad b_{23}= 0.04687500000 \quad b_{123}=0.1812500000 \quad y=0.2931250000 - 0.1093750000 \quad X_1-0.4062500000$$

$$X_2-0.4437500000 \quad X_3-0.01937500000 \quad X_1 X_2 \quad 0.2812500000 \quad X_1 X_3 + 0.04687500000 \quad X_2 X_3 - 0.1812500000 \quad X_1 X_2 X_3$$

A. 4) We check the significance of the regression coefficients from the student criterion, initially in the same confidence range Δb all regression coefficients are in the following formula

$$\Delta b = t_{\alpha,k} \frac{S_y}{\sqrt{N}} \tag{8}$$

$t_{\alpha,k}$ - Student criterion, α - significance level, $k = N(m - 1)$ - the number of degrees of freedom.



If the regression coefficient is higher than the confidence range, then the coefficients are significant.

$$|b_0| \geq \Delta b, |b_i| \geq \Delta b, |b_{ij}| \geq \Delta b, |b_{ijk}| \geq \Delta b \quad (9)$$

Let's look at the following case $t_{0.05,16} = 2.16$, $\Delta b = t_{\alpha,k} \frac{S_y}{\sqrt{N}} = 0.4269$. According to the above inequality

in the regression equation b_3, b_{12}, b_{123} the coefficient is considered insignificant, we write the regression equation without this coefficient

$$y = 1.3025 + 0.25625x_1 + 0.2925x_2 + 0.50375x_3 + 0.06125x_1x_2 - 0.4875x_2x_3 - 0.055x_1x_2x_3$$

$$y = 8.812500000 - 2.687500000 X_1 - 0.4375000000 X_2 - 0.5625000000 X_1 X_3 + 0.4375000000 X_2 X_3 \quad (9)$$

We estimate the adequacy of the model when no significant coefficients are involved in the regression equation.

If the regression is taken as Equation (8), then the variance of the experiments is zero. In this case, all $N=2^k$ regression coefficients N on y values, in which case there is no degree of freedom to check the adequacy of the model. In this case, the adequacy condition is fully managed and the experimental plan is called complete. If some non-significant coefficients are not taken into account in the regression equation (8), a degree of freedom is formed, and it is necessary to check the adequacy of the model. Adequacy check y Experimental values of the output parameter, \hat{y} comparing the unwanted parameters with the calculated values of the different levels and determining their difference as a percentage according to the formula.

$$R_0 = 100 \left| \frac{\hat{y} - y}{y} \right| \quad (10)$$

\hat{y} and R_0 We show the values of

B. 4) We check the significance of the regression coefficients from the student criterion, initially in the same

confidence range Δb all regression coefficients are in the following formula $\Delta b = t_{\alpha,k} \frac{S_y}{\sqrt{N}}$

$$(8)$$

$t_{\alpha,k}$ - Student criterion, α - significance level, $k = N(m - 1)$ - the number of degrees of freedom.

If the regression coefficient is higher than the confidence range, then the coefficients are significant.

$$|b_0| \geq \Delta b, |b_i| \geq \Delta b, |b_{ij}| \geq \Delta b, |b_{ijk}| \geq \Delta b \quad (9)$$

Let's look at the following case $t_{0.05,16} = 2.16$, $\Delta b = t_{\alpha,k} \frac{S_y}{\sqrt{N}} = .03832668784$

According to the above inequality in the regression equation b_{12}, b_{13}, b_{123} the coefficient is considered insignificant, we write the regression equation without these coefficients.

$$y = 0.2931250000 - 0.1093750000 X_1 - 0.4062500000 X_2 + 0.2812500000 X_1 X_3 + 0.0468750000 X_2 X_3 \quad (9)$$

We estimate the adequacy of the model when no significant coefficients are involved in the regression equation.

If the regression is taken as Equation (8), then the variance of the experiments is zero. In this case, all $N=2^k$ regression coefficients N will be calculated with y values, in which case there is no degree of freedom to check the adequacy of the model. In this case, the adequacy condition is fully managed and the experimental plan is called complete.

If some non-significant coefficients are not taken into account in the regression equation (8), a degree of freedom is formed, and it is necessary to check the adequacy of the model. Adequacy check y Experimental values of the output parameter, \hat{y} comparing the unwanted parameters with the calculated values of the different levels and determining their difference as a percentage according to the formula.



$$R_0 = 100 \left| \frac{\hat{y} - y}{y} \right| \tag{10}$$

R_i maximum value 26.25 due to the fact that \hat{y} the difference is large, so all coefficients must be kept in the regression equation

A. 5. To check the adequacy of the linear model according to the Fisher criterion, we find the residual variance according to the formula.

$$S_{oc}^2 = \frac{\sum_{u=1}^8 (\hat{y}_u - \bar{y}_u)^2}{N - k - 1} = 1.1562 \tag{11}$$

here: \hat{y}_u - N the value calculated for the linear regression index in the chi option, \bar{y}_u - кўрсаткичнинг амалдаги қиймати, N - number of options, k- number of factors.

We see the statistics

$$F = \frac{S_{oc}^2}{S_y^2} = \frac{1.1562}{0.3125} = 3.7$$

If we check by Fisher's criterion F_{α, k_1, k_2} according to the table value,

here: α - depending on the significant level $k_1 = N - k - 1 = 4$, $k_2 = N(m - 1) = 16$, from the table,

This inequality $F < F_{\alpha, k_1, k_2}$ the hypothesis of adequacy is fulfilled.

$F_{\alpha, k_1, k_2} = 3.01$ and $F > F_{\alpha, k_1, k_2}$ because the linear Fisher criterion is not satisfied for this case, so linear regression is not appropriate.

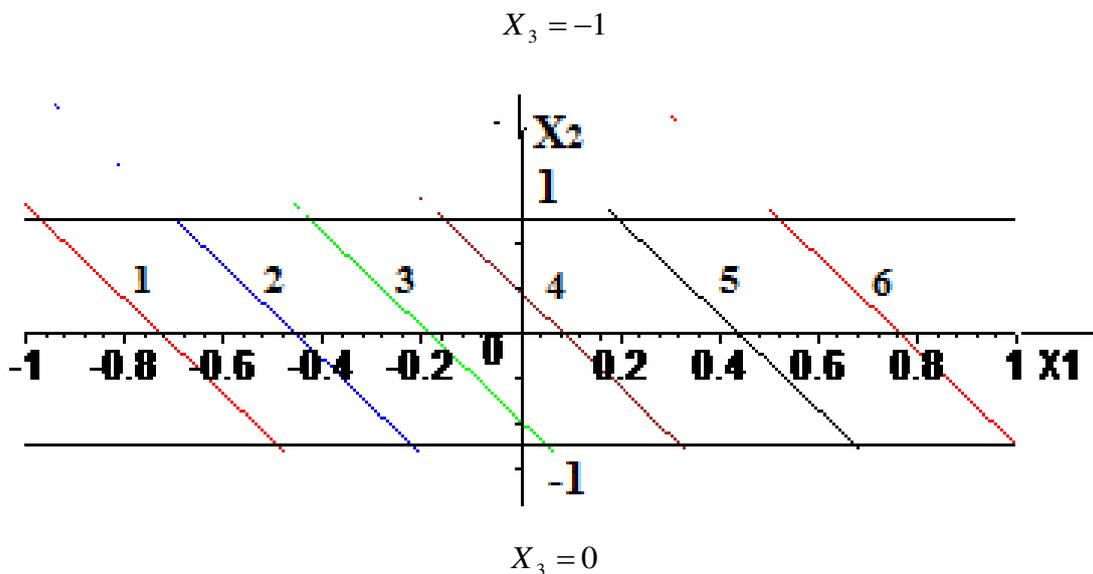
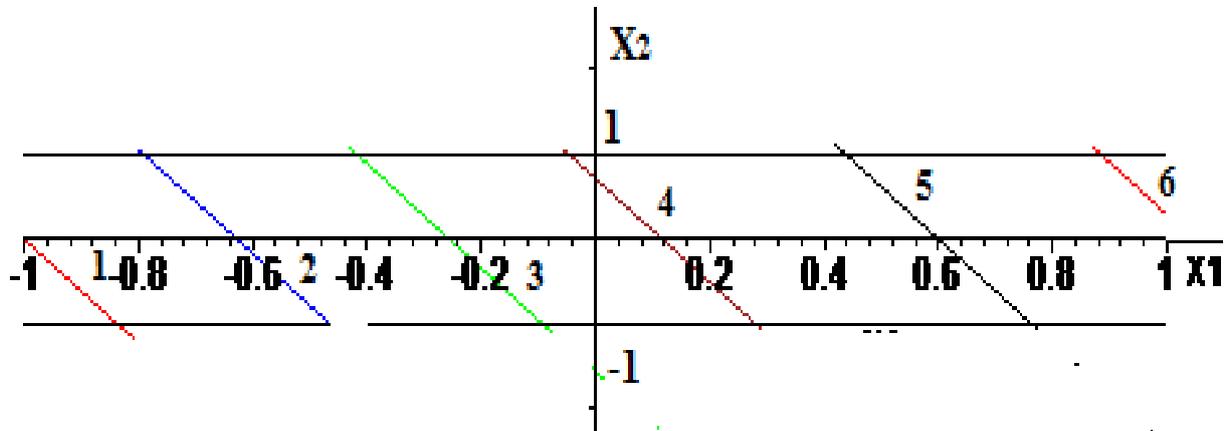


Figure 1. The ability of factor y to rewind raw silk at different values
2 factor $X_2=1$ a graph of the relationship between factors 1 and 3 when



1- $y = 11.5$, 2- $y = 10.5$, 3- $y = 9.5$, 4- $y = 8.5$, 5- $y = 7.5$, 6- $y = 6$,

Figure 2. The ability of factor y to rewind raw silk at different values

2 facto $X_2=0$ a graph of the relationship between factors 1 and 3 when.

B. 5. To check the adequacy of the linear model by the Fisher criterion, we find the residual variance according to the formula.

$$S_{oc}^2 = \frac{\sum_{u=1}^8 (\hat{y}_u - \bar{y}_u)^2}{N - k - 1} = 1.1562 \quad (11)$$

here: \hat{y}_u - N The value calculated for the linear regression index in the chi option, \bar{y}_u - current value of the indicator, N - number of options, k- number of factors.

We see the statistics $F = \frac{S_{oc}^2}{S_y^2} = 2.931761787$

If we check by Fisher's criterion F_{α, k_1, k_2} according to the table value,

here: α - depending on the significant level $k_1 = N - k - 1 = 4$, $k_2 = N(m - 1) = 16$, From the table we find, this inequality $F < F_{\alpha, k_1, k_2}$ the hypothesis of adequacy is fulfilled. $F_{\alpha, k_1, k_2} = 3.01$ дан $F < F_{\alpha, k_1, k_2}$ because the linear Fisher criterion is satisfied for this case, so the linear regression is appropriate.

For the practical use of the results of statistical processing fixed the input parameter on the basis of regression equations $y = y_c$ It will be possible to establish graphical relationships between unwanted factors in the values. The third factor for this purpose X_3 the remaining two factors in the net value of X_1 ва X_2 graphs based on the regression equation are shown in Figures 1-2.

Graphs are the change interval of the output parameter $0.1 < y < 0.6$ input factor in X_3 structured at two values of. Factors using them X_1 ва X_2 you can select values from the graphical links between.

$$X_3 = -1$$

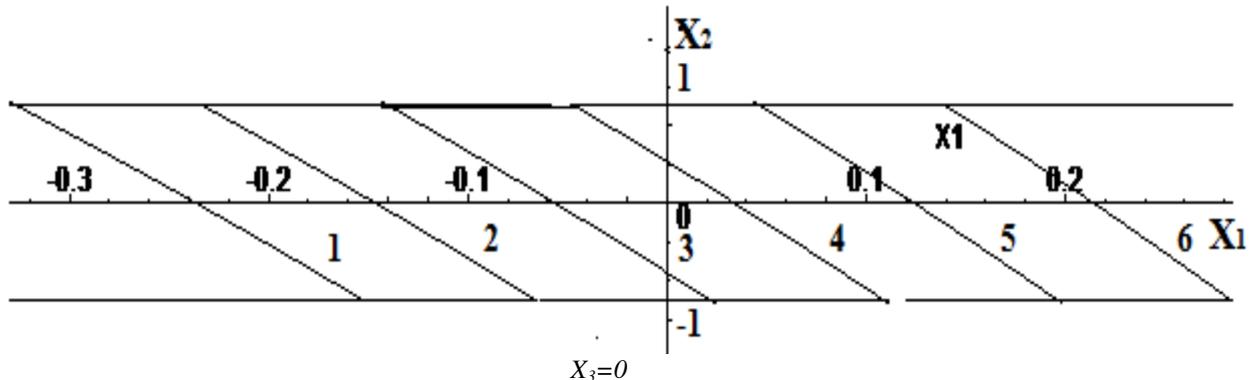
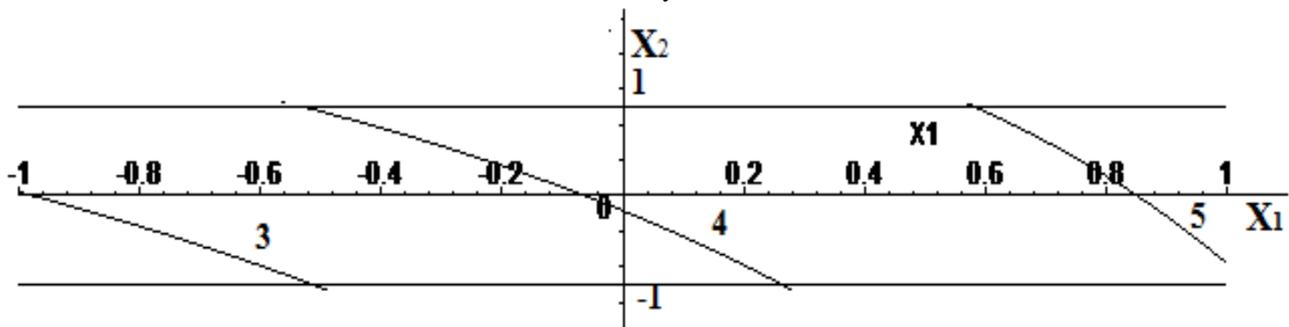


Figure 3. Graph of the relationship between the 1st and 3rd factors when the amount of raw silk rings at different values of factor y is 2 factor $X_2 = 0$.



1-y=0.6, 2-y=0.3-5, y=0.4, 4-y=0.3, 5-y=0.2, 6-y=0.1 will be

Figure 4. Graph of the relationship between the 1st and 3rd factors when the amount of raw silk rings at different values of factor y is 2 factor $X_2 = 0.5$.

IV.CONCLUSION

As a result of experiments carried out in the process of rewinding raw silk, the concentration, temperature, processing time of the prepared new emulsion were obtained as an undesirable parameter. The regression equation of the values of the obtained indicators was constructed. The results showed that the conditions of the Cochran criterion for evaluating the adequacy of the model of all variants of homogeneous parallel experiments of the variance were met, ie

$G < G_{\alpha, k_1, k_2}$ satisfied the condition. At these rates, the rewind capability improved and the number of interruptions decreased. The emulsion concentration, emulsion temperature dependence graph $X_3 = -1$ is obtained from the graph of the change of the corresponding values satisfied by the processing time.

A. Residual variance was determined to verify the adequacy of the linear model according to the Fisher criterion of the rewinding capacity of raw silk during the rewinding process, and according to the Fisher criterion.

$F < F_{\alpha, k_1, k_2}$ condition checked. Linear regression was not appropriate because the condition was not met.

B. As a result of the experiments, the factors influencing the number of rings of raw silk were tested for the adequacy of the linear model according to the Fisher criterion, and the linear regression was appropriate. That is

$F < F_{\alpha, k_1, k_2}$ condition fulfilled. As a result of statistical processing, the regression equation was selected as an unwanted parameter $y=y_c$ value was fixed. The result is a third factor X_3 at the expense of the net value of X_1 and X_2 a graph was obtained based on the regression equations.

REFERENCES

1. N.M.Islambekova, J.A.Akhmedov, U.N.Azamatov, S.S.Haydarov. Formation and increase of efficiency of cluster system in the silk industry // Proceedings of the international conference "Problems of using marketing concepts in improving the effectiveness of action strategies in Uzbekistan". Namangan 2019 y. 370-374 b.



2. H.Alimova, N.Islambekova, A.Gulamov, Sh.Fayzullaev “Technology of silk production” Textbook T. «TTYESI» 224 b, 2018 y.
3. A.Gulamov, N.Islambekova, U.Azamatov, A.Eshmirzaev “Technology and equipment of textile products” Textbook T. «TTYESI» 184 b, 2018y.
4. X.A.Alimova., V.A.Usenko. Silk growth. T. : «Sharq», 2001. - 272 p.
5. Усенко В.А. Шелкокручение. <https://search.rsl.ru/ru/record/01001130054>
6. Кукин Г.Н., Соловьев А.Н., Кобляков А.И. Текстильное материаловедение. <http://www.twirpx.com/file>.
7. Рубинов Э.Б. Технология шелка. М. Легкая и пищевая промышленность. -1981. -С. 56-64.<https://search.rsl.ru/ru/record/01001044919>
8. Islambekova NM, Azamatov UN, Djuraev BE, Gulamov AEFY-2008 cocoon spinning machines and quality indicators of raw silk produced in them // Integration of science in the organization of production in the textile industry role and solution of current problems. International scientific and technical conference. Part I. Margilan, July 27-28, 2017. -S. 145-149.
9. Akhmedov Zh.A., Alimova Kh., Aripdjanova D.U., Bastamkulova Kh.D. Ways and technologies for making natural silk // European Sciences review, № 9-10, 2016 (September-October). -P. 179-181.
10. S.M. Targ. Short course teoreticheskoy mechanics. 20-e izd. -M. : 2010. -416s.
11. Yu. Yu. Tarasevich. Mathematical and computer modeling. Izd. 4-e, ispr. M. : Editorial URSS, 2004. 152 p.
12. N. Ravshanov et al. Fundamentals of mathematical and computer modeling. Methodical manual. Tashkent -2016.



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