# ANALYSIS OF CONDUCTING A FULL FACTORY EXPERIENCE (TOT) IN THE PRODUCTION OF FABRIC TISSUES AND EVALUATION OF THE RECEIVED MODELS

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***ABSTRACT***

*The article provides a scientific analysis of scientific and technological progress in the textile industry, the improvement of all aspects of production using mathematical and automated methods..*

**KEYWORDS:** *Textile, tanda, back, woven flower*

## INTRODUCTION

Scientific and technological progress in the textile industry is to improve all aspects of production using mathematical and automated methods. In particular, the analysis of experimental research in the production of towel tissue showed that some qualitative aspects of the process play a special role in the successful management of technological parameters and their optimization. Currently, modeling is used in solving specific technical, economic and other problems in various fields of science and technology.

An experimental method of mathematical description of a technological object or process is the processing of experimental data obtained directly at these production facilities or on a semi-industrial laboratory machine. The most effective solution to the problem of obtaining a mathematical model of a complex process is a combination of theoretical and experimental methods. In this case, the theoretical method is mainly used to analyze the structural properties of objects and products, as well as to obtain the general form of the equations, while the experimental method is used to analyze the quantitative analysis and theoretical conclusions

**MAIN PART**

Optimization is done using multi-factor scheduling of the experiment, i.e. TOT 23 experiment. In this case, 2 is the number of levels; 3 - number of factors; the number of trials is 23 = 8.

1. Factors influencing the implementation of the optimization process and the resulting parameters are selected.

Incoming parameters that need to be optimized by value]:

$x_1$ – Tanda reports.

$x_2$ – Back report.

$x_3$ – Hexagonal waffle cutting.

The following indicators were selected as the output parameter:

$Й_1$- Tissue air permeability, [(см$^3$/см$^2$/секунд)]

$Й_2$- Tissue abrasion resistance [tcycl]

$Й_3$— The tissue breaking force was selected. [cX]

2. The limits of variation of factors are determined and included in the table below.

3. 3. In order to simplify the processing of research results, we move from the natural values of the factors to the coded values.

$$x_i = \frac{X_i - X_{ai}}{I_i} \qquad (1)$$

Here $x_i$ - the coded value of the factor;

$X_{ai}$ - the natural value of the inch factor;

$I_i$ - range of variation.

1 – table. Table of levels of factors of natural value

| Variable factors | Low Level | High Level | Variation Range |
|---|---|---|---|
| Tanda reports | 8 | 9 | 1 |
| Back report | 8 | 9 | 1 |
| Hexagonal waffle cutting. | 9 | 9 | 1 |

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The results of the coding are presented in Table 2.

Thus, after coding, all higher levels are denoted by +1 or simply (+), lower levels by -1 or simply (-).

Table 2. Results of factor coding

| № | Variable factors | Lower level coding | High level coding |
|---|---|---|---|
| 1 | Tanda reports | $x_1 = -1$ | $x_1 = 1$ |
| 2 | Back report | $x_2 = -1$ | $x_2 = 1$ |
| 3 | The number of corners of the tissue flower | $x_3 = -1$ | $x_3 = 1$ |

The experiments are carried out strictly by setting the values of the unwanted parameters in the sequence given in column 4. The results are recorded in column 5. The order of the 4th column is based on a random table, the task of which is to conduct tests in this order and eliminate the influence of random factors on the process under study..

5. A test matrix is created and the experimental results are processed.

6. **Tissue air permeability**

The planning matrix included in the study results is presented in the table above The arithmetic mean of the optimization parameters for each test, which consists of iterations according to the experimental results.

$$\bar{Y} = \frac{\sum_{i=1}^{N} Y_i}{m} \quad (2)$$

is calculated.

is the value of the series variances across the column.

$$S^2\{Y\} = \frac{\sum(Y_i - Y_1)^2}{m-1} \quad (3)$$

$$S^2(Y) = 2{,}03$$

here $m$ - number of repetitions.

6. The homogeneity of the variance is determined using the Cochrane criterion.

$$G_x = \frac{S^2\{Y\}_{max}}{\sum S^2\{Y\}} \quad (4)$$

Here $G_x$- The calculated value of the Cochrane criterion

$S^2\{Y\}_{max}$- Maximum variance of the first test

$\sum S^2\{Y\}$ - the sum of all series variances

1) $G_x\{Y_2\} = \frac{S^2\{Y\}_{max}}{\sum S^2\{Y\}} = \frac{3{,}1}{16{,}2}$

To determine the experimental recovery, we compare the calculated value of the Cochrane criterion with the table.

In our case TOT $2^3$ ва $П_д$=0,95 for

$$G_x\{Y\} = 0{,}16 < G_{жад} = 0{,}5137$$

if $G_x\{Y\} < G_{jad}$ if so, it is possible to proceed to the calculation of regression coefficients.

$$Y_R = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_{12}x_1x_2 + b_{13}x_1x_3 + b_{23}x_2x_3 + b_{123}x_1x_2x_3$$

The coefficients in the equation are calculated.

$$b_0 = \frac{1}{N}\sum Y \quad (6)$$

where i is the test mode

j is the order of factors

$$b_i = \frac{1}{N}\sum x_i \bar{Y} \tag{7}$$

$$b_{ij} = \frac{1}{N}\sum x_i x_j \bar{Y} \tag{8}$$

7. Significance of regression coefficients The calculation criterion of the Student's criterion is determined by means of tR:

$$t_R\{b_i\} = \frac{|b_i|}{S\{b_i\}} \tag{9}$$

$$S\{b_i\} = \frac{S^2\{Y\}}{N} \tag{10}$$

Here $C^2${Й} – series variance. It is determined using the following formula.

$$S^2\{Y\} = \frac{1}{m} S^2\{\overline{Y}\} \tag{11}$$

Here m is the number of test repetitions.

$S^2\{\overline{Y}\}$ - recovery dispersion. It is determined using the following formula.

$$S_m^2\{Y\} = \frac{1}{N} S^2\{Y\} \tag{12}$$

Here N is the number of tests.

$S^2(Y)$ - the sum of series variances

$$S^2(b_0) = \frac{1}{8}16{,}2 = 2{,}025 \qquad S^2(b_{ij}) = \frac{0{,}253}{8} = 0{,}032$$

$$S^2(b_i) = \frac{1}{8}2{,}025 = 0{,}253 \qquad S(b_{123}) = \sqrt{0{,}032} = 0{,}178$$

We determine the calculated values of the Student Criterion for the calculated coefficients:

$$t_1(b_0) = \frac{62{,}51}{2{,}025} = 30{,}87 \qquad t_1(b_{12}) = \frac{2{,}81}{0{,}032} = 88{,}89$$

$$t_1(b_1) = \frac{7{,}34}{0{,}253} = 28{,}99 \qquad t_1(b_{13}) = -\frac{3{,}81}{0{,}032} = 12{,}5$$

$$t_1(b_2) = \frac{7{,}29}{0{,}253} = 28{,}79 \qquad t_1(b_{23}) = -\frac{3{,}56}{0{,}032} = 112{,}59$$

$$t_1(b_3) = \frac{-0,48}{0,253} = 1,92 \qquad t_1(b_{123}) = -\frac{3,39}{0,178} = 19,04$$

The estimated value of the student criterion is compared with the tabular value of this criterion, taken from Annex 3 of the textbook "Fundamentals of modeling of technological processes in the textile industry.".

$$t_{жад}[P = 0,95;\ \ \Phi_2 = 16] = 2,12$$

Here м=3, Н=8

A regression coefficient $t_R > t_{жад}$ will be significant.

Thus $Y$ - in our equation structured for the proportion of long fibers in the fiber waste $b_0, b_1, b_2, b_{12}, b_{13}, b_{23}, b_{123}$ the coefficients were significant.

## CONCLUSION

Based on the research, all the mathematical models obtained were analyzed and the following conclusions were drawn.

Precise indicators of the stress-strain state of the yarns in the woven fabrics were obtained.

The experimental results determined the arithmetic mean values of the optimization parameters for each test consisting of iterations.

Factors influencing the implementation of the process of optimizing the body and back folds of towel tissue have been identified.

Possibility to use coded values from the natural values of the factors in order to simplify the processing of the analysis result;

The air permeability of the tissue of the towel was confirmed by the calculation of the dependence of the tissue on the report.

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