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OPTIMIZATION OF THE COMPOSITION OF THE MIXTURE IN THE PRODUCTION OF POLYMER-COMPOSITE MATERIAL USING THE METHOD OF MATHEMATICAL PLANNING

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Abstract
This article analyzes the method of ensuring the operational properties of parts using a new polymer composite material for workers in the construction industry.

Keywords: polymer-composite material, "Scheffe" matrix, - synthetic rubber, sulfur, turan, elasticity.

Introduction

Polymer-composite material for construction workers a method of ensuring the operational properties of details by application in the development of technology for making special work clothes, it is necessary to mix components of different properties and sizes. In this case, one of the biggest problems is the issue of optimizing the proportions of the constituent components.

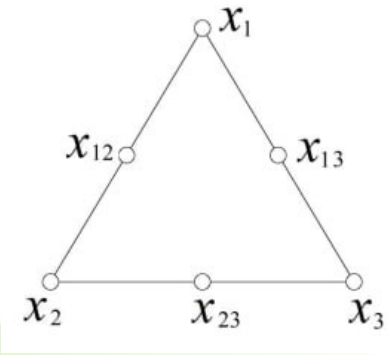
When determining the change in the value of all q-components included in the researched mixture, it was required to change the view of the working matrices.

Scheffe's matrix is widely used among many matrices in the optimization of the composition of the mixture. In order to obtain a mathematical model of the regression relationship between the effect of the percentage of rubber, sulfur and turanic substances on the properties of clothing, the Scheffe's matrix was used for "Composition-property" mathematical models. (Table 1). Scheffe matrices and formulas for calculating regression coefficients of given polynomials are given.

Scheffe's canonical polynomial was used to select the regression equation representing the composition of the three-component mixture. Scheffe's canonical polynomial was used to select the regression equation representing the composition of the three-component mixture

$$Y_R = b_{1k}x_1 + b_{2k}x_2 + b_{3k}x_3 + b_{12}x_1x_2 + b_{13k}x_1x_3 + b_{23k}x_2x_3$$

When comparing mathematical models, the number of coefficients in the model that should be experimentally determined is 6



A given second degree polynomial (n=2). For this example, when the number of components is equal to q=3, the regression model looks like (1.), and its coefficients are determined from the following formula:

$$b_{1k} = Y_1 \; b_{2k} = Y_2 \; b_{3k} = Y_3$$

$$b_{12k} = 4Y_{12} - 2Y_1 - 2Y_2$$

$$b_{13k} = 4Y_{13} - 2Y_1 - 2Y_3$$

$$b_{23k} = 4Y_{23} - 2Y_2 - 2Y_3$$

The model presented above can be obtained as a result of experiments conducted using this matrix.

Table 1 Scheffe matrix for "content-property" mathematical models

u	x_{1u}	x_{2u}	x_{3u}	Y_u	Y_u
1	1	0	0	Y_1	Y_1
2	0	1	0	Y_2	Y_2
3	0	0	1	Y_3	Y_3
4	1/2	1/2	0	Y_{12}	Y_{12}
5	1/2	0	1/2	Y_{13}	Y_{13}
6	0	1/2	1/2	Y_{23}	Y_{23}

The matrix experiments presented in Table 1 were carried out at 6 points in appropriate proportions.

The requirements for the physical properties of the fabric being prepared are determined by the function of the gauze and depend on their fiber composition, structure and finish. The components that make up the mixture according to the order of composition of the matrix were defined as follows:

- percentage of synthetic rubber;
- sulfur content;
- Turan share.

Based on the research conducted to study the effect of the composition of the mixture on the protective properties of clothing, the following parameters were obtained as output parameters:

- uniformity of polymer-composite material;

A working matrix was created for conducting experiments (Table 2).

Working matrix for conducting experiments

Experiment number	fiber mixture composition			biacrity			
	x_{1u}	x_{2u}	x_{3u}	Y_{1u}	Y_{2u}	Y_1	$\overline{Y}_u$
1	1	0	0	19.1	18.9	19.2	19.3
2	0	1	0	0	0	0	0
3	0	0	1	9.3	9.2	8.9	9.1
4	0,5	0,5	0	7.2	7.8	7.4	7.6
5	0,5	0	0,5	5.1	5.3	5.6	5.4
6	0	0,5	0,5	3.7	3.5	3.6	3.9

This matrix is given by a regression mathematical model given in equations of the third degree:

$$Y_R = b_{1k}x_1 + b_{2k}x_2 + b_{3k}x_3 + b_{12}x_1x_2 + b_{13k}x_1x_3 + b_{23k}x_2x_3 \quad (1.)$$

The values of the regression coefficients are defined as follows:

$b_{1k} = \overline{Y}_1 = 19.3$ $\quad b_{2k} = \overline{Y}_2 = 0$ $\quad b_{3k} = \overline{Y}_3 = 9.1$

$b_{12k} = 4\overline{Y}_{12} - 2\overline{Y}_1 - 2\overline{Y}_2 = 4 \cdot 7.6 - 2 \cdot 19.3 - 2 \cdot 0 = -8.2$

$b_{13k} = 4\overline{Y}_{13} - 2\overline{Y}_1 - 2\overline{Y}_3 = 4 \cdot 5.4 - 2 \cdot 19.3 - 2 \cdot 9.1 = -35.2$

$b_{23k} = 4\overline{Y}_{23} - 2\overline{Y}_2 - 2\overline{Y}_3 = 4 \cdot 3.9 - 2 \cdot 0 - 2 \cdot 9.1 = -2.6$

Taking into account the specified regression coefficients, we write a mathematical model that represents the regression relationship between the composition of the fiber mixture and the heat storage property of the fabric:

$$Y_R = 19.3x_1 + 9.1x_3 - 8.2x_1x_2 - 35.2x_1x_3 - 2.6x_2x_3$$

The outgoing parameter determined by this model, that is, the optimal shares of components that are part of the mixture, are determined by identifying the heat storage property of the non-liquid and placing it at the corresponding points of the Simplex grid and combining the same values.

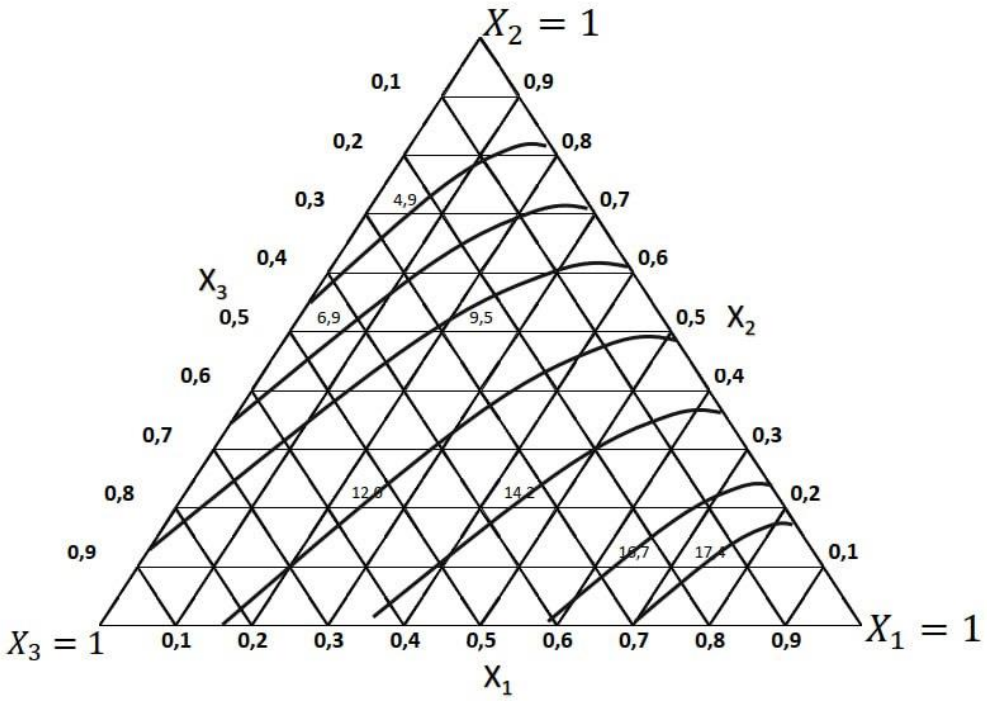


Figure 1.Experiment points in the Simplex

In the analysis of the diagram, we can see the process of optimizing the effect of a special garment on the hymenium husk by changing the proportion of substances in the composition of the polymer composite material. In the first experiment, we can see that 30% synthetic rubber, 60% sulfur makes up 10% Turan in the ham, makes the property of chemistry and elasticity the highest; when we reduce synthetic rubber by 10% (Experiment 2), we can see that a moderately flexible (ebonite) material, Synthetic Rubber by 10%, and Turan substance by 30% (experiment 3), a

Conclusion

Rubber material is very widely used in industry. It has been achieved to increase the elasticity nature of the material by mixing sulfur substances in Turan Ham as a filler. Obtaining a new polymer composite material was determined through theoretical-practical experiments.Фойдаланилган адабиётлар рўйхати.

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