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Research of Structure of Fabrics

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ABSTRACT: The article presents the results of experimental studies of the influence of the temperature-humidity regime of production on the mass and thickness of transporting belts made of harsh cloth, from treated fabric and from non-woven fabric installed on dough-rolling machines. According to the obtained experimental results, the regularities of the change in mass and thickness of the conveyor belt are determined depending on the operation time.

KEYWORDS: conveyor belt, technical fabrics, filter, adherence, operational dimensions, non-woven fabric, woven cloth, hard cloth, processed fabric.

I.INTRODUCTION

Depending on their purpose, the fabrics must have appropriate physical-mechanical and consumer properties, determined by the type of fibrous material from which the fabric is made, its structure, and also certain quality indicators. The physical-mechanical and consumer properties of the fabric are characterized by strength, rigidity, resistance to abrasion, shrinkage after washing, crushing, sliding, permeability and electroneability. To the tissues of technical and special purpose, in addition to the listed physical-mechanical and consumer properties, demands are made in accordance with the scope of their application.

Technical fabrics after technological processes of weaving and finishing production should have optimal parameters of structure and characteristics of operational properties, which allow best performing their working functions in industrial enterprises.

The main raw material for the production of technical fabrics are natural and chemical fibers. In connection with the fact that technical requirements are raised in the process of exploitation: - Q-factor, elasticity, resistance to various factors and media, the choice of raw materials for their production plays an important role. It is known that the loose structure of the conveyor belt increases the adhesion of articles. This problem affected, in particular, baking plants that have in their technological process a number of features: high environmental safety of the conveyor belts used, low adherence to them of semi-finished products and certain operational dimensions.

II. EXPERIMENT

In order to investigate the influence of the service life and humidity of the medium on the fabric structure, we carried out experimental work. Experimental studies of the influence of the temperature-humidity regime of production on the mass and thickness were carried out on three samples of transporting belts: from the treated fabric -II option and from the non-woven fabric - III variant, mounted on the dough-rolling machines.

The experiment was carried out for 36 months, where the control of the experimental results was carried out every 3 months, while the shop temperature was 20 ° C and the mill humidity was 65%.

As a result of the experimental study of the dependence of the mass of the Y- (kilogram) tape on the operating time X (months), the following data were obtained (Table 1).

Table 1

X_u	3	6	9	12	15	18	21	24	27	30	33	36
Yu_1	1,99	2,05	2,09	2,11	2,12	2,13	2,14	2,15	2,18	2,19	2,20	2,20
Yu_2	1,99	2,05	2,09	2,11	2,12	2,13	2,14	2,15	2,16	2,17	2,18	2,18
Yu_3	1,99	2,05	2,09	2,11	2,12	2,83	2,92	3,3	3,77	3,85	3,9	4,00

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III. THEORETICAL STUDIES

Based on the obtained experimental results, their regularities were studied on the basis of mathematical models. To describe the experimental data under consideration, we can conditionally adopt the following model

$$Y = a_0 X^{a_1}$$

which after transformation has the form

$$Y_{RL} = a_{0L} + a_1 X_L$$

Having established the conditional form of the mathematical model, the calculated results of the regression coefficients were obtained (Table 2 for the II variant).

Table 2

№	X_u	$\lg X_u = X_L$	$X_{uL} - \overline{X}_L$	$(X_{uL} - \overline{X}_L)^2$	Y_u	$\lg Y_u = Y_{uL}$	$(X_{uL} - \overline{X}_L)Y_{uL}$
1	3	0,4771	-0,7234	0,523307	1,99	0,2988	-0,216152
2	6	0,7781	-0,4224	0,178422	2,05	0,3118	-0,131704
3	9	0,9542	-0,2463	0,060664	2,09	0,3201	-0,078841
4	12	1,0792	-0,1213	0,014714	2,11	0,3243	-0,039338
5	15	1,1761	-0,0244	0,000595	2,12	0,3263	-0,007962
6	18	1,2553	0,0548	0,00300	2,13	0,3284	0,017996
7	21	1,3222	0,1217	0,014811	2,14	0,3304	0,040210
8	24	1,3802	0,1797	0,032292	2,15	0,3324	0,059732
9	27	1,4314	0,2309	0,053315	2,16	0,3344	0,077212
10	30	1,4771	0,2766	0,076507	2,17	,03365	0,093076
11	33	1,5185	0,3180	0,101124	2,18	0,3385	0,107643
12	36	1,5563	0,3558	0,126594	2,18	0,3385	0,120438
$\sum_{u=1}^{N}$		14,4057	-	1,182645	25,47	3,9204	0,042340

Regression coefficients are determined on the basis of the table:

$$d_{0L} = \overline{Y}_L = \frac{3.9204}{12} = 0.3267 \quad ; \quad d_1 = \frac{0.04234}{1.182645} = 0.035$$

$$Y_{RL} = 0.3267 + 0.035(X_L - \overline{X}_L)$$

$$Y_{RL} = 0.285 + 0.035 X_L$$

And the required equation is obtained

$$Y_R = 1.93 \cdot X^{0.035}$$

In the experiment under review, repeated experiments were not carried out, therefore, the variance of reproducibility was not evaluated. Therefore, for statistical evaluation of the importance and accuracy of the model, the importance of regression coefficients and confidence intervals for the true average of the output parameter at any factor level was determined.

Dispersions of the regression coefficients and the equation are defined as follows

$$S^2\{d_1\} = \frac{S^2_{над}\{Y\}}{\sum_{u=1}^{N}(X_{uL} - \overline{X}_L)^2} = \frac{0.002884}{1.182645} = 0.015790$$

$$S^2\{d_{0L}\} = \frac{S^2_{над}\{Y\}}{N} = \frac{0.002884}{12} = 0.000240$$

$$\overline{Y}_L = \frac{1}{N}\sum_{u=1}^{N} Y_{uL} = \frac{3.9204}{12} = 0.3267$$

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$$S^2\{Y_L\} = \frac{1}{N-1}\sum_{u=1}^{N}(Y_{uL} - \overline{Y}_L)^2 = \frac{0.001532}{12-1} = 0.000139$$

Substituting the values found $S^2\ \{Y_{uL}\}$ and $S^2_{above}\ \{Y_L\}$ in the formula of the calculated value of the Fisher criterion, we obtain

$$F_R = \frac{S^2\{Y\}}{S^2_{над}\{Y\}} = \frac{0.000139}{0.002884} = 0.04829$$

Table value of the Fisher criteria $F_T = [f = 11,\ f = 10] = 2.85$

Since $F_R \langle F_T$ then the linearized model has sufficient informational utility in its use.

Analogously, experimental studies of the effect of the lifetime on the weight (kg.) Of a conveyor belt made from treated fabric, from severe fabric and non-woven fabric, have obtained mathematical models having the following form:

for a conveyor belt made of a harsh cloth

$$Y_R = 1.93 \cdot X^{0.065}$$

for a conveyor belt made of treated fabric

$$Y_R = 1.93 \cdot X^{0.035}$$

for a conveyor belt made of non-woven fabric

$$Y_R = 1.93 \cdot X^{0.19}$$

And also as a result of experimental studies of the influence of the service life on the thickness (mm) of a transport belt made of a harsh fabric and non-woven fabric, mathematical models having the following form were obtained:

for a conveyor belt made of treated fabric

$$Y_R = 2 \cdot X^{0.06}$$

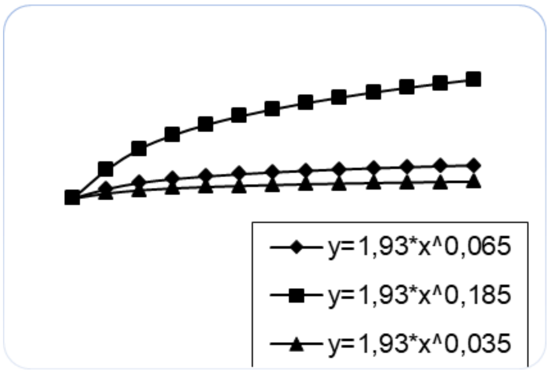
for a conveyor belt made of a harsh cloth

$$Y_R = 2 \cdot X^{0.09}$$

for a conveyor belt made of non-woven fabric

$$Y_R = 2 \cdot X^{0.2}$$

In Fig. 1 shows the patterns of mass change (in kg.) Of the conveyor belt, depending on the time of operation.



A range of 1 - belt made of harsh cloth; range of 2 - belt made of non-woven fabric; range 3 - belt series made from treated fabric.

Fig.1.Regularities of changing the mass of the conveyor belt depending on the time of operation.

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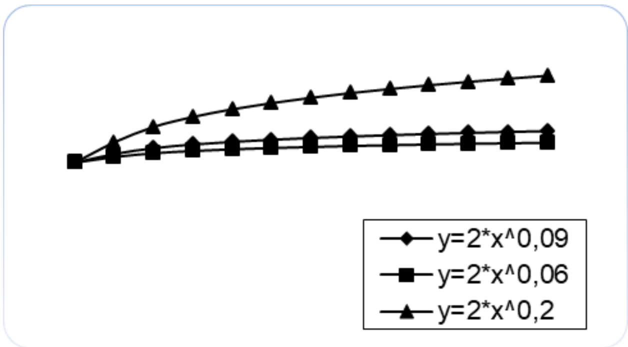
Figure 2 shows the regularities of the change in the thickness of the conveyor belt (in mm.), Depending on the time of operation.



A range of 1 - belt made of harsh cloth; range 2 - belt series made from treated fabric; range 3 - belt made of non-woven fabric.

Fig.2. Regularities in changing the thickness of the conveyor belt depending on the time of operation.

IV. CONCLUSIONS

From the graphs, Fig. 1 and 2, it follows that the lifetime of the conveyor belt made of non-woven fabric is no more than three months, the conveyor belt made of a harsh cloth is about two years old, and the transport belt made of treated fabric is three years old. This is due to the fact that the degree of adhesion of the transported material in the belt made from the stern fabric is lower by 58% and in the belt made from the treated fabric is lower by 71% than in the belt made of non-woven fabric. The structure of the severe fabric contains only twisted yarns mutually intertwined, and the treated fabric is additionally water-repellent, which reduces the adhesion of the transported material to the tape. Conversely, the structure of the nonwoven web contains fibers threaded with twisted yarns that increase the adhesion of the conveying material to the tape.

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