Journal of Engineering and Applied Sciences 13 (23): 10145-10147, 2018
ISSN: 1816-949X

Mathematical Substantiation of the Rational Package (BAG) of Fully-Formed FUR Articles With Content of Polymer Composition

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Abstract: The study presents the results of experimental studies on the mathematical substantiation of the use of polymer compositions which provides the specified form stability and reliability, meeting the modern requirements of industrial production, the efficiency of their use in production conditions. In this case, the processing of all-seamed details of garments made from natural fur with the subsequent obtaining of a given shape by using the deformation properties of natural raw materials. Also, studies were carried out on the rational location of local areas of application of the polymer composition, taking into account the deformation features of the fur semi-finished product. As a result of the research, recommendations were given on the use of the proposed reinforcement options and the methods of the all-molded package of the product using a polymer composition which makes it possible to improve the quality and shape stability of the garment components and the economic efficiency of production.

Key words: Polymer compositions, deformation properties, shape stability, natural fur, whole-molded products, relaxation, reliability of results, resource-saving

INTRODUCTION

Improving the mechanisms of shaping and molding in order to achieve a high quality of manufacturing garments by increasing their form stability is the need to evaluate the technological conditions for the formation of the package (Melikov, 1986; Tashpulatov, 2008; Cherunova, 2008).

Insufficient stability of the form of parts of clothing after the technological process can be the result of a number of reasons. Some of them are: incomplete consideration of the strain relaxation in the material and the package when determining the technological conditions for shaping, the failure to comply with technological regimes, ignoring the location of materials or applying the polymer composition in a package of parts, disturbing the mechanism of formation and the lack of mechanisms for the formation of a rational package (Tashpulatov *et al*, 2015a-c; Cherunova and Milutina, 2013).

MATERIALS AND METHODS

The increase in the quality of molding, apart from the last of the above reasons, depends mainly, primarily on the skilled work of the performers. Elimination of the same disadvantages inherent in the method of shaping is associated with the modernization or development of new equipment.

It is known (Tashpulatov, 2008; Azimjonovna, 2017) that it may be sufficient to study the physical-mechanical and technological properties of a package with a polymer composition in order to study the shape stability of parts of garments in this case headdresses, from the effect of external-force systems and the mechanism of compound deformation (change in shape) consisting of several chemical components.

The purpose of the experimental studies is to determine the rational package for the manufacture of clothing parts of increased form stability, taking into account the deformation properties of the material (Schermerhorn *et al*, 2011). The complexity of evaluating and predicting the shape stability of parts from deforming materials during the manufacture of garments is related to the fact that they are determined not only by the composition of the fibers, the kind and structure of the materials which have heterogeneity of the deformation properties of the raw materials in different directions but also they are determined by the structural component of the package, reinforcing substances and its densities in the package (Kearney and Gebert, 2009).

RESULTS AND DISCUSSION

The relaxation value of the testingpackage of the garment parts is determines by measuring the deflection bend of the sample segment after obtaining

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a three-dimensional shape. The measurements carried out for 24 h. Variants of the package samples originally designed at different angles for the arrangement of the applied polymer composition in the package relative to the nominal axis of the semi-finished product (from 0-180° with a 15°-variation step).

Five selected for further workfrom all the options considered: with angles = 0, 30, 45, 60 and 90° to the nominal axis. The results of the studies on these samples allow us to estimate the nature of the change in the magnitude of the relaxation of the deformation of the bulk shells over the entire range of theoretically considered variants.

According to the results of experimental studies, it is establishes that the samples manufactured according to the third (45°) version have increased form stability. The results obtained allow us to conclude that the shape of shells of the third variant is sufficiently stable. It is advisable to increase the amount of relaxation to ensure the specified shape of the shells while designing the segment configuring the specified shape of the operating devices of the equipment. It is advisable to apply the reinforcing strip of the polymer composition to the semi-finished parts in such a way that they are located at an angle of 45° to the nominal axis of the semi-finished product to obtain a stable volumetric shape of the headgear (headdress) segment.

It is reveals that the relative changes in the deflection boom are in the range of 8-12% from the analysis of the obtained data, depending on the size of the segment boom and the application of the polymer composition in the package and is describes by the regression equation:

$$Y = 61.4+2.79x_1+1.116x_2+1.8x_3-0.7x_1x_2+ 0.43x_1x_3-0.14x_2x_3-1.61x_1x_2x_3$$

Further verification of the reliability of the results obtained during testing of various versions of the package of parts is carry out. Five different variants of packet formation selected to study the physical and mechanical properties. Ten series of tests is carryout.

The purpose of the experiments is to show the advantage of some variants of packages over others. It is necessary to limit the possible number of trials while ensuring sufficient reliability of the difference in the experiments (at a given level of significance).

First, it is necessary to make sure that the results of the experiments between the different variants of the packet samples differ significantly. Taking into account the small number of experiments and the natural error in the observations, the statistical inhomogeneity of the observation arrays verified. To do this, consider each series of experiments as a sample from the general aggregate. The volume R of the samples n, n, ..., n, the partial averages of Y, Y, ..., Y and sample variances S', S', ..., S'. Provide that the samples are independent and belong to the same normally distributed aggregate for any other samples I and :

$$B \in P\left\{ |\ddot{Y}_i-\ddot{Y}_j| \le t_{ij}\sqrt{\frac{s^2_i}{n_i}+\frac{s^2_j}{n_j}} \right\} = 2\phi\left(t_{ij}\right) \quad (1)$$

where, (t) is the laplace integral function.We calculate:

$$t_{ij} = \frac{|\ddot{Y}_i-\ddot{Y}_j|}{\sqrt{\frac{s^2_i}{n_i}+\frac{s^2_j}{n_j}}} i, j = 1,2, ..., R\ i \neq j \quad (2)$$

The values t, are compares with the table values of homogeneity t, where 2 is the confidence probability. If the minimum sample size n is >30, then we use the S-distribution and compare t,t (h-1) with the student's distribution table. If the general aggregate is homogeneous, then in (1-) 100% of samples will take place:

$$t_{ij} < t\alpha \quad (3)$$

and for the samples •100:

$$t_{ij} \ge t\alpha \quad (4)$$

If the calculated criterion value t, satisfies condition Eq. 3, then at the significance level the homogeneity hypothesis is adopts. If t, is satisfies Eq. 4, then the hypothesis at the significance level is rejects.

When analyzing the correctness of the hypothesis put forward, there may be errors of the first and second kind. The errors of the first kind are those in which the hypothesis is true but it is rejects, i.e., the criterion fell into the critical area.The probability of this error is .

The errors of the second kind are those for which the wrong hypothesis is accepted. The probability of this error is 1-, i.e., the smaller the probability of the first kind, the greater the probability of an error of the second kind.

In the experiments carried out, the hypothesis of difference-heterogeneity of the results is advanced, therefore in order to avoid errors of the first kind, we take = 0.05, i.e., 5% level of significance.

Ten experiments was done in two series of tests of packages of parts. Therefore, to determine the criterion t we use the student's quantile distribution t (n-1) which for n =10 is equal to t (9) = 2.260.

Thus, the hypothesis of the heterogeneity of the results of the experiments is accepts, if t_{ij}2.260. An analysis of the experimental results shows a significant difference in the results of the experiments of all the series. Sample package No. 3 has a difference with the rest of the samples, even at 1% significance level of t (9) = 3.250.

CONCLUSION

Thus, the check on the statistical homogeneity of samples during the tests of the physical and mechanical properties of the packets made it possible to reveal a significant difference in the results of most experiments of all series in different directions of application of the polymer composition relative to the nominal axis of the packet samples. The results of the experiments provide a basis for choosing the most rational version of the package for the manufacture of clothing items of a given range.

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