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Influence of Wet Heat Treatment on the Performance Properties of Fabrics of Different Fibrous Composition

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ANNOTATION

The article deals with the issues of changing the qualitative characteristics of dress fabrics under the influence of wet-heat returns. For the study, the fabrics in question were washed (the number of washes was 1, 5, 10). A comprehensive analysis of the results of testing dress fabrics for options before washing and after washing was carried out.

KEYWORDS: *fabric, wash, warp, weft, strength, breathability.*

I. INTRODUCTION

Textile materials are exposed to complex wear and tear factors during use. The most frequent wear factor is the complex influence of washing. Changes in linear dimensions of products in the process of washing are influenced by mechanical effects (repeated deformation, abrasion), temperature and composition of the washing solution, spinning features, drying conditions. In order to preserve the wearing life of articles it is necessary not to break the operational properties of fabrics in the process of wet-heat treatment. Due to the fact that the main indicators in the current standards for fabrics are strength and elongation, these indicators were also investigated under the influence of wet heat treatment.

II. METHODOLOGY

In the process of closing manufacturing, under the influence of heat and moisture, the processed materials change their linear dimensions and, consequently, the dimensions of clothing details change, their shape is distorted. As a rule, these effects lead to a decrease in linear dimensions, v. 1, p. e. Shrinkage resistant materials. Shrinkage is known to be caused by relaxation caused by stretching of materials during textile manufacturing processes and by swelling of the fibers. In the process of laying the fabric, when moving parts of clothing at various stages of sewing production, the materials are stretched, and under the influence of wet-heat treatment they relax.

For the study, the fabrics in question were subjected to washing (the number of washes was 1, 5, 10). According to GOST 30157.1, the washing mode for dress fabrics was selected. In this case the bath modulus is 1:30, the water temperature is 400C 3, 3 grams of detergent. Soak the samples for 10 minutes with periodic spinning 10 times. Rinse at 40 ^{0}C for 5 minutes, then squeeze out the samples by hand, iron at a temperature not exceeding 200 ^{0} C for 20 seconds.

III. RESULTS AND DISCUSSION

The stability index of linear dimensions of fabrics after wet treatments is used to assess the reliability of textiles that are periodically washed during operation. These are primarily fabrics used to make dresses and summer costumes. A decrease in the linear size of tissues due to factors arising during wet treatments is called shrinkage, and an increase is called attraction.

The appearance of shrinkage or attraction of fabrics is unpleasant and undesirable during the operation of textiles, as this can lead to a sharp deterioration in their appearance and the impossibility of further use as intended. The strong shortening of the length of dresses, trousers, jackets causes dissatisfaction among consumers with the quality of the products used. Therefore, the minimum change in linear dimensions after wet treatments is the most important indicator of tissue quality and is normalized in standards. Textiles are periodically washed, dried and ironed during operation. Therefore, for fabrics, the change in linear dimensions is determined after wet-heat treatment (locks, washes, ironing). The type of wet-heat treatment is determined by the operating conditions of textiles. For linen and silk fabrics, shrinkage after washing is usually normalized, and for wool suit-and-raft fabrics, the products of which should be subjected to chemical cleaning, not washing, during operation, shrinkage after dry cleaning is determined. However, due to the high cost of dry cleaning services, as well as their absence in many localities, consumers are subjected to washing. Therefore, for such fabrics, the change in linear dimensions after washing and ironing is of interest.

Table 1 shows the results of change in strength characteristics of fabrics depending on the number of washes.

Table 1.Changes in the strength characteristics of fabrics depending on number of washes

Type of exposure	Fabric name							
	100% cotton Sample I		100% Viscose Sample II		100% PE Sample III		33% BC, 67% PE Sample IV	
	warp	Weft	Warp	weft	warp	weft	warp	Weft
Washing frequency	Breaking load, N							
0	312	196	475,7	320,25	335,0	201,0	564,0	312,0
1	354	201	416,0	317,0	331,0	196,0	436,0	301,0
5	341	198	386,0	301,0	330,0	191,0	434,0	300,0
10	326	181	364,0	296,0	316,0	187,0	426,0	294,0

As a result of testing, it was found that fabric sample 4, made from a mixture of viscose and synthetic fibers, in comparison with other samples continues to have high indicators of breaking load, although for this sample, the greatest destruction after 10 washes is observed (loss of strength on the basis of almost 24,5%, sample 2 has a significant loss of strength on weft and is 7.8%. The lowest firmness loss after 10 washings is observed in pattern 3 and amounts to 5,7% of warp and 6,9%, as the fabric made of 100% polyester is wear-resistant and durable, does not need any special care (washable at 40-60 degrees C in a machine), dries quickly after washing, holds color well and practically does not give shrinkage. Sample 1, on the contrary, has a 4.49% increase in core strength due to the special impregnation. In general, sample 4 has greater breaking properties, while sample 3 has lower breaking properties due to its low surface density. Table 2 represents the results of determining tensile elongation of fabrics.

Table 2. Dependence of elongation at rupture of fabrics on the number of washings

Type of impact	Fabric name							
	100% cotton Sample I		100% Viscose Sample II		100% PE Sample III		33% BC, 67% PE Sample IV	
	warp	Weft	warp	weft	warp	weft	warp	weft
Wash	Elongation at break, %							
0	7	14	14	21	4	6	5	7

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1	8	15	14	21	4	5	5	7
5	9	17	14	20	4	6	6	8
10	9	16	15	18	3	5	7	8

As a result of these tests, it was found that all fabrics had an increase in elongation on the basis and on the weft for specimen 1 and 2 by 2% and on the weft for specimen 4 by 1%, except for fabric 3, for which elongation on the weft decreased by 3%.

Table 3. The table shows the results of determination air permeability of fabrics

Type of impact	Fabric name			
	100% cotton Sample I	100% Viscose Sample II	100% PE Sample III	33% BC, 67% PE Sample IV
Wash	Air permeability,sm^3/sm^2.sek			
0	92,4	72,6	310,0	14,25
1	87,7	49,6	303,7	13,77
5	93,9	40,9	308,4	13,24
10	100,8	51,6	309,9	14,11

As a result of the study of breathability of fabrics from number of washings, it was found that the greatest air permeability has a sample of fabric 3, worked out with the lowest density of fabric. Fabric 1 swells up more in the process of washing, since it is made of 100% cotton fibers, so in the initial period of washing breathability decreases slightly in the initial period of washing, but increases afterwards due to washing of fibers and breaks of elementary threads. As can be seen from the table, the air permeability decreases by 28.9% in sample 2, by 0.03% in sample 3, and by 0.98% in sample 4.

Sample 4 has a 13.01% decrease in surface density, sample 2 has a 1.41% decrease, and samples 1 and 3 have a 0.3% and 1.36% increase in surface density respectively. At the same time, the color strength to dry and wet friction does not change.

Table 4. Change in shrinkage depending on the number of washes

Type of impact	Fabric name							
	100% cotton Sample I		100% Viscose Sample II		100% PE Sample III		33% BC, 67% PE Sample IV	
	Warp	Weft	warp	weft	warp	weft	warp	weft
Wash	shrinkage, %							
0	-4,5	-2,0	-5,0	3,0	0	0	-1,0	0
10	-5,0	-1,5	-2,0	-2,0	0	0	-1,5	-5

IV. CONCLUSION

As it can be seen from the table, after 10 washes, the size of sample 1 on the basis and sample 4 on the weft changed the most. In sample 3, as well as before washing, the sizes did not undergo changes after washing. Stabilization of sizes of cotton fabrics comes after 3-5 washes. Dimensional stability of fabrics is also affected by residual moisture, especially for free-dried fabrics, shrinkage increases to a certain maximum with increase of density in the opposite thread system to the measurement of linear dimensions and for determination of shrinkage. With further increase in density in the opposite system, the shrinkage in this system will decrease because there are no bends in the yarns. Thus, the shrinkage is greater in that system of yarns, which is more compacted. Comprehensive evaluation of dress fabrics quality after 10 washings has been carried out, the results of which are shown in table 5.

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Table 5. The value of the mass of polygons for the warp and weft in a comprehensive assessment

0	Sample type	warp	weft
1	Sample I	0,134	0,172
2	Sample II	0,195	0,180
3	Sample III	0,266	0,256
4	Sample IV	0,147	0,076

According to the analysis of results by mass, Sample III (polyester fibers) had the highest values for the basis and weft. Regarding other values, sample №3 had 49.6% more than sample I, 26.7% more than sample II, 44.7% more than sample IV; for weft sample №3 had 32.8% more than sample I, 29.7% more than sample II, 70.3% more than sample IV.

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