

The comparative analysis of physic-mechanical indicators of textile materials for special clothes

Iztayeva Aliya Auelbekovna, candidate of technical science
Ongarbayeva Zauresh Bolatbekovna, master of technical science
Almaty Technological University
Almaty city, Republic of Kazakhstan
e-mail: aliya-81@list.ru

Abstract. *In article four major factors and models of object of research of physic-mechanical properties of textile materials of special clothes are considered. Eight physic-mechanical indicators of textile materials have been as a result revealed: hygrosopicity, humidity, water persistence, superficial density, air permeability, explosive loading on length and width of a fabric and worn out on a plane. This research shows us change of physic-mechanical properties of textile materials at influence of meteorological factors and overalls operation at work of machine operators.*

Key words: special clothes, textile materials, physic-mechanical indicators, agro-climate factors, methodology.

The comparative analysis of the basic physic-mechanical indicators of textile materials of the chosen articles for special clothes of machine operators, from changing depending on meteorological factors influencing their durability, has been spent with use of program SPSS 14.0. Features of application of methods of comparison consist in that according to the spent experiments it is necessary to reveal distinctions in average values of compared indicators of the specified fabrics. Thus it is supposed that the laboratory data about fabrics for special clothes of machine operators is homogeneous and submits to the normal law of distribution.

On the basis of studying of four major factors of model of object of research of mechanical properties of textile materials of special clothes eight physic-mechanical indicators, designated by variables - Y1 have been revealed..., Y8 which characterise an exit, result of the put experiment. Under the influence of entrance agro meteorological factors and duration of their operation at work of machine operators these indicators of fabrics changed.

For compared data sets checked their uniformity, or the so-called test about equality of dispersions one of statistical criteria. The criterion of Leven as it is steady against deviations from normal empirical distributions was for this purpose applied. [1]

One of problems of our research is revealing of distinctions between physic-mechanical indicators of six textile materials for special clothes of machine operators of agriculture. The one-factorial dispersive analysis based on a traditional classical method of Fisher was for this purpose used. The dispersive analysis, as well as t-criterion, assumes normal distribution of the data.

Values of F-criterion, number of degrees of freedom df , including probability of an error p for an estimation of the general importance, are resulted show in table 1.

TABLE 1 - the Dispersive analysis of physic-mechanical indicators of investigated materials

Indicator	Source	The sum Squares	df	Average Square	F	P
Hygrosopicity, %	Between groups	1,30E+03	5	259,23	529,033	3,05E-71
	In groups	5,00E+01	102	0,49		
	The general	1,35E+03	107			
Humidity, %	Between groups	1,99E+02	5	39,78	368,519	1,34E-63
	In groups	1,10E+01	102			
	The general	2,10E+02	107	0,11		
Water persistence, Mm hg	Between groups	7,51E+03	5	1502,39	7,438	5,52E-06
	In groups	2,06E+04	102	201,99		
	The general	2,81E+04	107			
Superficial density, g/m2	Between groups	1,57E+05	5	31345,31	68,565	4,66E-31
	In groups	4,66E+04	102	457,16		
	The general	2,03E+05	107			
Air permeability,	Between groups	5,08E+03	5	1016,69	12,965	9,13E-10

dm ³ /m ² , sec	In groups	8,00E+03	102	78,42		
	The general	1,31E+04	107			
Explosive loading of a fabric on a basis, H	Between groups	3,18E+07	5	6,36E+06	290,161	1,26E-58
	In groups	2,24E+06	102	2,19E+04		
	The general	3,40E+07	107			
Explosive loading of a fabric on a duck, H	Between groups	7,23E+06	5	1,45E+06	183,437	2,53E-49
	In groups	8,04E+05	102	7,89E+03		
	The general	8,04E+06	107			
Worn out on planes, cycles	Between groups	1,30E+09	5	2,61E+08	294,454	6,28E-59
	In groups	9,03E+07	102	8,85E+05		
	The general	1,39E+09	107			

In table 1 the characteristics connected with influence of various fabrics on physic-mechanical indicators between groups are deduced. In line "In groups" the given characteristics in groups are deduced. In line "General" is specified a total sum of squares of differences of supervision and their arithmetic average, and also df - number of degrees of freedom. [2]

In our case the dispersive analysis yields as much as possible significant result for each of investigated physic-mechanical indicators of materials for special clothes of machine operators as they have high values of F-criterion with a significance value $p \leq 0,001$. It allows to draw a conclusion that the article significantly characterises divergences in all listed indicators.

On the basis of result of the dispersive analysis confirming effect of applied fabrics for special clothes of machine operators, it is possible to execute апостериорные

plural comparisons. Using the test of Duncan at the fixed significance value ($p = 0,05$), fabrics have been classified on homogeneous subgroups on each investigated indicator. [3]

In table 2 the average values of physic-mechanical indicators of fabrics distributed on subgroups are resulted. As appears from table 2, the test of Duncan with standard value $p = 0,05$ allocates:

- Two homogeneous subgroups on water persistence Y3;
- Three - on air permeability Y5;
- Four - on hygroscopic Y1, superficial density Y4 and explosive loading of a fabric on duck Y7;
- Five - on explosive loadings of density of a fabric on basis Y6 and истиранию on plane Y8;
- Six - on humidity Y2.

TABLE 2 - Homogeneous groups of fabrics for special clothes of machine operators

The article Fabrics	n	Groups of fabrics for $p = 0,05$					
		I	II	III	IV	V	VI
1	2	3	4	5	6	7	8
Hygroscopicity Y ₁ , %							
87406	18	1,918					
03C50	18		6,030				
87015	18		6,318				
81415	18			8,101			
18306	18				11,569		
03C40	18				12,031		
Humidity Y ₂ , %							
87406	18	0,420					
81415	18		0,745				
87015	18			1,321			
03C50	18				2,981		
03C40	18					3,527	
18306	18						3,826
Water persistence Y ₃ , mm hg							
18306	18	147,944					
87406	18		166,611				
87015	18		168,333				
03C50	18		169,056				
81415	18		170,556				
03C40	18		173,444				
Superficial density Y ₄ , g/m ²							
81415	18	118,556					
87406	18	129,389	129,389				
87015	18		140,056				
03C40	18			198,000			
03C50	18			200,889	200,889		
18306	18				212,944		

Air permeability Y5, dm ³ /m ² ·s							
87406	18	27,017					
87015	18		36,133				
03C40	18		41,717	41,717			
03C50	18		41,806	41,806			
81415	18			46,617			
18306	18			46,994			
Explosive loading of density of a fabric on basis Y6							
03C50	18	462,9					
03C40	18	523,3					
18306	18		696,2				
87406	18			833,3			
81415	18				1663,5		
87015	18					1830,8	
Explosive loading of density of a fabric across Y7							
03C50	18	331,111					
03C40	18		438,167				
18306	18		489,056				
87406	18		494,111				
81415	18			880,278			
87015	18				1049,833		
Worn out on density Y8, cycles							
18306	18	8933,4					
87406	18	9542,1					
03C50	18		11728,1				
03C40	18			14831,2			
81415	18				15717,5		
87015	18					18643,7	

Thus, when fabrics on individually considered physic-mechanical indicators get to one subgroup, they are identical. When the test of Duncan carries fabrics in different subgroups, they have significant distinction on the given indicator at level equal 5 %.

The received information concluded in each separate indicator is insufficient for a judgment conclusion about physic-mechanical properties of fabrics as a whole.

Conclusions should be based on set of several indicators. From compared indicators it is difficult to specify on it is unique a leading variable. The problem of a choice of the most informative signs enters into a circle of problems of the multidimensional analysis as one of the major. [4,5]

For check of uniformity of investigated materials has been calculated statistician Leven on each separate indicator for the chosen fabrics that is presented in table 3.

TABLE 3 - Check of uniformity of materials of the article 81415 and 87015

Indicator	Statistics of Leven F	<i>P</i>	<i>T</i>	<i>df</i>	<i>P</i>
Hygroscopicity, %	41,809	2,2E-07	9,213	34	9,1E-11
Humidity, %	14,296	0,00060	-15,480	34	5,8E-17
Water persistence, mm hg	2,174	0,14957	0,522	34	0,60488
Superficial density, g/m ²	4,910	0,03350	-4,751	34	3,6E-05
Air permeability, dm ³ /m ²	0,181	0,67307	3,813	34	0,00055
Explosive loading of a fabric on a basis, H	20,470	7,0E-05	-2,981	34	0,00528
Explosive loading of a fabrics across, H	6,405	0,01617	-5,293	34	7,2E-06
Worn out on planes, cycles	47,660	5,9E-08	-9,259	34	8,1E-11

As appears from table 3, the hypothesis about equality of dispersions of materials for special clothes of machine operators of articles 81415 and 87015 is not accepted for all physic-mechanical indicators, except water persistence as for this indicator the test of Leven gives value 0,05. Indicators of investigated samples of fabrics on other physic-mechanical indicators are not homogeneous as to them there correspond settlement levels of the statistical importance $p < 0,001$.

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