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INVESTIGATION ON STABILITY OF TEXTILE MATERIALS FOR OVERALLS PROCESSED BY NEW BIOCIDAL PREPARATIONS

***Abstract*:**. *This article is devoted to the research of new promising biocidal preparations, in particular ethyl, allyl and methyl, which promote the improvement of the consumer properties of textile materials and increase their durability. The problem of protecting textile materials and products from microbiological destruction is complex and multifaceted, and its successful solution requires coordinated and focused efforts of specialists of various profiles. Of particular relevance is the search for effective ways to protect against microbiological destruction of textile materials.*

And today one of such methods of protection is to provide textiles with biocidal properties, which not only prevents the growth of bacteria, but can also provide a high level of wear resistance of tissues.

The aim of the work was to study the impact of new low-toxic biocidal drugs on the stability of coloring of textile materials to the effect of various physical and chemical factors.

In the research, the method and technology of providing biocidal properties to textile materials for the production of overalls, in particular, impregnation of textile materials in alcoholic solution of biocidal preparations, was developed. As samples were selected fabrics of different chemical composition, which are intended for the manufacture of overalls.

The best results were obtained with dry friction, and, treatment, does not significantly affect the stability of color, and in the case of cotton-polyester fabric, on the contrary, even increases it.

Low indicators of the stability of color to the action of wet friction is due to the low resistance of colors to water.

***Keywords*:** *Biocide, textile materials, antimicrobial treatment, coloring.*

INTRODUCTION END PROBLEM STATEMENT

The problem of protecting textile materials and products from microbiological destruction is complex and multifaceted and its successful solution requires coordinated and targeted efforts of specialists of various fields - chemists, biologists, technologists, ecologists, material scientists, commodity scientists and others in many countries of the world. Particularly relevant is the search for effective ways to protect against microbiological destruction of textile materials and products that have in their composition the most sensitive to the action of microorganisms, cellulose fibers. This problem combines several basic aspects, namely [1,2]:

- identification of basic physiological groups, genera and species of microorganisms prevailing in the processes of microbiological destruction of textile materials and products of various fibrous composition;
- studying the mechanisms of biodegradation of textile materials and products of various fibrous composition by fiber-destroying microorganisms;
- the search for effective means of protection of textile materials of clothing, interior, medical and technical purposes from fibrous (especially cellulose and keratinolactory microorganisms);
- detection of textile materials and products of various intended purpose and methods of production of pathogenic microflora and the search of effective means of protection from him;
- wider use of modern chemical, biological and nanotechnology for the effective protection of man and the environment from the harmful effects of certain physiological groups, genera and species of microorganisms.

Conditions of production and operation of natural textile materials of technical purpose, involve contact with microorganisms, sometimes in conditions of high humidity and air temperature, therefore there is a danger of their biological destruction. Manifestation of excessive growth of microorganisms on textile products is diverse and undesirable, as it is accompanied by the formation of an unpleasant odor, with the appearance of mold fungi by a change in color, and may lead to deterioration of the physical and mechanical properties of textile material, for example, elasticity and durability [3].

To prevent the development of microorganisms, textile materials are subjected to antimicrobial treatment, resulting in the growth of microorganisms reliably and for a long time delayed, textile materials retain their appearance and properties, become not only safe, but can perform protective functions for humans.

In addition to the mentioned environmental and hygienic effects, as a result of antimicrobial treatment of textile materials, a certain economic effect is achieved, because as a result of such treatment, the life of the products is extended by 10-15%. Therefore, the antimicrobial treatment of the textile material of clothing purpose can be considered as polyfunctional [8], since it makes it possible:

- to provide effective protection of textile materials and products of various intended use from microbiological destruction;
- to substantially improve hygiene of products by eliminating unpleasant odors on them, caused by the presence of bacterial products;
- reduction of access to the human skin of the transit microflora.

Biocidal protective treatment is considered effective only when it is not noticeable, does not impair the consumer properties of the textile material and does not create inconvenience in the application of the product. Different types of antimicrobial drugs can be used in order to protect the textile materials and products of different intended use and fibrous composition from the negative effects of the decomposing and pathogenic microorganisms. Analyzing the properties of some biocidal drugs, we can conclude that all of them have certain disadvantages [4, 5] such as:

- Insufficient stability of antimicrobial effect to wet treatments;
- low efficiency, toxicity and hazard for humans and the environment;
- low atmospheric resistance;
- insignificant duration of action;
- high cost;
- rapid adaptation of microorganisms to the action of biocidal substances.

Therefore, the search for effective, non-toxic biocidal preparations and the provision of biocidal properties for special purpose clothing fabrics, which are used in conditions of high humidity, as well as in living conditions, is an urgent task for the prevention of the development or reduction of bacterial growth, the provision of an adequate level of sanitation and hygiene, a high level of wear resistance of the studied textile materials and due to a number of reasons. The main ones are [6,7]:

- high level (up to 40%) of microbiological destruction of many types of textile materials and products in their general wear (especially it concerns textile clothing, interior and technical materials and products, operation of which occurs at high relative humidity and air temperature, as well as contact with the soil);
- an integral part of the microbiological destruction of clothing and other textile materials when wearing them is a long-lasting light-weather, wet treatments, chemical reagents;
- significant influence of microbiological destruction of many types of textile materials and products on the terms of their operation (especially this applies to various types of professional and special clothing with regulated terms of operation).

LITERARY ANALYSIS

Based on the analysis of literary sources [8-15] and our research, in this paper we confine ourselves to studying only one aspect of this multifaceted task, namely: we study the influence of new low-toxic biocidal preparations on the stability of coloring to the effect of various physical and chemical factors such as washing, sweat, distilled water, ironing with steam, dry and wet friction and light.

MAIN ARTICLE

According to this, we selected new biocidal products that are successfully used for antimicrobial protection in other industries, namely:

- ethylthiosulfanilate (ETC);
- allythiosulfanilate (ATC) - allyl biocide;
- methylthiosulfanilate (MTS) - methyl biocide.

These antifungal biocidal preparations with multi-vector pharmaceutical dynamic manifestations for the protection of industrial products and the treatment of dermatomycosis, in particular synthetic analogues of natural phytoncides, are synthesized at the Department of Technology of Biologically Active Compounds, Pharmacy and Biotechnology at the National University "Lviv Polytechnic".

The object of research to solving the tasks close to the structure of cotton and cotton and polyester fabrics were selected. Characteristics of refueling data of these tissues is shown in Table 1.

Samples of the investigated fabrics were selected from the existing range of textile materials intended for production of overalls and sold by LLC "Special Textile" (Kiev, Ukraine).

Table 1

Characteristics of refueling data of investigated fabric [16]

Number sample	Marking	Title of Fabrics	Fibrous composition	Fiber content, %	Species interlacing	Surface density, g/m2	Color
1	3014	«Orton»	Cotton	100	Twill	280	Orange
2	9511	«Greta»	Cotton-polyester	50 50	Twill	245	Burgundy
3	1305	«Alpha»	Cotton-polyester	20 80	Combined	220	Green

Biocide treatment of the investigated tissues was carried out in the Analytical and Research Test Laboratory "Textile-TEST", Kyiv (Kyiv National University of Technology and Design).

The processing formula is shown in Table. 2. We selected the following processing technique. Samples of tissues were impregnated with prepared solutions of biocidal preparations at room temperature (18-20°C) and relative humidity 63-65% for 1-2 min. The samples were then pressed to the appropriate humidity on the plus and dried at a temperature of 50-75°C (depending on the formulation of the immersion bath biocidal preparation) for 5-7 minutes, to residual moisture 6-8%.

Table 2

Formulation of the immersion bath with biocidal treatment of the investigated tissues, authors'

Biocidal preparation	Operation	Solution composition,%	Treatment mode
Ethylthiosulfanilate ETS	Seepage (immersion) to full wet growth Pressing Drying Duration	Minimum effective concentration – 0,5 % Alcohol solution (60% alcohol, 40% water)	 70-75°C 5-7 min
Allythiosulfanilate (ATC)	Seepage (immersion) to full wet growth Pressing Drying Duration	Minimum effective concentration – 0,5 % Alcohol solution (60% alcohol, 40% water)	 70-75°C 5-7 min
Methylthiosulfanilate (MTS)	Seepage (immersion) to full wet growth Pressing Drying Duration	Minimum effective concentration – 0,5 % Alcohol solution (60% alcohol, 40% water)	 70-75°C 5-7 min

The stability of color to washing, sweat, distilled water, ironing with steam, friction and light, was determined by changing the initial color of the samples, as well as the degree of coloration of the white materials, using two scales of gray standards, in balls. The color fastness to ironing was evaluated by the degree of coloring of adjacent cotton fabric.

Results The results of studies of treated cotton and cotton-polyester fabrics are shown in Table. 3-4.

Table 3

Stability of color of investigated fabrics for washing, sweat, water, ironing [17, 18]

№ variant	Treament product	Indices of color stability of the fabric, points, to action							
		Without processing	Washing	Without processing	Sweat	Without processing	Distilled water	Without processing	Ironing with steaming
cotton, 100 %									
1	ETS	3/2	4/3	3/2	4/4	3/2	4/4	4	4-5
2	ATC		4/3		4/3		3-4/3		4-5
3	MTC		4/3		4/3		4/3		4-5

cotton-polyester, 50x50 %									
4	ETS	4/4	4/4	4/4	4/4	4/4	4/4	4	4-5
5	ATC		4/4		4/4		4-5/4-5		4-5
6	MTC		4/4-5		4/4		4/4		4-5
cotton-polyester, 20x80 %									
7	ETS	4-5/4-5	5	4-5/4	5	4-5/4-5	5	5	5
8	ATC		5		4		5		5
9	MTC		4		5		5		5

From the data analysis of Table 3, it is evident that the cotton-polyester fabric with high content of polyester fiber is the least exposed to wear, that is, the stability of the color of this textile material is highest. This can be explained by the chemical structure of cotton-polyester fabric, and the dominant influence of polyester fiber in the textile material, on the formation of consumer properties.

Treatment of investigated textile materials with biocidal preparations does not significantly impair the stability of the color to the action of washing, sweat, distilled water, ironing with steaming. The resulting antimicrobial treatment of cotton and cotton-polyester fabrics are characterized by satisfactory resistance to different types of processing. At the same time, the treatment with Etiltiosulfanilat of the ETS proved to be more effective than treatment with aliln and methyl biocide.

It should also be noted that the treatment of investigated tissues with biocidal preparations does not reduce, but on the contrary, increases the stability of color to washing, sweat, distilled water, ironing. More visibly these changes are noticeable on pure cotton. Thus, the index of resistance to washing, without finishing, on cotton fabric received 3/2 points, and after treatment with the studied drugs - 4/3. A similar situation persists on cotton fabric treated with

ETS, ally l and methyl biocide, in the study of resistance to sweat and distilled water.

Table 4

Stability of color of investigated fabrics to dry and wet friction, light [17,18]

№ variant	Treatment product	Indicators of stability color fabrics points to action					
		Without processing	Of dry friction	Without processing	Of wet friction	without processing	Light
cotton, 100 %							
1	ETC	4	4	2-3	3	3	2
2	ATC		4		3		2
3	MTC		4		3		2
cotton-polyester, 50x50 %							
4	ETC	4	4	3	3	5	4
5	ATC		5		4		5
6	MTC		5		4		4
cotton-polyester, 20x80 %							
7	ETC	5	5	5	5	5	5
8	ATC		5		5		5
9	MTC		5		5		5

By assessing the stability of the color of the investigated tissues, after treatment with biocide preparations, to friction, it was found that the best results are obtained with dry friction, and, treatment, does not significantly affect the stability of coloration, and in the case of cotton-polyester fabric, on the contrary, even increases it. Low indicators of the stability of color to the action of wet friction, due to the low resistance of colors to water. It is necessary to note the low light-fastness of the color of pure cotton, compared with the rest of the tissues.

From data analysis table. 3-4 it can be seen that the stability of the color of pure cotton to the effect of all factors of physical and chemical deterioration is slightly lower compared with the investigated cotton and polyester fabrics, due to features of the supramolecular structure of cotton fibers.

CONCLUSIONS

Consequently, as a result of the conducted research, the effectiveness of biocide treatment of cotton and cotton-polyester textile materials for the production of overalls for washing, sweat, distilled water, ironing with steam, wet and dry friction and light were established. Evaluating the stability of the color of the investigated tissues, after treating with biocide preparations, to the above factors, it was found that the best results of the stability of coloration are obtained on cotton-polyester tissues, and the treatment does not significantly affect the stability of coloration, and in the case of cotton-polyester fabric, on the contrary, even increases it.

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