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EFFECT OF POLYURETHANE COATINGS ON THE RIGIDITY OF COTTON FABRIC

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Today finishing of textile materials are mainly carried out by impregnating in solutions of chemical reagents, which impart appropriate properties to the fibrous material, as well as by fixing the active substance on the surface of the fiber using a polymer binder. The growing demand for high chemical resistance and mechanical strength of special coatings, as well as the restrictions associated with the emission of volatile organic compounds, have led to the development of new polymer compositions for the textile industry [1]. Water dispersions of polymers are of great practical importance in the technology of finishing textile materials due to the combination of valuable properties and compliance with modern environmental requirements.

For polymer films designed to create coatings on textile materials, a number of requirements for the physicochemical properties are put forward. In addition to the formation of a crosslinked structure, polymer protective films should have elasticity, strength, softness, as well as reduced stickiness and, therefore, low bv dirt retention. Moreover, the formed polymer coatings should not impair the hygienic and mechanical properties of the textile material, as well as be stable throughout the life of the products.

One of the main requirements for textiles treated with a polymer composition is low rigidity, since an increase in this indicator worsens the performance characteristics of the material. In connection with the above stated research aimed at the development of new finishing compositions for textile materials are relevant.

Despite the development of polymer chemistry and the creation of new monomers, urethane polymers are widely used as a binders for the final finishing of cotton textile materials due to high adhesive and cohesive strength, resistance to physical and mechanical stress [2].

The goal of this work is to study the effect of polymer coatings of urethane nature on the rigidity of a textile material.

A cotton fabric with a surface density of 230 g/m^2 was selected for the study. Water dispersions of aliphatic polyurethanes Aquapol 12 and Aquapol 14 are chosen as film-forming substances. These polymer dispersions form a transparent and non-tacky films that will ensure the absence of the negative influence of the selected preparations on the coloristic properties of the fabric in the process of finishing.

The polymer coating on the fabric was formed by padding in solutions with a various concentration of polyurethanes, followed by drying and heat setting. The rigidity of fabric samples was determined according to GOST 10550-93 on a PT-2 device using the console method.

The obtained indicators of rigidity of the fabric with different polymer coatings are presented in Table 1.

Table 1 – Effect of polyurethane coatings on the fabric rigidity

Treatment	Concentration, g/l	Bending rigidity, E_I, μN·cm^2	
		warp direction	*weft direction*
without treatment	0	10200	2562
Aquapol 12	50	32833	11258
	100	51972	19476
Aquapol 14	50	38872	10209
	100	52019	19913

Data analysis in Table 1 shows that the use of polyurethane dispersions Aquapol 12 and Aquapol 14 at a concentration of 50 g/l the fabric samples rigidity in the warp direction increases by 221.9% and 281.1%, respectively and the rigidity in the weft direction increases by 339.4% and 298.5%.

Increasing the concentration of the studied polyurethanes to 100 g/l leads to an increase in rigidity in the warp direction by 409.5% for Aquapol 12 and by 410% for Aquapol 14, and in the weft direction by 660.2% and 677.2%, respectively.

The different influence of the studied polyurethanes on the rigidity of cotton fabric due to differences in the chemical structure of the binders. It is known that the physicomechanical properties of polyurethane films depend on the nature of the functional groups and their location. A hard fragment of the polymer chain, giving the polymer its hardness, strength, and reduced elasticity, is formed by isocyanates, and the flexible sections, which determine its softness and elasticity, are formed by compounds of polyethers and polyesters [3]. According to previously obtained results, the Aquapol 14 film is characterized by the least elasticity, which indicates a high degree of cross-linking of the polymer. This data correlate with the indicators of the films resistance to hydrolysis and to soap-soda treatment and confirm the high crosslinking degree of the Aquapol 14 polyurethane film compared to Aquapol 12.

Considering the results of analysis of the effect of polyurethane coatings on the mechanical properties of fabric, the dispersions Aquapol 12 and Aquapol 14 can be recommended as a binders for immobilizing functional additives on the surface of cotton textile material for clothing assortment when used at low concentrations.

References

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