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Study Of the Influence of The Nature of Catalysts And Urea Concentrations on The Effect of Modification

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Annotation. Fabrics modified with the participation of ammophos as a catalyst gave high levels of crease resistance with the least loss of initial strength and a stable size, which indicates the high efficiency of this catalyst.
Key words: modification, concentration, urea, catalyst, properties, cross-linking.

Introduction

One of the main requirements for manufacturing enterprises today is to reduce the consumption of processed materials, or, in other words, to reduce production costs by consuming as little raw material as possible per unit of production. This, in turn, leads to increased economic efficiency of the enterprise.

In modern conditions, managers of dyeing and finishing factories, when producing high-quality fabrics, must provide for a rational, cost-effective construction of a technological process that ensures that textile materials are given a complex of consumer properties; comfortable to wear, sanitary and hygienic properties in full compliance with environmental requirements.

The strategy of action in five priority areas of development of the Republic of Uzbekistan in 2017-2021 identified one of the priorities as increasing the competitiveness of the national economy through deepening structural reforms, modernization and diversification of its leading industries.

The textile industry is one of the drivers of these transformations. The tasks outlined in the Action Strategy, such as modernization and diversification of industry by moving it to a qualitatively new level, increasing the processing of local raw materials, mastering the production of fundamentally new types of products, increasing the competitiveness of domestic goods in foreign and domestic markets, localization of production and import substitution were successful made in the textile industry [1].

Materials And Methods

Next, we studied the effect of urea concentration on the crease resistance angle of fabrics after finishing in the presence of 120 g/l Carbamol CEM. Urea is added to the sizing solution in order to reduce the release of free formaldehyde during the finishing process of fabrics. Figure 4.2 shows the curves for changing the crease resistance angle of fabrics, calico art. 148 on the amount of urea in the presence of various catalysts in a concentration of 5 g/l. From curves 1-4 /Fig. 4.2/ it is clear that with the same amount of catalysts and TsEM carbamol, an increase in the amount of urea in the solution led to a decrease in the crease resistance angle.

Depending on the nature of the catalysts, the reduction in the crush resistance angle occurs differently. Thus, in the presence of more acidic catalysts, ammophos salts and ammonium chloride, although a decrease in the crush resistance angle is observed, it is greater compared to magnesium chloride. Fabrics finished without urea, in the presence of ammophos, had a crease resistance angle of 2240, in the presence of ammonium chloride, 2130, and in the presence of magnesium chloride, 1870 and calcium phosphate, 1720. After finishing with 8 g/l of urea, the crease resistance angle was ammophos, respectively. 1860, ammonium chloride -1700, magnesium chloride -1520 and calcium phosphate 1400.

RESULTS

Thus, the more acidic the environment, the higher the crush resistance angle. Probably, in a more acidic environment, the CEM carbamol molecules have time to interact with cellulose molecules.

Analysis of free formaldehyde content after finishing showed that fabrics finished with magnesium chloride and 10 g/l urea contained 0.57% free formaldehyde.

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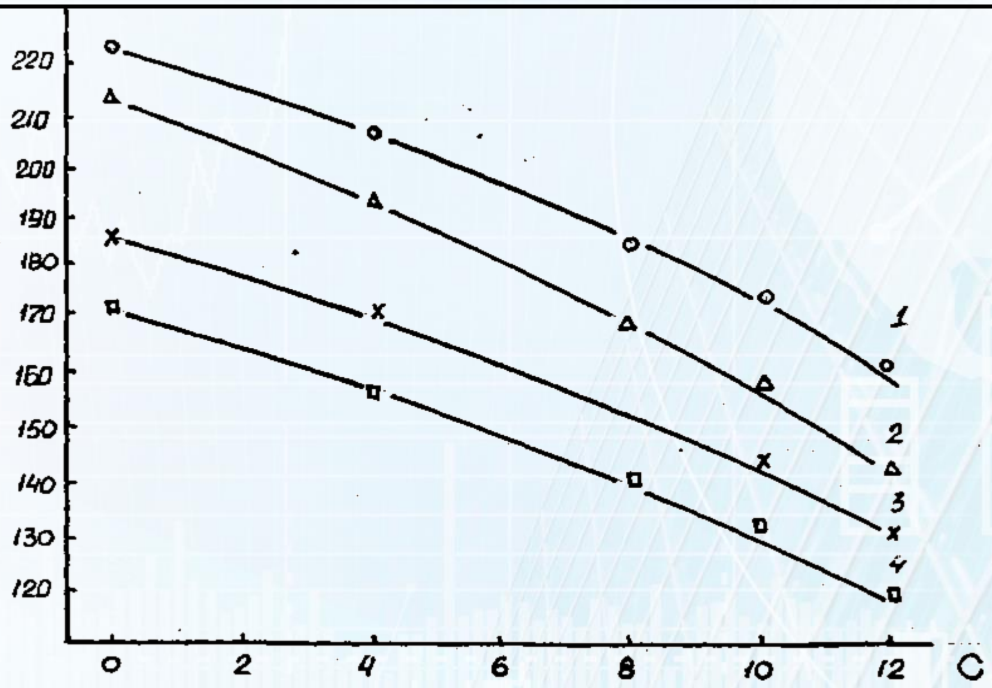

Fig. 1 Effect of urea concentration on the crease resistance angle
1-ammophos; 2-ammonium chloride; 3-calcium phosphate;
Magnesium 4-chloride

Fabrics finished with ammophos and ammonium chloride under similar conditions contain free formaldehyde in the composition of 0.22 and 0.35%, respectively.

To establish the influence of the number of catalysts on the quality of finishing, a chemical modification of fabrics (calico art. 148) was carried out with a change in the number of catalysts while maintaining a constant quantity of the remaining components of the sizing solution.

At the same time, the drying temperature, heat treatment and processing time remained unchanged. The results of these studies are presented in Table 4.3, from which it can be seen that an increase in the concentration of catalysts in the solution led to an increase in the angle of resistance to crushing.

A significant increase in the crease resistance angle is observed with the participation of catalysts of ammonium chloride, zinc nitrate, calcium phosphate and ammophos, where the increase averaged 91-980 compared to the original. However, the mechanical properties of the fabrics decreased by an average of 38% for the warp and 40% for the weft. A significant decrease was observed in the presence of zinc nitrate.

Recipe for impregnating solution, in g/l

Carbamol CEM	**- 120**
Urea	**- 5**
PEE	**- 10**
PVAE	**- 5**
Ammonium chloride	**- 10**
Ammophos	**- 10**
Magnesium chloride	**- 10**
Calcium phosphate	**- 10**
Zinc chloride	**- 10**
Zinc nitrate	**- 10**

Water rest up to 1000ml

DISCUSSION

This is probably due to the strong oxidizing property of nitric acid. Fabrics modified with the participation of ammophos as a catalyst gave high levels of crease resistance with the least loss of initial strength and a stable size, which indicates the high efficiency of this catalyst.

As is known, in the process of finishing fabrics, ammophos is in an equilibrium state in an aqueous solution, forming phosphoric acid, which acts as a catalyst for the following reaction

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$$2(NH_4)H_2PO_4 \rightleftarrows (NH_4)_2PO_4 + H_3PO_4$$

Table 1
The influence of the concentration and type of catalysts on the physical and mechanical properties of cotton calico fabrics art. 148

Type of catalyst	gain %	Tensile strength		Loss of strength		The angle is unbreakable, degrees	Sizing agent washability,%
		basis	ducks	basis	ducks		
Original		441	304			123	
NH_4 Cl	7,3	264	176	40	42	218	4,1
$MgCl_2$	6,1	304	196	31	31,5	193	4,7
$ZnCl_2$	6,9	284	205	5,5	2	205	4,3
$Zn(NO_3)_2$	7,5	245	147	44	2	221	3,5
Ca (H_2PO_4)	7,8	255	166	42	45	214	4,0
(NH_4) H $_2PO_4$	8,2	284	205	35,5	32	23	2,2

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Conclusions

Consequently, highly soluble and easily hydrolyzed salts of phosphoric acid and phosphoric acid itself are effective catalysts for the modification of cellulose-containing tissues with cross-linking reagents.

From the literature it is clear [2-3] that the use of phosphoric acid and its salts as a catalyst makes it possible to obtain high performance in modified tissues. However, pure phosphoric acid is expensive and difficult to obtain, and the NKK catalyst proposed by the authors of [4] was discontinued in industrial production due to technical problems.

Based on literature data and the results of laboratory studies, we came to the conclusion that it is probably possible to use the initial fertilizer products - ammophos, extraction phosphoric acid EPA - as a catalyst. They are produced by the domestic industry on a large scale, are highly soluble and compatible in cold and hot water and with sizing components.

In laboratory conditions, bleached cotton fabric (calico art. 148) was modified according to the following recipe and the results were obtained, which are shown in Table 4.4

Recipe for modifying cotton fabrics (calico art. 148)
with the participation of the EPA catalyst, g/l.

Carbamol TsEM - 100-120
Urea - 5-10
Polyethylene emulsion - 10
Polyvinyl acetate emulsion - 5
Extraction phosphoric acid - 5-10
Water rest up to 1000 ml

The results indicate in Table 4.4 that extraction phosphoric acid EPA can be successfully used as a catalyst for crease-resistant and low-shrinkage finishing of cellulose-containing fabrics. Thus, the modified cotton calico fabric art. 148 with the participation of 120 g/l carbamol TsEM and 5 g/l EPA had a crease resistance angle of 219 with a loss of strength along the warp/weft, respectively, 31%/29%.

Increasing the EPA concentration to 10 g/l led to an increase in the crush resistance angle to 234^0. A similar picture is observed after modifying samples of cotton fabrics with the participation of 100 g/l Carbamol TsEM, where the crease resistance angle was 201-207.

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Table 2
Physical and mechanical parameters of tissues modified with the participation of EPA

Concntration g/l			Weight gain, %	Loss of strength, %		Sum of crease resistance angles, degrees, warp+welt
Carbamol Cem	EFC	urea		basis	ducks	
120	5	5	7	31	29	219
120	10	5	8,2	35	32	234
120	5	10	5,8	28	22	187
120	10	10	6,3	26	27,5	198
100	5	5	5,2	27	25	201
100	10	5	6,4	23	20	207
100	5	10	4,7	22	19	176
100	10	10	5	21	17,5	187
Original unfinished						123

An increase in the concentration of urea in the sizing solution leads to a decrease in the finishing effect, and a parallel increase in the concentration of EPA significantly affects the increase in the crease resistance angle.

After modification of fabrics with the participation of the EPA catalyst, no sharp decrease in tensile strength is observed. Thus, when modifying cellulose-containing fabrics, it is possible to successfully use EPA as a catalyst, and at the same time obtain modified fabrics whose physical and mechanical properties meet consumer requirements.

To achieve a crush resistance angle of 2000, it is enough to use 100 g/l carbamol, 5 g/l urea EPA, 5 g/l PEE and 10 g/l PVAE. To obtain a better finished fabric, you should use a sizing solution containing 100 g/l carbamol CEM, 5 g/l urea, 10 g/l EPA, 5 g/l PEE, 10 g/l PVAE.

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