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Influence Of Temperature On Changes In Ph Of Appreting Solutions In The Presence Of Various Catalysts

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Annotation. The correct choice of catalyst, its concentration, nature and its activity in cross-linking reactions of cellulose molecules play a decisive role in the quality finishing of fabrics.

Key words: finishing, finishing agent, macromolecule, catalyst, crease resistance, solution

Introduction

For finishing fabrics, a number of sizing reagents are used that contain reactive functional groups that could react with the hydroxyl groups of cellulose macromolecules. For the final finishing of cellulose-containing fabrics, it was once proposed to use formaldehyde as a cross-linking reagent. Such finishing leads to an increase in crease resistance, at the same time it is accompanied by a significant decrease in the strength characteristics of the finished fabrics.

In this regard, many researchers are searching for new reagents in order to reduce the loss of strength of cotton fabrics during chemical finishing. Thus, the authors of [1] studied the possibility of using N-hydroxymethyl derivatives: methylol derivatives of urea, ethylene urea, propylene urea, melamine, etc.

The properties of these preparations, stability in solutions, the feasibility of using them for a particular type of finishing, the stability of finishing agents applied to textile materials, the effectiveness of their use in finishing production have been quite well studied and described in the literature [2-3].

However, the indicated methods of chemical modification of cotton fabrics, which have already become classical methods of high-quality finishing, using the above preparations, do not allow us to consider the problem of finishing production exhausted. Currently, the problems of optimizing final finishing methods are being solved, taking into account environmental protection issues related to the need to reduce the release of formaldehyde into the atmosphere of the workshop and its content in the finished finished fabric [4].

Materials And Methods

During storage of the sizing solution and after impregnation of fabrics, the pH of the solution changes depending on the chemical nature of the catalyst. So, when used as a catalyst $MgCl_2$ pH solution practically does not change, but in the presence of $AlC1_3$, $FeCl_3$, NH_4Cl, a change in the pH of the solution is observed. As experiments have shown [5], [6], [7], [8], the effectiveness of tissue modification with methylol derivatives in most cases depends on the composition of the sizing solution.

Consequently, changing the pH of the sizing solution makes it possible to judge the relative activity of catalysts used to modify textile materials. It should be noted that for high-quality finishing of fabrics, i.e. For the formation of predominantly cross-links between cellulose macromolecules, it is necessary to maintain the pH of the sizing solution during impregnation and drying within 3-5 [9].

To reduce the heat treatment temperature to 100-120^{0}C (time 2 minutes), it is recommended to use the $AL_2(OH)_5$-CL catalyst alone or in a mixture with salts and organic acids. With accelerated condensation, heat treatment is carried out at a temperature of 175-215^{0}C using a mixture of $AL_2(OH)_5$-CL with phosphoric acid or hydrogen peroxide [10].

A wide range of temperature conditions of heat treatment (from 100 to 175^0 C) ensures the use of derivatives of monomeric alkylphosphinic acid ($C < 8$) as catalysts: methyl, - chloromethyl and trichloromethyl phosphinic acid, their magnesium and ammonium salts, phenylphosphinic acid and its diammonium salt. Sulfamic acid and its ammonium salt are recommended as effective catalysts for crease-resistant finishing of cotton and viscose fabrics.

The correct choice of catalyst, its concentration, nature and its activity in cross-linking reactions of cellulose molecules play a decisive role in the quality finishing of fabrics. To date, a number of catalysts have

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been used, including hydrochloric acid, magnesium chloride and sodium borofluoride to crosslink cellulose with formaldehyde. Boron fluoride turned out to be an effective catalyst, but when cellulose is cross-linked with formaldehyde, a large drop in strength is observed, reaching up to 50%.
Similar results were obtained when using organic acids, their mixtures with inorganic salts, and polycarboxylic acids as catalysts. Experiments have been conducted on the use of trichloroacetic acid to modify textile materials in the presence of dimethyloldioxyethylene urea. However, it turned out to be unacceptable due to the decomposition of trichloroacetic acid during heat treatment with the formation of chloroform

Researchers have proposed new effective catalysts TEM, TKTs and TEK, which ensure the formation of cross-links between fiber cellulose macromolecules during drying of fabrics, which made it possible to combine drying and heat treatment with low-crease finishing in one operation and conduct the process using the so-called high-speed condensation method. For example, the use of the TEM catalyst makes it possible to carry out the finishing process at a temperature of 130^0C for 1 minute, while ensuring an increase in the breaking load per thread by 15%, and abrasion resistance of fabrics by 40.% compared to finishing, including heat treatment when using magnesium chloride catalyst

Interesting works are aimed at assessing the low creaseability of cotton fabrics based on the angle of recovery of the treated fabric, in which oxazolidines, as well as mixtures of organic and inorganic acids, were used as catalysts [11].
The ready-made working solution for modifying tissues, before introducing catalysts into its composition, had a pH of 8.6-8.85 at 200 C. After introducing a certain amount of catalysts into the solution, the pH decreases. This is explained by the fact that OH ions are neutralized by H+ ions, which are formed due to the hydrolysis of salts. Thus, the pH of an aqueous solution containing 5 g/l NH4Cl. Made up 5.56.

Results

To establish the effectiveness of the catalysts, changes in the pH of the sizing solution containing various catalysts were studied. Since the pH of the sizing solution and the concentration of hydrogen ion play a decisive role in the modification of tissues, by studying the change in pH, the effectiveness of the catalyst can be determined. For this purpose, the influence of salts used as a catalyst in the modification of tissues, as well as acids, i.e. hydrochloric, nitric, orthophosphoric acids, was studied.

Figure 4.1 shows curves of changes in pH of ready-made sizing solutions depending on temperature, the compositions of which are given in Table 4.2.

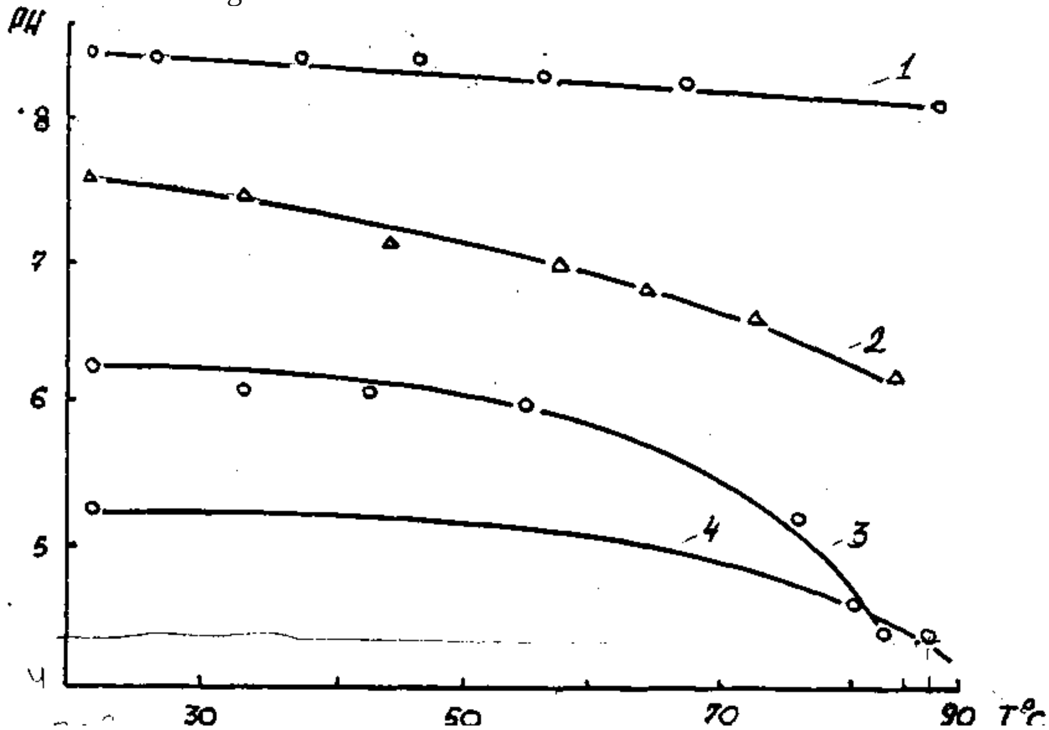

Fig.1. Change in pH value of the finished sizing solution depending on temperature for catalysts:

1- MgCl2, 2- NH4Cl, 3- NCC, 4-EPA

Discussion

The concentration of DMEM and urea is 7% and 0.7%, respectively. The concentration of catalysts NKK, EPA is 0.7% curve. 3.4, NH_4Cl 0.5%, $MgCl_2$ - 1.0% curve. 1.2, From curves 1.4 in Fig. 4.5 it can be seen that the pH of the solution containing the NH_4C1 catalyst in the initial stage changes slightly, and at a temperature of 90-100^{0}C there is a transition to an acidic environment. The pH of the solution, where MgCl is taken as a catalyst, practically does not change, i.e. shows a slightly alkaline environment and, as is known, the catalytic activity of MgCL manifests itself at high temperatures of the order of 140-160^{0}C.

Table 1
Compositions of sizing solutions

No. of curves	Catalyst name	Amount of catalyst, g/l	Amount of DMEM, g/l	Amount of urea, g/l
	NCC	7	140	7
	$MgCL_2$	10	140	7
	NH_4C1	5	140	7
	$Mg(H_2PO_4)_2$	7	140	7
	$NH_2H_2PO_4$	5	140	7
	EPA	7	140	7

Conclusions

A low pH value of the solution is observed in the presence of the NCC catalyst, since at a temperature of 20^0 C the pH is 6.25 and at a temperature of 82^0 C the pH is 4.45, which creates an optimal pH value at the time of modification. The lowest pH value is obtained where EPA is used as a catalyst. So, at a temperature of 20^{0}C pH is 5.31, and at a temperature of 86^{0}C pH is 4.32, i.e. EPA components are completely ionized. This creates favorable conditions for high-quality modification of fabrics, since cross-linking begins in the wet state of the fabrics. The more temperature stable the environment, the faster the crosslinking reaction occurs. In addition, in a wet state, the number of free hydroxyl groups in cellulose increases due to the breaking of hydrogen bonds, primarily intermolecular ones.

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