STUDY OF PHYSICOCHEMICAL AND COLORISTIC PROPERTIES OF TISSUE PRINTED POLYMER COMPOSITIONS

Sayimova Dilbar Kakhramonovna[1], Sultonov Shavkat Abdullaevich[2]
Mikhliev Oybek Avloyorovich[3], Jumaeva Anora Adkhamovna[4]

[1,2]Navoi State Pedagogical Institute, Uzbekistan
[3,4]Karshi Institute of Engineering and Economics, Uzbekistan

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Abstract:

Thickening polymer compositions based on bentonite, hydrolyzed acrylic emulsion (HAE) and K-4 preparation have been developed. The structural and mechanical properties of printed fabrics with polymer compositions have been studied.The influence of the components of the composition on the color intensity was established and it was revealed that an increase in the concentration of HAE in the printing ink leads to an increase in the color saturation.

Key words: Composition, bentonite, acrylic emulsion, cotton fabric, degree of fixation, degree of penetration, color intensity, heat setting, performance properties.

I.INTRODUCTION

To date, the available literature data on the development of the technology of composite materials based on natural and synthetic polymers intended for printing fabrics, mainly, are of an empirical nature without deep scientific substantiation.

Therefore, the development of scientific foundations for the creation of new types of thickening compositions based on bentonite and water-soluble polymers with specially selected ingredients is an urgent problem in the textile industry.

The development and use of new thickening compositions allows not only to reduce the consumption of food raw materials - starch, but also to completely eliminate the use of expensive imported sizing and thickening materials while maintaining the necessary requirements for the technological properties and thickener of printing ink.

The structure of concentrated polymer solutions, which are characterized by anomalous flow behavior, is usually modeled by a labile structural network formed by functional associates. The study of the structure of associates during the transition from polymer solutions to polymer printed compositions leads to a violation of the regularity of the structure of supramolecular formations, which, first of all, affects the rheological properties of the system. Therefore, studying the rheological properties of polymer solutions and polymer printed composites under various conditions provides important information on structural changes. This makes it possible to predict the behavior of printed compositions in the process of their penetration and printing of textiles [1-3].

II.EXPERIMENTAL PART

As a thickener for printing ink, we used bentonite from the Navbakhor deposit with a particle size of about 0.5 mmc, hydrolyzed acrylic emulsion (HAE) and K-4 (uniflock) preparation. Composition of the composition, g / kg: bentonite -40; K-4-2.5; acrylic emulsion 8.0.

The printing ink on cotton fabric with the developed compositions with thickening polymer compositions was carried out.

The structural and mechanical properties of printed fabrics, in particular the degree of penetration, the degree of fixation, plastic strength, yield stress, were studied, the results of which are presented in Table 1. As can be seen from the data presented in Table 1, there is a uniform decrease in the yield stress depending on the composition of the composition, which indicates good compatibility of thickeners regardless of their ratio in the mixture and regardless of additives and components of the printing ink. The good compatibility is also confirmed by the high stability of the resulting mixtures.

It should be noted that with an increase in the concentration of HAE in the composition, the degree of penetration and fixation of the dye on the tissue increases. So, for example, at a HAE concentration of 5 g / kg, the degree of penetration and the degree of fixation are, respectively, 65 and 53%; with an increase in the HAE concentration to 8 g / kg, the degree of penetration increases to 84% and the degree of fixation to 69%.

As you can see, along with the rheological properties of printing inks, the value of the plastic strength of the internal structure also has a strong influence on the printing results. In this case, we assume that the degree of transfer of the printing ink from the engraving of the printing roller to the fabric depends on the ratio of the adhesive forces of adhesion of the printing ink to the roller and cohesive forces, which are determined entirely by its internal structure.

Table 1. Structural and Mechanical Properties of Printed Fabrics with Polymer Compositions. Content: bentonite-40 g / kg and K-4 - 2.5 g / kg

HAE, g/kg	Composition of the thickener	Power penetration PP,%	Fixation degree FD, %	Plastic strength, g/cm^2	Yield point g/cm^2
5	Bentonite-K-4	65	53	9.1	19.2
	Bentonite	60	56	10.4	15.7
6	Bentonite-K-4	75	53	8.7	8.7
	Bentonite	71	59	10.6	5.2
7	Bentonite-K-4	83	58	6.8	6.8
	Bentonite	78	71	8.1	3.1
8	Bentonite-K-4	84	69	4.7	6.1
	Bentonite	82	77	5.3	2.8
9	Bentonite-K-4	85	72	4.1	5.9
	Bentonite	83	78	5.0	2.5

The degree of fixation depends both on the amount of ink passing onto the fabric and on the depth of its penetration into the fabric. The more the printing ink passes to the fabric and the deeper it penetrates into its depth, the higher the expected value of the degree of fixation. An increase in the concentration of HAE in the printing ink leads to an increase in color saturation, especially noticeable in the case when bentonite and K- 4 (Fig. 1, curve 1). The maximum color intensity in all samples is observed at a HAE concentration of 7.5-8 g / kg in printing ink (Fig. 1). It was revealed that an increase in the concentration of HAE promotes an increase in the saturation of the color of the printing ink of compositions 2 and 3 (Fig. 2).

However, an increase in HAE concentration leads to a decrease in color saturation in the case of the polymer composition thickener K-4- (Fig. 2, curve 1). The decrease in the saturation of the colors, apparently, is due to the fact that the hydrophobic part of the molecules exerts a sterotic hindrance during the sewing of the film with the tissue.

The results obtained made it possible to establish the concentrations of the components of the printing ink, which determine the minimum unevenness of the color and the minimum difference in shade. So, for example, the minimum color unevenness is observed when the content of bentonite is 40g / kg, HAE is 8g / kg, K-4 is 2.5g / kg. At the same concentrations, a minimum color variation is also observed (Figs. 3 and 4).

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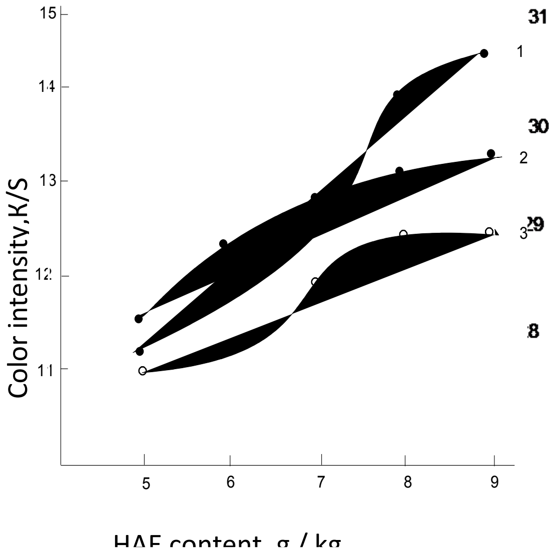


Fig. 1 Intensity dependence from the content of GAE in print noisy paint.

Content of thickener composition:

1) Bentonite – K4;
2) Bentonite;
3) K-4;

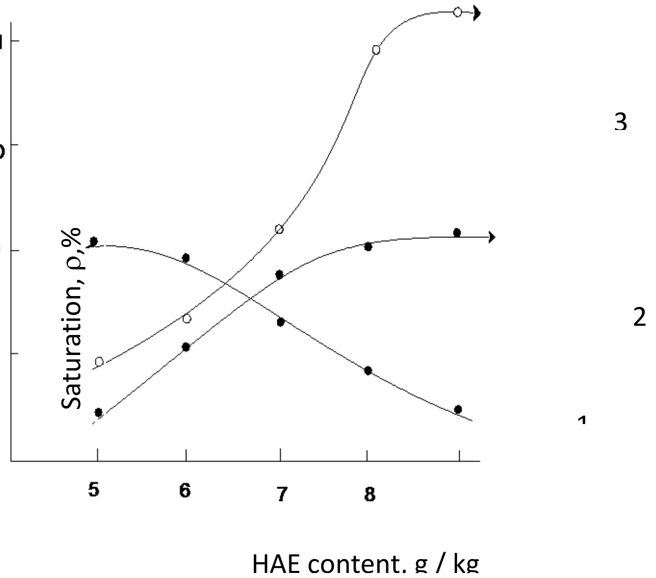
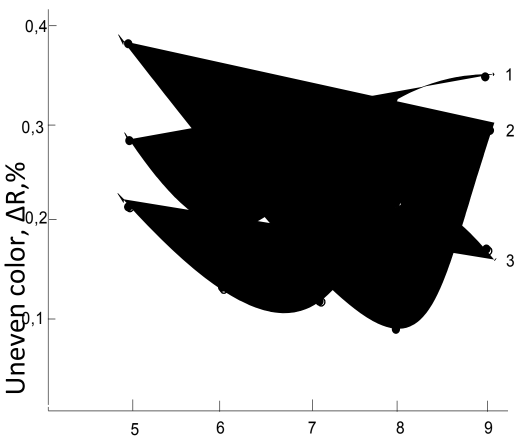


Fig. 2 Saturation dependence colors from GAE content in printing ink.

Content of thickener composition:

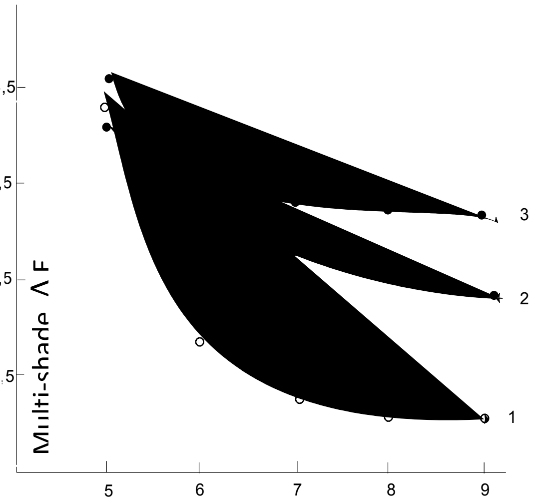
1) K – 4;
2) Bentonite



HAE content, g/kg

Fig. 3 Dependence of unevenness races from the content of HAE in printing ink.

1) K-4;
2) Bentonite - K-4;
3) Bentonite.



GAE content, g/kg

Fig. 4 Dependence of different shades on the content of GAE in printing ink. The designation is the same as in Fig. 4.

The analysis of the results obtained allows us to assert that the colors that are most resistant to physicochemical effects are achieved when using a printed composition containing 8 g / kg HAE. Obviously, with this HAE content, a sufficient number of crosslinks between the film-forming component and the polymer base of the fabric are realized, which provides a sufficiently high color strength. As for the stiffness of the printed fabric, it sharply decreases when the content of the composition is 8g / kg HAE, however, a further increase in the concentration of HAE does not lead to sufficiently sharp changes in stiffness. The decrease in stiffness with the introduction of HAE is obviously associated with its plasticizing effect [4-5].

One of the main indicators of printed cotton fabrics is color fastness. It depends on the temperature and duration of curing.

Samples printed with HAE, bentonite, and K-4 were dried and heat-set in an oven at 393, 403, 413, 423K and a heated iron at 433K.

The data obtained show (Table 2) that with an increase in the fixing temperature, the color strength increases. Already at 393K satisfactory results are obtained in wash, dry friction and sweat resistance, but low results in wet friction resistance. This is obviously due to the fact that at this temperature there is an insufficient degree of crosslinking of the polymers. Therefore, it is more rational to heat-fix at a temperature of 413-423K for 3 minutes.

Thus, the introduction of a hydrolyzed acrylic emulsion of bentonite and K-4 into the composition of polymer compositions as a thickener leads to an improvement in the performance and color characteristics of printed fabrics.

Table 2. Influence of heat setting conditions of printed fabrics on the performance properties of coloring

Fixation temperature, K	Thermosetting time, min	Color fastness, points			
		to dry friction	to wet friction	to wash	to sweat
393	3	5/3	5/2	5/3	5/3
	5	5/3	5/3	5/4	5/3
403	3	5/3	5/3	5/3	5/4
	5	5/4	5/3	5/3	5/4
413	3	5/4	5/3	5/3	5/4
423	3	5/5	5/4	5/4	5/4
433	1	5/3	5/4	5/3	5/3

III.CONCLUSION

The fixation of the polymer composition, in particular Bentonite and other ingredients of the printing ink, occurs due to the formation of a network structure of the printing compositions on cotton fiber.

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