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INVESTIGATION OF THE PROCESS OF DYING WITH DISPERSIVE DYES OF FABRIC FROM POLYESTER-BAMBOO FIBERS

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Abstract:

This article discusses the possibilities of chemical finishing of mixed polyester-bamboo fabric with dispersed dyes. The purpose of this study is to obtain a mixed fabric based on bamboo and polyester fiber and to develop a technology for dyeing with disperse dyes. The object of the study was a blended fabric made of polyester and bamboo fibers with technical characteristics, 140 cm wide, 36 g/m2 surface density, the number of threads per 10 cm of fabric, 352 warp, 350 weft.

The influence of several factors on the degree of color intensity of samples made of mixed polyester-bamboo fabric has been studied.

There are three fundamentally different methods of dyeing polyester fibers with disperse dyes, under pressure at 120-130°C, at a boiling point using carriers, as well as dyeing with a thermosol method. The choice of dyeing technology depends on the form in which the polyester fiber is dyed, on the equipment and the dye used

The main area of application of disperse dyes is the dyeing of polyester fibers, yarns and fabrics, including blended ones, containing a polyester component. Also, disperse dyes are used for printing on polyester and blended fabrics. Dyes that are highly resistant to sublimation at high temperatures and are recommended for use in continuous dyeing technologies for textile materials.

In order to obtain an intense and uniform color on the mixed material. The influence of the factors of the dyeing process on the quality indicators of the coloring of a mixed fabric based on polyester and bamboo fibers has been studied. To study the effect of dye concentration, pressure of the dyeing process and dyeing temperature on the color intensity of the mixed fabric, dispersed dyes of various tones were used, such as dispersed blue K, dispersed yellow Z, dispersed black EX-SF.

Keywords: Polyester fiber, bamboo fiber, dyeing, mixed fabric, disperse dyes, temperature, color intensity, concentration.

INTRODUCTION.

It is more appropriate to use the term "complementary fibers" to characterize the use of fibers or threads in blends and heterogeneous materials, when the disadvantages of one type of fiber are leveled by another fibrous component. Cellulose and polyester fibers are a classic example of complementarity - the polyester component sharply reduces the wrinkle characteristics of the resulting fabrics and increases their wearability, almost without affecting other properties, such as hygroscopic ones [1].

Dispersed lightfast dyes are widely used in the dyeing of textile materials from cellulose and chemical fibers. According to the chemical structure, disperse dyes are polar organic compounds, slightly soluble in water. Since their molecules do not contain sulfo and carboxyl groups, they do not dissociate into ions in aqueous solutions, and therefore do not carry a charge [2].

Dyes have a high melting point and are prone to sublimation, that is, they have the ability to go into a gaseous state when heated. Solutions of disperse dyes are highly dispersed systems in which dye particles are in both soluble and solid phases. Therefore, dyeing is always carried out in solutions saturated at a given temperature.

Literature and method. The higher the degree of dispersion of these dyes in the final form, the more stable the suspension, then you can get a more saturated and even color. As the dye molecules are absorbed by the fiber, an additional amount of the dye passes into the solution [3].

The range of textile and knitted products is largely expanded and improved through the use of

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multicomponent mixtures of natural fibers with synthetic or artificial. To obtain the color of the same intensity on both components of the blended cotton-lavsan yarn, it is necessary to select dye compositions and dyeing modes that provide the same fixation of the dye on both components of the blended yarn.

The article [4] presents the results of studying the process of dyeing mixed cotton-lavsan yarn with dispersed and direct dyes. The influence of variable factors and the sequence of introducing chemical reagents and dyes into the dye bath on the quality indicators of coloring were studied.

The scientists also studied the possibility of using textile auxiliaries to intensify the process of dyeing cotton-silk blended fabric with active and direct dyes. It has been established that the use of intensifiers increases the fixation of the active and direct dye on the fiber [5].

The degree of selection of dyes from the dye bath for mixed materials, the intensity of the resulting color can be changed by introducing various electrolytes, surfactants into the dye solution, as well as changing the pH of the solution, which increase the degree of color intensity of the textile mixed material. Polyester fiber is the leader among other known fibers, being the only highly growing share of consumption [6]. And also many scientists are interested in studying the influence of external factors on the dyeing process of polyester and cellulose mixed materials.

To date, a significant amount of materials has been accumulated for finishing textile mixed materials, methods and technologies for dyeing, as well as for formulating dyes and coloring compositions. Scientists have studied the processes of using a combined solution of dyes when dyeing mixed materials from 85% bamboo viscose and 15% polyester fiber. To study the state and interaction of dispersed and direct dyes in the dye solution, depending on their concentrations and ratios, the absorption curves of individual solutions of dispersed yellow and their mixtures were taken on a Minolta spectrophotometer at a temperature of 25±0.50C.

From the result, it can be seen that with an increase in the concentration of the dispersed dye by a factor of five, a sufficient amount of the dye is in the monomolecular form, i.e. although the graph broadens, the absorption maximum remains [7]. Depending on the concentration of the dye in the solution, there is a certain part of the individual dyes in an aggregated form with varying degrees of aggregation.

We used a blended fabric made of polyester and bamboo fibers, the main technical characteristics of which are given in the table.

Table

Main technical characteristics of blended fabric

Name of fabric	Width of fabric, cm	Surface density of fabric, g/m2	Number of threads per 10 cm of fabric	
			By warp	By weft
Blended fabric (PE/bamboo)	140	36	352	350

The influence of several factors on the intensity of coloring of samples from mixed polyester-bamboo fabric was studied.

Discussion. Investigation of the influence on the dyeability of a mixed polyester-bamboo fabric under the conditions of dyeing polyester fibers with dispersed dyes, with constant parameters: beginning of dyeing: temperature 50-600C; process duration 20 (min); dyeing conditions: temperature 1000C, duration 60-90 (min); dye concentration (% of tissue weight) 3%. Dyeing of samples is carried out in a dye bath containing a dispersed dye 3% by weight of the fabric and a surface active substance (surfactant) 1 g/l at a modulus of 30-50.

The results of the influence of parameters on the color intensity of the mixed fabric with various disperse dyes are presented in diagrams (Fig. 1-3). Figure 1 shows that with increasing pressure, there is an increase in the degree of color intensity of the mixed fabric based on polyester and bamboo fibers. In the case of dispersed black EX-SF in the range from 300 to 350 MPa, the degree of color intensity increases more intensively relative to other dyes. From the point of view of the dyeing mechanism of chemical fibers with disperse dyes, the dye dissolves in the fiber-forming polymer as in a solid solvent during dyeing, or the dyeing process should be considered as the adsorption and diffusion of the dye in the pores of the fiber and fixing it on specific areas of the accessible inner surface of the polymer.

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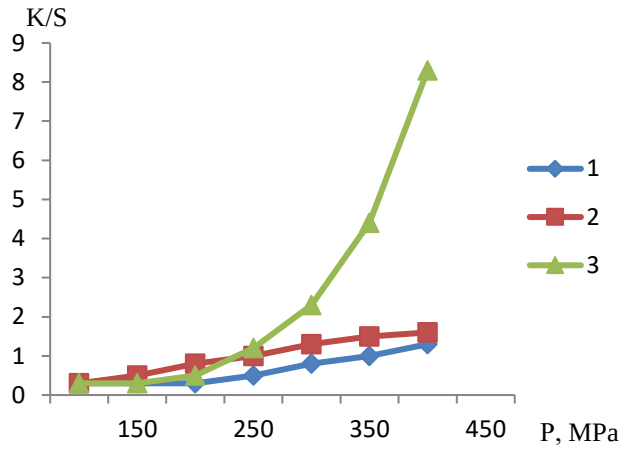

Figure 1. Influence of the temperature pressure of the process of dyeing with disperse dyes on the intensity of dyeing of the fabric.
1-dispersed blue K; 2-disperse yellow Z; 3-dispersion black EX-SF;

In connection with the foregoing, the optimum working pressure is assumed to be 350 atm. When studying the effect of temperature on the degree of color intensity of the mixed fabric, the experiments were carried out under the following conditions with constant parameters: P=350 atm, τ=45 min, dye concentration=1% of the mass of the fabric

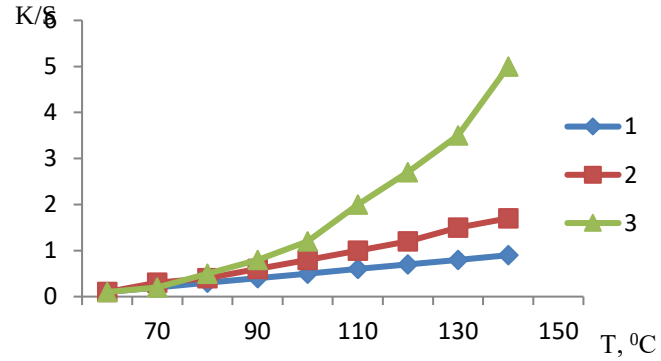

Figure 2. Influence of dyeing temperature with disperse dyes on the intensity of fabric coloring.
1-dispersed blue K; 2-disperse yellow Z; 3-dispersion black EX-SF.

As can be seen from Figure 2, it follows that with increasing temperature, the color intensity also increases, and this dependence is most pronounced in the case of dispersed black EX-SF. This indicates that the process of dyeing a mixed fabric based on polyester and bamboo fibers with dispersed dyes is exothermic in the same way as when dyeing in an aqueous medium. Dyes for dyeing synthetic fibers must be resistant to high temperatures and must not sublimate

In connection with the above, the optimum operating temperature is assumed to be 1200C. When studying the effect of the concentration of disperse dyes on the color intensity of the mixed fabric, the experiments were carried out in the following parameters, t=1200C, P=350 atm, τ=45 min.

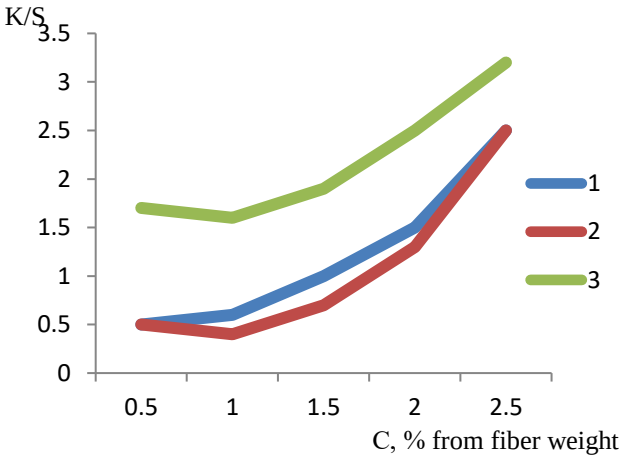

Figure 3. Influence of dye concentration on the intensity of tissue coloring.
1-dispersed blue K; 2-disperse yellow Z; 3-dispersion black EX-SF;

Figure 3 shows that with an increase in the concentration of the dye, the degree of coloring of the mixed fabric increases, and it is directly proportional to the increase in the concentration of the dye

Results. During the dyeing process, stabilization of sorption processes is first observed, that is, there is an alignment and achievement of an equilibrium state in the form of saturation of the fiber.

Under the action of an external load, the polymer macromolecules occupy positions corresponding to an unstressed change in the state of the fibers. At the moment of rapid cooling of the textile material, this new arrangement of polymer macromolecules is fixed due to the re-formation of intermolecular bonds.

The upper limit of the heat treatment temperature is limited by the softening temperature of one or another synthetic fiber, and the lower limit is determined by the minimum energy required for the reversible destruction of intermolecular bonds.

The permissible temperature range also depends on the medium in which the heat treatment is carried out. Usually it is carried out with hot air. Sometimes heat treatment of fabrics is combined with

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the process of fixing dyes with synthetic fibers, for example, when dyeing with disperse dyes [8].

Conclusion. So far, studies have been carried out and certain conclusions have been made on the development of a technology for dyeing mixed textile materials based on cotton and nitron fibers, natural silk and nitron in various ratios. Textile material containing no more than 35% polyester fiber is designed for the climate of our republic. The development of a chemical treatment technology for such mixed materials is an individual process and depends primarily on the nature of the polymer and its quantitative ratio in the mixture

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