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RESEARCH ON THE SELECTION OF DYES FOR DYING MIXED YARN BASED ON SILK AND COTTON FIBER

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Abstract:

The article presents the results of an experimental study on the choice of dyes for dyeing cotton-silk blended yarns, which ensures the purity of color and uniformity of color on both components of the blended yarn**.** Dyeing cotton and silk fibers with the same active dye, regardless of the color of the dye, does not make it possible to obtain the same intensity and okarski and, accordingly, the degree of use of the dye differs. The process of diffusion of the dye into the fiber and the mechanism of binding with functional groups when dyeing yarn from mixed fibers differs from the process of dyeing a single-component yarn; it has been shown that the evenness of the dye, regardless of the fibrous composition at low dye concentration, has positive results. This pattern is observed when dyeing individual fiber components and mixed yarns. Considering that textile materials can have a different structure and fibrous composition, it is necessary to select the appropriate composition for dyeing and technological mode.

Keywords: Yarn, reactive dyes, color intensity, color evenness, single-shaft dyeing method, two-bath dyeing method.

1.RELEVANCE OF THE TOPIC:

In the market economy, ensuring the competitiveness of textile materials based on natural fibers and their mixtures in the world market, searching for new directions to improve product quality, improving the technology of chemical finishing of blended fabrics, developing advanced technologies is of great importance. The creation of mixed materials in different ratios shows the possibility of purposefully imparting a complex of valuable properties to products, providing an expansion of the range of textile materials.

2.MAIN BODY.

All over the world, there is a growing demand for textile materials made from natural fibers, and especially materials for clothing are gaining in popularity. Globally, the annual production of cotton fiber by the main cotton-producing countries - China, the United States of America, India, Pakistan and Uzbekistan, which account for over 70% of the world's cotton production, is 19.6 million tons. In the world, an average of 19.3 thousand tons of raw silk is harvested annually. Uzbekistan ranks third in this indicator after China and India.

Large-scale economic reforms carried out in the textile industry of the Republic are aimed at the modernization and technical re-equipment of industries, ensuring the complete processing of fiber raw materials into finished products. This task can be solved by expanding the assortment of fabrics and knitwear, as well as improving consumer properties not only by creating new product structures and finishing technology, but by widespread use of a mixture of fibers in the new assortment. Especially interesting combinations in products can be obtained from natural cotton and silk fibers. In recent years, the work of many scientists has been devoted to expanding the range of mixed fabrics and knitwear containing natural silk; they are aimed at expanding the range of high-quality silk fabrics and knitwear, replacing expensive raw materials (natural silk) with cheaper and more affordable ones (cotton). As a result of the formation of mixtures of natural fibers in different ratios, it becomes possible to purposefully impart a complex of valuable properties to products and expand the range of silk fabrics and knitwear [1-3].

The creation of new mixed materials predetermines the need to develop a special technology for the refinement of these materials.

The process of textile materials is the main stage of chemical technology, the purpose of which is to obtain dyes with a given color characteristic and stability under the conditions of use of textiles.

The process of dyeing mixed materials requires taking into account the specificity of the compatibility of the components of mixtures of dyes of the same and different classes, the affinity of fibers for the dyes included in the mixture during single dyeing, as well as the preservation of the complex of physical and physicochemical properties of fibers.

It is known that the range of the class of dyes capable of dyeing cotton and silk is quite wide, but they have drawbacks that are revealed during operation. Cotton fiber is dyed with straight, active, vat, sulfur, insoluble azo dyes. Silk is dyed with direct, active, basic, acidic, chrome dyes. It follows that for dyeing cotton-silk mixed products, individual classes of dyes can be used: direct and active, or you can use a mixture of different classes of dyes that color one of the components of the mixed product. [4].

Active dyes have superiority over other classes of dyes in terms of variety, versatility and ease of use, breadth of colors, brightness and purity of tones, and resistance of colors to wet treatments. Currently, active dyes are widely used for dyeing and printing cotton and silk fabrics. Reactive colorants suitable for practical use must satisfy a number of requirements. They must ensure the flow of chemical interaction with fibrous materials at a level of at least 70% with the formation of a bright, saturated color with high resistance to various physical and chemical influences [5].

Color uniformity depends on diffusion ability and the ease with which hydrolyzed dye is removed from the fiber during washing. Reactive dyes used in batch dyes must have sufficient affinity for the fiber to provide high dye fixation.

In order to obtain the same color intensity on both components of the mixed fabric, among the available brands of active dyes, it is necessary to search for a dye that has approximately the same affinity for cotton and silk with a single dyeing method, or to select dyeing compositions and dyeing modes that provide the same covalent fixation on both components of the mixed fabric.

In this regard, 13 brands of active dyes of different colors, widely used in the production of the Republic, were selected for the study.

For dyeing cotton and silk yarns with active dyes, we chose an alkaline method and, in accordance with the manufacturer's proposed technology, according to the following mode:

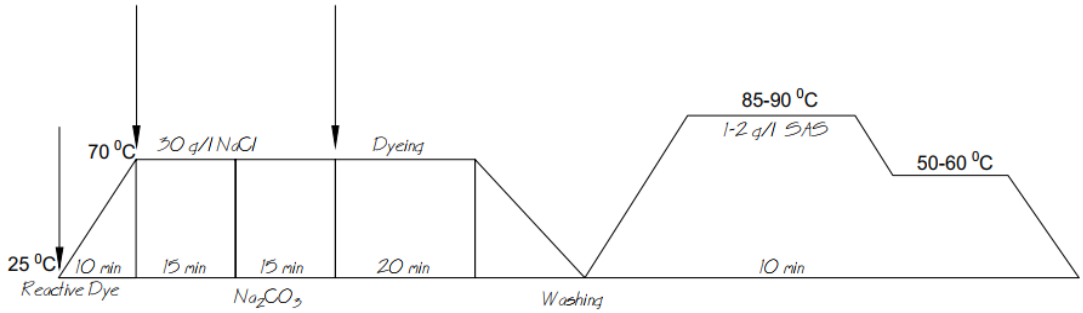

Fig. 1 Technological mode of dyeing mixed yarns

The values of the color intensity of the samples dyed in one and a separate bath under identical dyeing modes show the difference in the affinity of the dyes to cotton and silk fibers. This is due to the fact that the molecular structure and types of active groups and their location determine the affinity of the dye for the fiber [6].

Table 1. Influence of the nature of the dye and the method of dyeing on the quality of dyeing cotton silk yarn

№	Dye name	Color intensity K / S			
		One-bath dyeing method		Two-bath dyeing method	
		Cotton yarn	Silk yarn	Cotton yarn	Silk yarn
1	Active Blue 195	5,0	14,1	1,2	12,4
2	Active blue 21KN-G	5,0	12,0	2,5	17,0
3	Active Blue 195KN-Rs	5,0	5,0	2,0	20,0
4	Active blue 21 KN-G	5,0	15,0	3,0	10,0
5	Active Orange 122 EF-2R	10	11,1	12,0	13,1
6	Active Orange 123 EF-2R	13,5	15,0	12,1	17,0
7	Active Black R	10,0	23,0	5,0	25,0
8	Active Red 239	10,0	13,0	7,0	18,0
9	Active yellow 176 M-3RE	40,0	15,0	5,0	18,0
10	Active Red 239 M-3B E	6,0	18,0	6,0	17,0
11	Active yellow 176 3RS	5, 0	13,0	4,0	12,0
12	Active blue 194 M-2GE	13,5	20,0	10,0	24,1

According to the research results, it was revealed that among the dyes used, Active blue 194 M-2GE, active orange 122 EF-2R, active orange 123 EF-2R give similar color intensity on yarn made of cotton and silk fibers with single dyeing and when dyed separately. Further studies were carried out to determine the amount of the dye to be fixed and the quality of the dye, by the method of dyeing the fibrous components and mixed yarn from one bath (Table 1).

The values of the color intensity of the samples dyed in one and separate baths at identical dyeing modes show the difference in the affinity of dyes to cotton and silk fibers. This is due to the fact that the molecular structure and types of active groups and their location determine the affinity of the dye for the fiber [7].

Table 2. Influence of dye concentration on the degree of use and quality of dyeing cotton-silk yarns

№	Concentration of dye, from the mass of the thread %,	Use, %			Color intensity K / S			Smooth coloring, R		
		Cotton yarn	Silk yarn	Cotton: silk yarn 50:50	Cotton yarn	Silk yarn	Cotton: silk yarn 50:50	Cotton yarn	Silk yarn	Cotton: silk yarn 50:50
Active Blue 195										
1	1	40	41	52	3,8	7,2	9,2	0,3	1,0	0,6/0,8
2	2	30	42	58	5,6	11.6	13,3	0,4	0,6	0,3/0,6
3	3	30	44	61	3,0	13,3	13,6	0,4	0,8	0,6/0,6
4	4	41	48	62	3,8	9,7	13,0	1,5	3,0	1,0/2,6
5	5	16	52	64	4,7	6,0	9,3	2.6	3,3	0,3/3,9
Active Orange 122 EF-2R										
1	1	40	42	61	4,1	12	12,6	0,3	0,5	0,6/1,3
2	2	30	47	63	5,6	12,6	15,3	0,6	0,4	0,3/0,5
3	3	30	44	64	5,0	13,6	15,6	0,8	0,6	0,5/0,7
4	4	40	48	67	8,3	12,6	13,0	1,5	3,2	1,0/1,6
5	5	16	49	68	9,7	14,1	13,3	2,6	4,3	0,8/1,3
Active Orange 123 EF-2R										
1	1	40,0	55	57	4	9	13	1,6	1,0	1,1/2,3
2	2	47,0	56	58	8	10	11	1,2	1,6	0,5/0,7
3	3	49,3	58	61	12	17	12	1,8	1,0	0,8/0,9
4	4	46,0	61	62	12	15	17	3,2	2,2	1,4/2,5
5	5	47,8	62	64	10	17	10	2,0	1,5	2,2/2,8

Research results show that when dyeing with active blue and orange at their low concentrations, the amount of bound dye on cotton yarn is 30-49% and the intensity of the dye is in the range of 3.8 ÷ 12.0. When dyeing silk with these dyes, the amount of dye bound to the fiber increases 1.5-3 times, the color intensity is in the range of 6.0 ÷ 17.0. When dyeing active orange with dyes of cotton and silk yarn, the degree of fixed dye is 1.5-2 more, and the intensity of dyeing is increased from 2 to 3 times.

An increase in the concentration of the dye from 3 to 5% does not lead to a significant improvement in the quality indicators of the color. When dyeing the blended yarn with active blue and orange 122 EF - 2R dyes, the degree of use of the dye reaches 30 ÷ 68% and the color intensity ranges from 3.0 to 13.6. The degree of use of the dye does not change significantly, and the color intensity of the blended yarn gives a good result when dyed with the active orange dye 123 EF - 2R.

It should be noted that the evenness of the color, regardless of the fibrous composition, at low concentration of the dye has positive results. This pattern is observed when dyeing individual fiber components and mixed yarns.

3.BASED ON THE RESULTS, THE FOLLOWING CONCLUSIONS WERE MADE:

- dyeing cotton and silk fibers with the same active dye, regardless of the color of the dye, does not make it possible to obtain the same intensity and okarski and, accordingly, the degree of use of the dye is different;
- the structure of the dye and the arrangement of its functional groups determine the affinity of the dye for the fiber;
- the process of diffusion of the dye into the fiber and the mechanism of bonding with functional groups when dyeing yarn from mixed fibers differs from the process of dyeing one-component yarn;
- to achieve the quality of dyes in color tone and their uniformity when dyeing yarn from mixed fibers, it is necessary to accelerate the dyeing process.

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