

JGRPD

ISSN : 3032-131X

<https://doi.org/10.61796/jgrpd.v1i3.458>**TECHNOLOGY OF DYING OF POLYACRYLONITRILE
AND MIXED COTTON-BASED FABRICS****Sharipova N.M.**

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Received: Jan 22, 2024; Accepted: Feb 29, 2024; Published: Mar 20, 2024;

Abstract: The purpose of this work is to study the process of dyeing knitted fabrics based on a mixture of cotton-nitron fibers with active and cationic dyes and to develop dyeing technology.

Keywords: cotton fiber, nitron fiber, mixed knitted fiber, dyeing, active dye, cationic dye, dyeing mode, light filter, color fastness, color intensity.

This is an open-access article under the [CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/) license**Introduction**

Currently, only PAN fiber copolymer is widely produced commercially due to the fragility of the fiber homopolymer and its poor dyeability. To overcome the above disadvantages, acrylonitrile is polymerized with monomers (vinyl acetate, methyl acrylate, methyl methacrylate, etc.) that increase the flexibility and dyeability of the fiber, dyeability (basic monomers or acidic functional groups). When dyeing PAN fibers, various dyes are used: dispersed, basic, acidic and some cubic dyes. Nowadays, cationic dyes are characterized by ease of use, color intensity, color brightness and color fastness. Dyes containing a positively charged chromophore molecule are called cationic dyes. But the water solubility of the dye anion plays an important role. The color stability of PAN fiber dyed with cationic dyes is explained by the formation of salts between the acid groups of the fiber and the dye molecule.

There are simple and modified types of PAN fiber. Conventional PAN fibers are dyed with dispersed and cationic dyes. Modified fibers, in turn, are dyed with dispersed, cationic, acidic and active dyes. Also, ordinary PAN fibers are stored with acid dyes, and a two-color effect is created using the one-bath method. In some cases, this condition is used in weaving or knitting production.

Dyeing of modified PAN fibers requires a highly acidic environment (pH = 2.5) using sulfuric acid to obtain bright color and transparency of the dye. When dyeing with a mixture of cationic and anionic dyes using the one-bath method, dye precipitate may form. To avoid precipitation, it is advisable to use anionic substances. They form a complex compound and a finely dispersed precipitate with the cationic dye and melt under high temperature. In the literature, a dye for dyeing textile fabrics based on simple and modified PAN fibers contains 0.1-20 g/l of an anionic active

substance based on benzene, naphthalene, biphenyl, anthraquinone, containing from 1 to 4 COOH or SO₃H groups.

Results and Discussion

I. A. Nabieva and a number of scientists studied the process of dyeing mixed cotton and modified kalavan in a ratio of 67:33 with an active dye. The dyes used in the study were Ostazin. The kinetics of staining was studied with the dyes ostasin turquoise and ostasin blue. Based on research, an optimal dyeing regime for nitron cotton in an alkaline environment based on the above dyes has been proposed. It was noted that samples painted using this technology are stained evenly, and their physical and mechanical properties are improved. The process of preparing calava nitron fiber, modified with silk waste, for dyeing with this mixture of dyes has also been studied. This type of modification is 15-31%. Two-bath and one-stage combined methods for cooking and bleaching calava containing nitron were experimentally studied.

The output parameters were the degree of whiteness and consistency of the calava, the concentration of alkali, bleaches, surfactants, temperature and process duration. Research shows that the combined one-step method provides 93.2% whiteness and 95% consistency.

The dyeing of 50/50 wool/acrylic yarn with a mixture of monotriazine structural reactive dyes was studied.

Hydrolyzed PAN fiber containing nitroamine and carboxyl groups, and PEF, PA, S-fiber fabrics, fabrics and knitwear at a temperature of 105-140°C, a temperature of 1.5-2 atm. It is washed with water under pressure and then painted in a dye solution with a concentration of amide and carboxylic acid or hydrazine of 0.02-0.06 mol/l.

Information is provided on dyeing polyester and cotton fabrics using a one-stage, one-bath method. Research results have shown that painting can be done under high temperature and alkaline conditions. This method saves time, energy and water, and improves the production efficiency of equipment. As a result of its use, the consumption of the dye is reduced and its hydrolysis is prevented.

Indian scientists show that the cause of uneven coloring of dyed fabrics is the influence of the linear density of the fibers and the degree of maturity. As a result of research, it is possible to obtain an even color as a result of improving the properties of mixed fibers. Even dyeing of chemical fibers was also observed.

Blends of polyester and cotton fiber in different proportions were treated with ultrasound. Dyeing was carried out with various molecular disperse and active dyes. It was compared with the results of fabric dyed using the traditional method. As a result, ultrasonic dyeing of polyester fibers is carried out at low temperatures. Auxiliary substances are used to reduce the volume of wastewater.

When dyeing unfixed 50% (permeability 16-20%) and fixed 50% (permeability 2-4%) mats made of PAN fiber, cationic dye, color-evening acetic acid (pH = 4.5-5), bath temperature 80. at -85°C for

10-20 minutes, and the temperature is increased to 102-104°C at a rate of 1 degree/5 minutes and carried out for 30-60 minutes. Then it is slowly lowered to 40-50 °C and washed for 20-30 minutes.

Among all fibers, cotton ranks high. Elimination of defects in cotton fabrics is achieved by modifying them during the finishing process.

It is reported that the influence of the type of finishing on the aesthetic and hygienic properties of cotton and cotton-polyester fabrics used for clothing has been studied. Twenty samples of different proportions (100% cotton, 67% cotton and 33% polyester, 50% cotton and 50% polyester, 33% cotton and 67% polyester) were subjected to two types of treatments (using starch and elastomers). Washing dimensional change, wrinkle resistance, drapability and breathability were analyzed. Indicators are provided.

A method for producing fabric dyed in different colors using one dye composition has been patented. In this method, individual Synthetic threads of fabric of different orientations, consisting of names, are dyed. A dye bath for dyeing fabrics should consist of at least two categories: high concentration, medium contrast and low contrast dyes. It allows you to obtain multi-colored fabric based on one dye composition. On those parts of the resulting fabric that have the same base color, images of different colors will appear.

It has been shown that it is possible to dye polyester and cotton blended fabrics with disperse dyes using a cross-linking agent and an acid catalyst that reacts with the hydroxy groups of cotton fibers. This ensures that dispersed dye molecules enter the amorphous part of the cellulose. Polyester and cotton blend fabrics can be dyed in the same bath.

For dyeing polyester and cotton blended fabrics, it contains a mixture of dispersed or active and dispersed dyes, nonionic surfactants with anti-migrating, thickening and oxyethyl oxygen-saving compounds, since the aqueous thickener contains sodium salt of stimorol, containing a copolymer of stimorol and maleic acid. anhydride. Nonionic surfactant 9/10 BV with oxyethyl oxygen-preserving compound, its vinyl butyl ether and oxyethylene fatty alcohol, is given in the following components, g/l:

Dye -10-40

Sodium salt of stimorol, copolymer of stimorol and maleic anhydride 8-14

Sitanol 9/10 BV vinyl butyl ether oxyethylene fatty alcohol 1-2

Water up to 1 liter.

There is a known method for dyeing textile fibers and fabrics with natural dyes based on quercetin. Natural dyes based on quercetin contain 65-75% quercetin and 25-35% lignocarbhydrate complex in wood leaves. When processing with this substance, 0.2-4.0% of the dry mass is consumed.

In the dyeing method, a group of inorganic salts is selected according to quality: sodium chloride, ferric chloride, aluminum sulfate, sodium carbonate, potassium dichromate, lead sulfate in an amount of 2% relative to the absolutely dry mass.

It has been established that when dyeing cotton-polyester fibers, a polyester component is used in the workpiece, and for cotton fibers, an active cubic sulfur dye is used. Dyeing is carried out in two stages, since each dye belongs to a different class, so they were carried out in advance. The possibilities of one-stage dyeing with mixed dyes have been studied. Various dispersion dyes have been studied. Most of these dyes are expensive, so their use in enterprises is limited. As a result of the search for dyes, it was found that fabrics made from cellulose fibers can be dyed with some disperse dyes. To achieve this condition, it is necessary to pre-treat the cellulose component with water-soluble solvents, such as dimethylolurea.

Subsequent heat treatment ensures the penetration of the dye into the cotton fiber. This fiber is intended for dyeing with water-soluble disperse dyes, as well as dyes soluble in solvents.

Possibility of dyeing nitron and cotton carpets with active dyes. In it, a modified mixture of nitron and cotton in a ratio of 67:33 was selected as the active dye for dyeing kalavas. When studying the dyeing process, an active dye from the company Ostazin was used. The samples were painted with turquoise, blue, yellow and red paints. When studying the dyeing kinetics, the samples dyed turquoise and blue turned out to be correct. Based on the results obtained, the optimal regime for alkaline dyeing of mixed kalava threads with the specified dye was determined. Based on the results obtained, it was found that the clear color and physical and mechanical properties of the painted samples improved.

Dye a cotton blend blanket in a one bath style. The dyeing of cotton wool blends with dyes such as Lanazol and LS with the presence of the auxiliary substance YDR was studied. The above method showed excellent color rendering and excellent flatness of the mixed canvas.

Study of the physical and mechanical properties of cotton fabric intended for the manufacture of high-quality knitted products.

The production of fabrics consisting of a mixture of natural and synthetic fibers is of interest for increasing the range of knitted products. The physical and mechanical properties of a cotton-nitron mat with elastomeric thread have been studied.

One-step dyeing of polyester and cellulose fibers. A method of dyeing mixed fabric consisting of polyester and cellulose fibers in one dye bath was studied.

Dye mixed knits directly with dye. A comprehensive assessment of the influence of various types of TVV on the color characteristics of cotton-polyamide knitted fabric is given. The results obtained made it possible to divide the dyeing of cotton and polyamide in 1 bath with the tested direct dyes into 2 groups. For each group of dyes, a TVB group has been selected, which allows you to obtain a uniform and intense color on both polyamide and cotton. The concentration, time and temperature parameters of the process of direct dyeing of cotton-polyamide knitted fabric have been optimized.

Dyeing of mixed wool fabrics in a neutral environment with sulfate ethyl sulfanol reactive disperse dyes. Two samples of anionic sulfate-ethyl sulfone reactive disperse dyes were used to dye wool polyester and mixed fiber fabrics at different pH values. Maximum dye release was observed at pH=7. The results show that there is a bisulfate ethyl sulfone group. Reactive disperse dyes are more suitable for dyeing wool and mixed fibers than existing dyes of the monosulfate ethyl sulfone group. All dyed fabrics have good retention properties.

Conclusion

The comprehensive examination of dyeing techniques and fiber modifications for polyacrylonitrile (PAN) and cotton blends highlights several significant advancements and challenges. Acrylonitrile copolymerization with various monomers enhances fiber flexibility and dyeability, addressing the fragility and poor dyeability of homopolymer PAN fibers. The use of cationic dyes, known for their ease of use and vibrant color outcomes, underscores the importance of dye-fiber interactions, particularly the formation of salt bonds for color stability. The necessity of a highly acidic environment for dyeing modified PAN fibers to achieve bright and transparent colors is noted, as well as the role of anionic substances in preventing dye precipitation. Additionally, innovative methods such as the one-bath dyeing process for mixed fibers and ultrasonic dyeing for polyester at low temperatures demonstrate significant improvements in efficiency and environmental impact. The research underscores the potential for optimizing dyeing protocols to enhance the physical and mechanical properties of fibers, suggesting further exploration into sustainable practices and novel dyeing agents to expand the applicability and performance of textile materials.

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