A study of the process of printing patterns on mixed fabric

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Abstract. The article explores the possibilities of printing patterns using pigments in two stages on a cotton-polyester fabric with different fiber ratios. A two-stage pattern printing technology with active and dispersed dyes has been developed to apply withfor cotton-polyester fiber fabrics.

1 Introduction

Fabrics containing cotton and polyester fibers are widely used in the manufacture of body and outerwear assortments for different seasons, depending on the type of fabric treatment, household and special-functional properties. Assortments of cotton-polyester fiber fabrics can be made in the form of dyed or pattern print. In addition to the above-mentioned coloristic properties, the accuracy of the pattern border line on the fabric surface and the fullness of the dye to the fiber structure, while the dye-dyed fabric focuses on the same color intensity, saturation, fluency, resistance to different processing and other coloristic qualities in both fiber constituents. deep) is significant. The coloristic, consumer and technological properties of pattern print fabric depend on the type and quantity of components of the composition of pattern printing dye, the order of the pattern printing process and the fiber ratio. A number of studies are being conducted by domestic and foreign scientists to improve the technology of printing patterms on fabrics containing polyester and cotton fibers and increase the efficiency of the process. Of particular importance in this direction are the studies conducted by A.V. Fevalitin [1]. The author has achieved positive results in the simultaneous implementation of the process of pattern printing and final decoration of fabrics containing cotton and polyester fibers.

In addition, the technology of thermal printing (copying) of fabrics with a mixture of cotton and polyester fibers has been developed, using dispersed dyes with sublimation properties [2]. In the work reported by Chinese scientists [3], pattern printing on a fabric with a mixture of cotton-polyester fibers consists of the following steps: preparation of pattern printing dye, pattern printing itself, fixation of the dye to the fiber macromolecule, washing. Pattern printing dye consists of 1-20% starch thickener, 0.01-2% SAM, 0.02-2% dispersant, 15% active dye, 15% dispersed dye and water. The pattern is drawn on a special paper with pattern print paint. This is passed between the paper and the fabric heated wall, at which point the pattern on the paper passes through the fabric.

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Scientists from the People's Republic of China have also reported in a protected scientific study the technology of printing patterns in a single-step method with a mixture of cotton and polyester fibers in the fabric with active and dispersed dyes [4]. According to the results of the study, first the dispersant dye is thoroughly mixed with the thickener and then the active dye is added, at the same time the electrolyte and the alkaline agent are added to the pattern dye. The heat treatment temperature for fixation of the dye to the fiber is 205-2150S, the duration is 2-4 minutes. Dye that does not react with the fiber substrate is removed from the fabric by washing at a temperature of 1350C. The pattern formed on the surface of the fabric is distinguished by its brightness, resistance to various influences and high utilization rate of the active dye. [5] in the study protected the technology of pattern printing with a mixture of cotton-polyester fibers in the fabric with an active and dispersed dye.

The technology of two-stage pattern printing on cotton-polyester fiber blends with dispersants and active dyes has been reported [6]. According to this technology, the fabric is first printed on the fabric prepared for decoration in a neutral environment, and then dried. The absence of an alkaline agent in the composition of the pattern dye ensures the stability of the active dye. The dried fabric is soaked in a solution containing an alkaline agent and stored at room temperature for a certain period of time in order to ensure the interaction between the dye and the fiber macromolecule. The fabric is then washed and dried. The high color intensity of the patterns formed by this method indicates the full use of the dye. The fixation of the dye in the proposed method is carried out at low temperature, ie at room temperature, which allows maximum use of the dye, which in turn leads to a lower amount of dye in the wastewater - to protect the environment. The disadvantage of the proposed method is the special requirement for the dye, ie it requires a high tendency to fiber, otherwise the background is more likely to stain the fabric soaked in an alkaline solution. Chinese scientists [7] have recommended the addition of citric acid to pattern / dye dyes in cotton / polyester fiber fabrics with flossing and active dyeing. The results of many scientific studies are aimed at the use of pigment compositions in the printing of patterns on textile fabrics, as well as the development of methods for creating patterns of different colors [8]. A number of factors affect the increase in the color of pattern prints on textile products (the tendency of the dye to the fiber, the preparation of the fibers for pattern printing, the fiber structure, etc.). In order to produce high-quality patterns in the classical printing process [9], research has been conducted on the development of pattern printing technology with traditional pigments and active dyes for mixed fiber fabrics containing cellulose fibers.

Polyester and cotton fibers have a wide range of uses due to their unique properties. The hydrophobicity of one of the fibers causes the other to make the products derived from them have high comfort and aesthetic properties. When dyeing textile materials containing hydrophilic and hydrophobic fibers, it is especially important to choose the class of dye or their mixture, the textile excipients and dyeing technology that are part of the dye solution. The use of a combination of dyes in the dyeing of mixed fiber materials allows for intensive and smooth coloring [10].

2 Methods

The object of the study are samples of fabrics containing cotton and polyester in various proportions, which consist of cotton (Namangan-77) and polyester (polyethylene terephthalate grains produced in South Korea, created by the Reprocessing Uz JV). Quality indicators of printed materials: color intensity, color flatness according to the method, color fastness to washing are determined according to GOST 9733.4-83, color fastness to abrasion - according to GOST 9733.27-83.

3 Results and discussion

It is known that high-quality patterns can be formed in cotton fiber fabrics with active, cubic and water-insoluble dyes, and in polyester fiber fabrics with dispersed dyes. As the fabrics in the studied range are intended for outerwear, cubic dyes that are considered to be less resistant to abrasion and water-insoluble dyes that have low performance under the influence of water treatment were excluded from the scope of the study. Three xi containing cotton and polyester fibers

The possibility of applying active and dispersed dyes for the process of printing patterns on fabrics in the range was studied. The process of printing patterns on fabric samples containing 100, 75, 57, 44% cotton fiber in a single-stage evaporation method with the active dye was studied. Chemactive RED W-3B was selected as the active dye. This dye has a complete structure and is easy to penetrate into a hydrophobic fiber device. The quality of the pattern printing process is assessed by the accuracy of the pattern border line that falls on the fabric, the depth of the pattern, the color intensity, and its durability to various processing. The following table shows the quality indicators of pattern printed samples on a fibrous fabric mixed with an active dye by the single-stage evaporation method of the scientific work.

Table 1. Quality indicators of pattern printed samples on fibrous fabric mixed with active dye

Specimen Cotton/ polyester	Quality indicators of pattern printing					
	Abrasion resistance, in points, ball		The accuracy of the pattern border line,%	Colour intensity, K/S		Soap resistance, ball
	Dry	Wet		Front side	Back side	
100% cotton	4.5/4	4.5/2.5	101	25.5	25	4/4/3
75/25	4.5/5	4/2.5	105	13,5	9	3/4/3
57/43	5/5	4/3	110	12	10	3/4/3
44/56	5/5	5/3.5	117	16	12	3/4/3

From the given results we can observe a decrease in the accuracy of the pattern boundary line and the resistance of the color to abrasions when the patterns is pressed by evaporation with active dyes. However, the deeper penetration of the dye into the fabric structure ensures that the colors formed with the active dye are more resistant to light. The abrasion resistance of the resulting pattern color has a small value as the amount of polyester fiber in the mixture increases, which means that large molecules of the active dye are absorbed into the fiber surface without entering the dense polyester fiber structure. Also, because the polyester fiber device did not loosen during evaporation, the dye did not fully enter the hydrophobic fiber device. In the next stage of the work, an intensifier was added to the composition of the pattern press dye to loosen the hydrophobic fiber device. The Ves TP 0918 intensifier from Veskim was used as an intensifier

Table 2. Effect of intensifier - Ves TP 0918 on color quality indicators

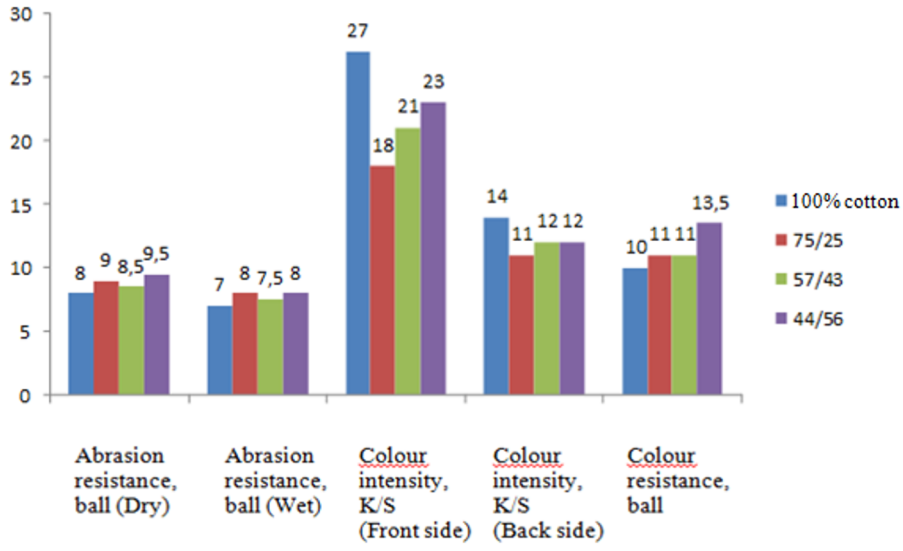
Specimen Cotton/ polyester	Quality indicators of pattern printing					
	Abrasion resistance, in points, ball		The accuracy of the pattern border line, %	Colour intensity, K/S		Soap resistance, ball
	Dry	Wet		Front side	Back side	
100% cotton	4.5/4	4.5/2.5	101	26	25	4/4/3
75/25	4.5/5	4/2.5	105	14	13	3/4/3
57/43	5/5	4/4	108	18	11	3/4/3
44/56	5/5	5/4	112	18	12	3/4/4

The results show that when an intensifier is added to a pattern print paint, the abrasion resistance of samples containing a large amount of polyester fibers is slightly increased, but the remaining parameters do not meet the standards. In order to increase the strength of colors in soapy samples, it was planned to increase the alkali concentration in the dye, which increased the covalent fixation of the dye to the fiber (Table 3).

Table 3. Dependence of color strength on alkali concentration

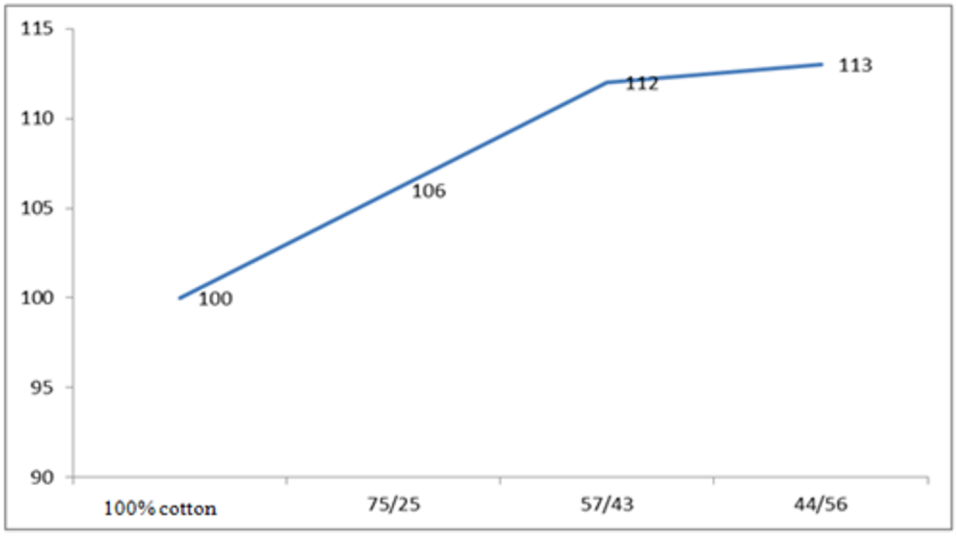
Alkali concentration, g/kg	Mixed fiber samples, cotton/polyester, ball			
	100	75/25	57/43	44/56
13	4/4/3	3/3/3	3/4/3	3/4/4
15	4/4/3	3/4/3	3/4/3	3/4/4
17	5/5/4	4/4/4	3/4/3	3/4/4
19	5/5/4	4/4/4	4/4/3	4/4/4

Although the strength of the samples to the soapy treatment was slightly increased, the accuracy of the pattern boundary line was not increased in the mixed fiber fabric samples. In subsequent studies, the possibility of printing patterns in a single step with a dispersant and active dye was studied. In this case, in contrast to the single-stage patterns printing method with dispersant and active dye, the patterns printing process was carried out by the method of thermal treatment at 190-2000S after the patterns was dried by printing. The quality indicators of pattern printed samples with active Chemactive RED W-3B and dispersed purple color mixtures are given in Fig. 1.



a)

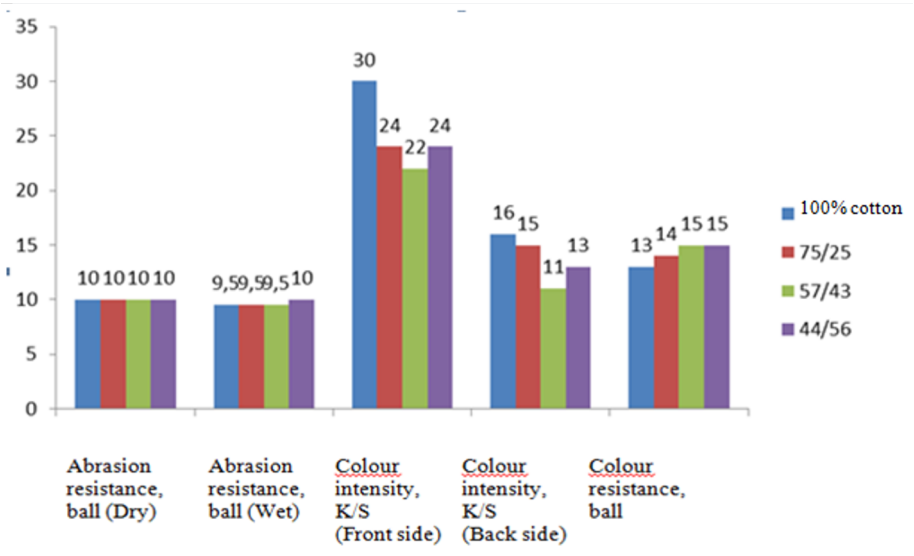
The accuracy of the pattern border line, %



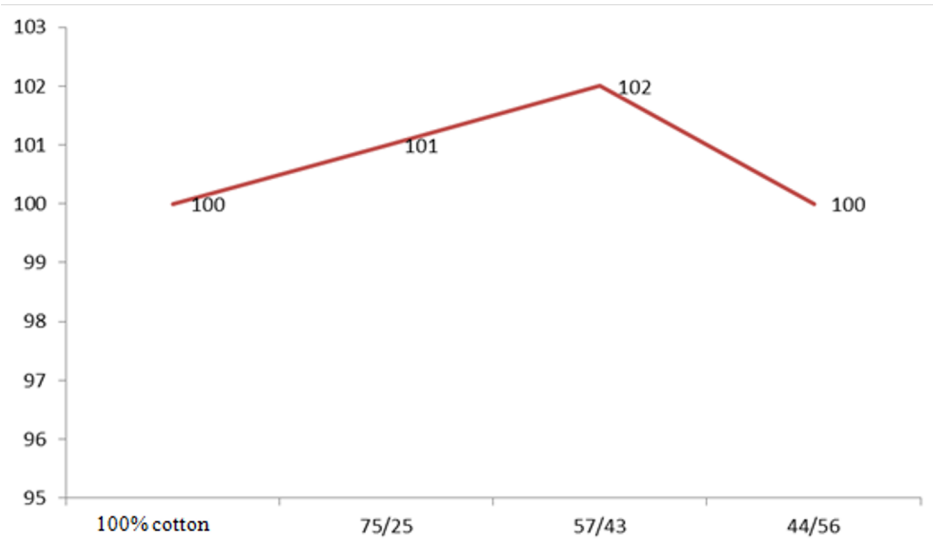
b)

Fig. 1. Quality indicators of floral printed samples with Active Chemactive RED W-3B and dispersed purple color

The data presented in the table show that it is possible to obtain high-intensity colors when printing patterns in a single step with two classes of dyes. However, the low boundary line accuracy and low color fastness indicate that the active dye is hydrolyzed and the amount of covalent bonding with the fiber is low due to the presence of an alkaline agent in the floral print dye. Therefore, in subsequent studies, a sequence of heat treatment was applied by removing the alkaline agent from the composition of the patterns dye, printing the patterns in a neytral medium on the samples, and then soaking them in an alkaline solution.



a)



b)

Fig. 2. Quality indicators of samples impregnated with alkaline solution by printing patterns with active Chemactive RED W-3B and dispersed with purple color mixtures.

4 Conclusions

According to the results of the study presented in the table, a two-stage method of printing patterns with active and dispersed dyes is proposed for three different assortments of fabrics containing different proportions of cotton and polyester fibers. In this case, when a pattern is pressed on the fabric surface with a floral dye in a neutral medium, the dye molecule is absorbed evenly on the fabric surface and diffuses to the active centers of the fiber. Diffusion of the dye molecule into the fiber continues until equilibrium is established in the system. When the patterns-dried fabric is soaked in an alkaline solution, covalent bonding of the dye molecules located at the active centers of the fibers with these active centers occurs. Therefore, the color fastness of the formed patterns and the accuracy of the boundary line of the patterns showed a positive result. In addition, the absence of an alkaline agent in the dye reduced its hydrolysis, resulting in a slightly higher color intensity of samples containing more cotton fiber.

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