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THE ROLE OF SURFACTANTS IN THE BLEACHING PROCESS OF NATURAL FIBER TEXTILE PRODUCTS

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Abstract: In the article, a continuous method of preparing cotton-silk mixed fiber satin and canvas fabrics for finishing is studied. In the research, the effects of properties and concentration of surfactants included in the preparation bath for finishing on the whiteness level and capillarity of fabrics were studied. It was found that the quality indicators of fabrics are higher when anionic surfactants are used in a concentration of 1.5 g/l, and nonionic surfactants (AQUASOFT-HT) are used in a concentration of 1 g/l.

Key words: Cotton, silk, capillarity, surfactant, degree of whiteness, continuous method, concentration.

Introduction. In the textile industry, cotton and silk fibers are mixed in different proportions to produce high-quality shirting, suiting fabrics and knitted fabrics. These fabrics are given high quality, beautiful appearance, firmness, wrinkle resistance, non-penetration through silk fiber, and light fastness, softness and affordability through cotton fiber [1]. Cotton-silk fabrics with their hygienic properties are superior to clothing and costume fabrics created on the basis of almost all artificial and synthetic fibers. In order to properly organize the process of preparing cotton-silk mixed fabrics for dyeing and flower printing, it is necessary to solve the problem of creating a finishing technology that takes into account the composition and chemical properties of both natural fibers. There are many different processes used in the finishing of yarns, and different types of equipment are used to carry out these processes. Depending on the type of gas produced and for what purpose it is used, they are given a different finish. These are the processes for yarn spinning: calcining, degreasing, boiling, bleaching and mercerizing. Desalination is usually combined with boiling. In the process of boiling, cotton cellulose, along with cleaning of impurities, also undergoes a change in its supramolecular structure. The composition of the boiling solution consists of caustic sodium (NaOH), sodium bisulfite ($NaHSO_3$), surfactant, sodium silicate ($Na_2SiO_3 \cdot nH_2O$) solutions. In the first stage of the boiling process, the textile material first boils, then soaks the alkali, and in the next stage, chemical reactions occur between the caustic sodium and the accompanying substances. In this case, pectin substances are hydrolyzed, become soluble in water and completely leave the fiber. Nitrogenous substances, that is, proteins, are hydrolyzed to form amino acids, which in turn combine with caustic sodium to form water-soluble salts. Minerals are washed away. Approximately 40% of waxy substances are hydrolyzed to form sodium salts of fatty acids. The rest of the waxy substances are removed from the fabric by emulsification with the help of Surfactants. Surfactants reduce fiber wetting and solution penetration into the fiber. Various catalysts were proposed to accelerate the boiling process: turpentine, amines, alcohols, anthraquinone and its derivatives, Leonil EV substance (BASF, Germany) and others [2].

Literature analysis. The analysis of the works published in the literature in the last 5-10 years showed that [3,4], there are very few works on the finishing of cotton and silk mixed fabrics [5], but there are a lot of scientific researches on threading and preparation of silk fabrics

for dyeing and embroidering, and they based on which there are technologies put into practice [6,7].

Continuous, semi-continuous and continuous methods of preparation for dyeing and dyeing of raw yarn are known, cleaning of a number of satellite substances and axor located in the outer shell of cotton fiber is mainly carried out in the processes of boiling and bleaching [8]. In the process of boiling, it can be done by boiling the cloth in a boiling solution of sodium alkali, surfactant, sodium silicate and a weakly reducing sodium hydrosulphite for 3-5 hours, or by steaming the compressed cloth soaked in this solution and leaving it for 8-12 hours, depending on the method. In such conditions, the silk fiber loses its strength. One of the most environmentally friendly and effective bleaching methods for cotton fiber fabrics is the hydrogen peroxide method.

In practice, cleaning of silk from sericin and other related substances is carried out using soap and soda method. In this case, 7-14 g/l of soap is obtained in the classical method and boiled for 1-3 hours, depending on the type of silk fabric. In recent years, in order to reduce the boiling time, it is proposed to increase the amount of soda in the solution to 3-5 g/l and to use effective surfactants instead of soap. In view of the above, the following was adopted as the basis of research on creating the most optimal technology for dyeing and preparing cotton-silk mixed fabrics for flower printing: combined boiling bleaching method, sodium carbonate as an alkaline agent, hydrogen peroxide was selected for bleaching, as well as for emulsifying waxy substances in fibers. the effects of a number of anionic and nonionic surfactants were studied. It is known that the standard capillarity of cotton fiber products should not be less than 130 mm/hour, to achieve this, it is necessary to ensure that cotton threads are perfectly cleaned of waxy substance and ash. In order to increase the effectiveness of the combined method, the use of enzymes that purify the starch of the axar starch in the boiling solution gives a positive result. The cotton fabric was treated with a solution of surfactants with 3 different cations (4.11×10; 7.62×10) Cellulose textile fabrics were dyed with three active dyes (blue 263, red and yellow 208) and with and without electrolyte (NaCl, Na_2CO_3) in the presence of surfactants with acryltrimethylammonium bromide with carbon number 12-16. The chemical structure and size of the surfactants and dye molecule has a significant effect on its binding to the fabric. When the fabrics are treated with cationic surfactants, the permeability of the dye from the solution to the fiber increases, while the total binding decreases when dyeing with red and blue dyes. Complexes are formed with dyes with 12-trimethylammonium bromide [9]. When nonionic surfactants (with ethoxylated higher alcohols S 9-18) in a concentration of 0-2.5 g/l was studied for the sorption index of the active dye, it was found that surfactants in the dye bath change the dye spectral properties, breaks down aggregates and algomerates, and create surfactant-dye micelles. NaCl has an effect against the formation of such aggregates [10]. The theoretical and practical aspects of the effect of surfactants, which are new acrylamine products released in the form of cationic electrolytes, on the color fastness of textiles dyed with active dyes were studied. According to the results of the experiment, the economic and environmental efficiency of the process increased, the dyeability of active dyes, the quality indicators of the dye and fabric color improved, and the theoretical and practical aspects of the binding of the dye to the fabric were worked out. [11].

Experimental part. As the object of research, two types of mixed fabrics of satin and canvas were used, consisting of silk for the warp threads and cotton fibers for the yarn threads, the fiber content of the satin fabric is 66.3% silk and 33.7% cotton, and the fiber content of the

satin fabric is 26% silk and 74% consists of cotton fiber. Table 1 shows the technology and conditions of the preliminary preparation process.

Table 1

Initial technological conditions

Technological processes	Chemical substances	Concentration, g/l	Temperature, °C	Time, min
Boiling	Na_2CO_3 Surfactants: Sulphanol or Metaupon H_2O_2 Na_2SiO_3	3, 5, 7, 10 2 2 1.5 30	95	30
Washing			40	10
Drying			20	

At the initial stage of research, the effect of sodium carbonate concentration on the quality parameters (capillarity and whiteness level) of cotton-silk fabric preparation based on the selected technological conditions was studied. The obtained results are presented in table 2.

Table 2

Na_2CO_3 to the capillary level of cotton-silk blend fabric

effect

Na_2CO_3 concentration, g/l	Capillarity, mm/h	Degree of whiteness, %
3	123/126	86.2
5	128/135	88.7
7	129/137	89.0
10	129/139	90.0

Note: sulfonol in the numerator, metoupon in the denominator

As can be seen from the results in table 1, high capillarity of the fabric can be achieved at a concentration of Na_2CO_3 of 5 g/l. And from surfactant, metaupon removes the waxy substances contained in cotton well. The influence of the concentration of anionic surfactants metoupon and sulfonol with a boiling-bleaching solution based on a selected concentration of Na_2CO_3 of 5 g/l was studied, where surfactant: 0.5; 1.0; was added at 1.5 and 2.0 g/l. Other conditions were captured as in table 2. The obtained results are presented in Figure 1.

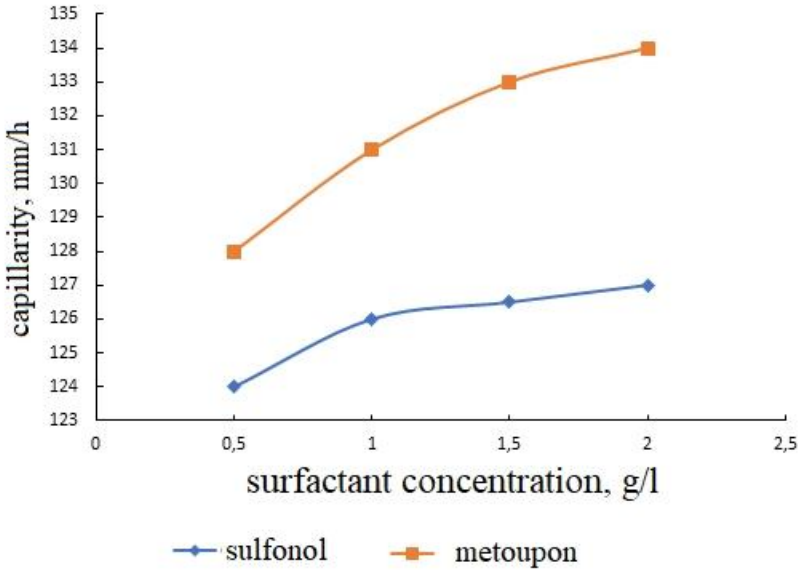

Figure 1. Effect of anionic surfactants concentration on the capillarity of composite fabrics

As can be seen from Figure 1, the fabric capillarity increases with the increase of surfactants concentration in the boiling solution, especially for metoupon, the increase is more dramatic. But the growth slows down from 1 g/l for sulfonol to 1.5 g/l for metoupon.

Table 3

The influence of the nature of anionic surfactant in the solution on the quality indicators of the fabric

Surfactants	Concentration, g/l	Degree of whiteness, %	capillaritymm/h	Tensile strength, N	Elongation %
metoupon	1,0	80,7/78,1	195/65	184/261	23/12
sulfonol	1,0	80,7/79,6	135/45	193/347	21/16

Note: the numerator of the fraction is for cotton fiber, the denominator of the fraction is for natural silk fiber

The results presented in table 3 show that under the studied conditions, the whiteness of the fabric is not satisfactory, especially for natural silk, and capillarity is high for cotton fiber but low for silk fiber.

In further studies, the effect of nonionic surfactants in the boiling-bleaching solution: AQUASOFT-HT and OP-10 on fabric quality indicators was studied (Figures 2 and 3).

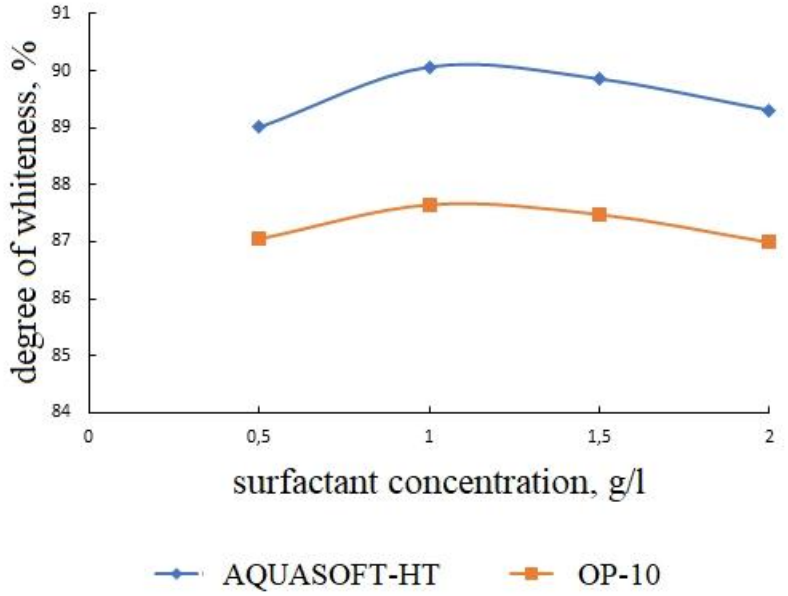

Figure 2. Effect of surfactant's nature on fabric whiteness

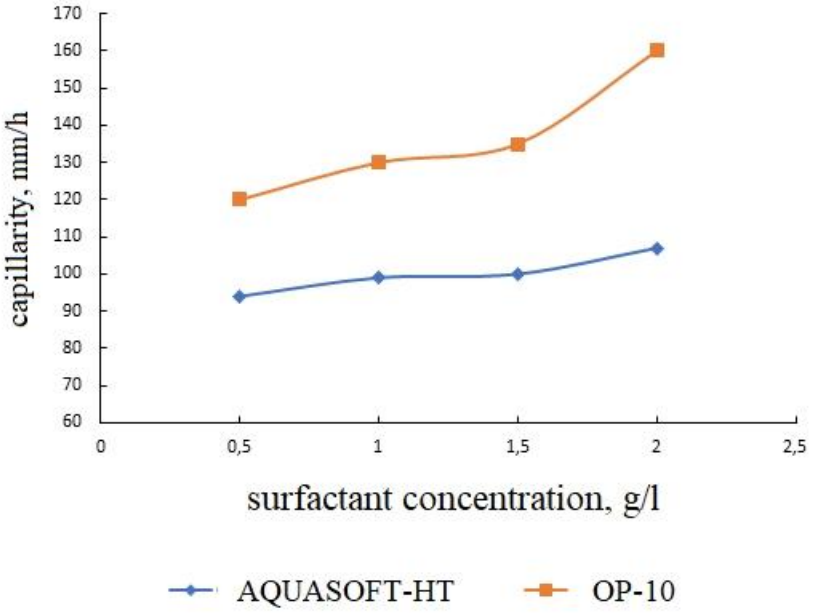

Figure 3. Effect of surfactant's nature on fabric capillarity

The results show that a high level of fabric whiteness and capillarity can be achieved when AQUASOFT-HT is used as a surfactant. Therefore, in the following experiments, AQUASOFT-HT was used and its concentration was taken as 1 l based on the above results.

Summary. The finishing process of satin with 66.3% silk thread, 33.7% cotton thread and linen mixed fiber fabric with 26% silk and 74% cotton fiber was analyzed. In the research, the effect of the nature and concentration of the alkaline agent Na_2CO_3, anionic and nonionic surfactants on the quality of preparation for finishing was studied. The whiteness and capillarity indicators

of the fabrics at a concentration of 5 g/l of Na_2CO_3, at a concentration of 1.5 g/l in the bleaching bath with metoupon from anionic surfactants, at a concentration of 1.0 g/l from nonionic surfactants at a bath with AQUASOFT-HT a high result was achieved.

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