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STUDY OF THE INFLUENCE OF PREPARATION OF KNITTED FABRIC ON THE SUPRAMOLECULAR STRUCTURE OF COTTON FIBER

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Preparation is an important technological stage of cotton knitted fabric finishing. It is at this stage that the basic properties of the textile material are formed, which provide not only the quality of the subsequent dyeing and final treatment, but also the hygienic properties of the finished products. These are primarily sorption properties that cotton knitwear gets after the removal of natural and technological impurities in the conditions of the preparation process. Sustained whiteness is another of the basic properties that a knitted fabric gets after preparation, and is an important quality indicator of this range of textile materials.

The classic preparation technology of the cotton knitted fabrics includes boiling and bleaching, which are carried out sequentially. The boiling is carried out in an alkaline or neutral medium in the presence of surfactants. Alkaline solutions of hydrogen peroxide are most often used for bleaching.

Currently, technology of the cotton knitwear preparation aimed at reducing time, temperature and water consumption. For this purpose, intensification of the preparation processes using physical, biological and chemical methods is carried out.

The simplest and most effective way to intensify the technology of boiling and bleaching of cotton knitwear is the use of chemicals that can speed up the process of removing associated impurities of cotton and give the cotton textile material capillarity and whiteness at low treatment temperature.

A promising direction of resource saving is combination of boiling and bleaching. According to the results of previous studies, the combined preparation technology of cotton knitted fabric was developed [1, 2]. It has been established that the developed preparation principle for cotton knitted fabric promotes the maximum removal of wax-like and colored substances from textile material and, as a result, increases capillarity and whiteness. The strength of knitwear decreases slightly. This became possible due to the application of the previously developed highly effective surfactants composition, which allows to combine the operations of boiling and bleaching and to carry out the preparation process at a reduced temperature of 80°C.

As a result of the research [3], it was established that the developed preparation technology affects the sorption kinetics and the fixation degree of the reactive dyes by cotton knitted fabric. The developed preparation method has advantages in comparison with the base one, which consist in the combination of boiling and bleaching. The reduction of the processing temperature from 100°C to 80°C ensures efficiency of the developed technology.

One of the reasons for the increase in dyes sorption by cotton fiber can be its damage due to excessive oxidation of cellulose of textile material with hydrogen peroxide during bleaching or during undesired oxidative destruction of the

substrate by oxygen of the air during boiling. As a result, the polymer chains of cellulose are broken, and the degree of polymerization reduces. At the supramolecular level, the degree of crystallinity decreases and the volume of amorphous regions increases. This in turn causes an increase in the sorption capacity of the fiber, including in relation to dyes. It should be noted that the obtained colors on a cotton substrate that was damaged during the preparation process are characterized by reduced resistance to physical and chemical influences, despite the intense sorption of the dye. In addition, the textile material loses strength, which is exacerbated during the operation of finished products.

The goal of the work is to study the changes in supramolecular structure of cotton fiber cellulose under the influence of the developed preparation technology of knitted fabric.

Study was carried out on grey cotton rib knitted fabric 1+1 with surface weight 150 g/sm². Preparation of knitted fabric was carried out according to the following preparation methods: alkaline boiling, basic combined boiling and bleaching technology, developed preparation technology.

When analyzing X-ray diffractograms of knitted fabric, it was revealed increase in the amorphous fraction of cellulose in the of the knitted fabric sample prepared according to the developed technology. This fact explains the increase in the sorption ability of the cotton knitwear specified sample.

The results of determining crystallite sizes in the volume of the cotton knitted fabric samples indicate that large and possibly defective crystallites have grey knitwear and knitwear prepared by the basic technology. For samples of cotton knitwear, prepared by the developed technology and by the method of alkaline boiling, the presence of smaller ordered crystallites is characteristic.

A quantitative analysis showed that the parameters of fibers diffraction of cotton knitwear that was prepared by the developed technology and by the method of alkaline boiling are characterized by the presence of smaller sized ordered crystallites. The relative level of crystallinity at the same time is the lowest among the studied preparation methods in comparison with the grey knitted fabric sample.

Literature

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