

Development of a Polymer Composite Composition for the Process of Dyeing Silk Fibers with Acid Dyes

Mutalipova Diloromkhon Bakhtiyorjon Kizi, Karomatov Sardor Aminovich

Teacher of the Department of organic and physiolloid chemistry of Bukhara State University

Annotation:

A detailed study of all stages of the manufacturing process (including the final finishing) of silk fabrics and the identification of patterns of colloidal chemical processes occurring during the boiling of raw silk in solutions of surfactants and enzymes, as well as the intensification of the process of dyeing the threads of the base of silk fabrics with active dyes, is important due to the need to choose optimal conditions for their implementation, ensuring the stability of the quality characteristics of finished products and increasing labor productivity and equipment.

Keywords: optimal technological modes, packing density, periodic method

On the other hand, only on the basis of studying the physico-chemical properties of fibroin, which undergoes significant changes during welding, dyeing and final finishing, it is possible to correctly establish the optimal technological modes of the above finishing processes. In this work, which initially had a practical orientation, certain efforts were focused on the study of the physico-chemical properties of natural silk, in order to clarify the patterns of changes in these properties in finishing processes.

A qualitative and quantitative method for the determination of sericin in raw materials and intermediates has been developed; a new scientific approach to the physical and chemical modification of silk with strong dyeing of the bases of abr fabrics with active dyes using enzymes, bifunctional compounds and cationic oligomers has been developed; the regularities of the process of dyeing silk with ctpv dyes in the lining and from mixed dye solutions have been studied.

The author defends: a) the scientific direction - the theoretical and technological justification of the methods of intensification of the technological technology for the manufacture of silk fabrics from natural silk; b) the solution of the national economic problem - the creation of a new chemical technology for the preparation of abr fabrics from natural silk, which ensures an increase in the efficiency of production and quality of finished products; c) established patterns, generalizations and results achieved.'

The personal contribution of the author is estimated by the fact that throughout the entire period of the work he carried out scientific guidance of the main theoretical and technological research, practical developments. And the introduction, creation of an improved chemical technology for the manufacture of silk fabrics "Khan-Atlas", considered in this dissertation. The author was directly involved in the formulation of the research task and in the discussion of the experimental work, which was carried out in co-authorship, including the analysis and registration of the results in the form of an application for an invention, scientific reports and publications.

The methodological part presented includes the characteristics of the materials used, methods of processing and preparation of samples, research methods. Along with the known methods of analysis, a new colorimetric method developed by us for the qualitative and quantitative determination of sericin in silk, using metal-complex monochlorotriazine dyes, is presented. The method is based on the difference in the packing density of the structural elements of silk protein substances.

The non-standard conditions of feeding and the variety of existing technological modes of primary processing of cocoons and cocoon winding and violation of these conditions predetermine the heterogeneity of the composition of raw silk and the structural features of silk protein substances. One of the important conditions for obtaining high-quality silk thread in the process of decoction is to ensure the stability of the amount of residual sericin, with its different content in the original raw silk, as well as the effect of sericin content on the packing density of silk structural elements.

In this regard, it becomes relevant to systematically study the process of boiling raw silk in solutions of various synthetic surfactants and proteolytic enzymes, to establish optimal parameters that ensure the amount of residual sericin 4-6%, the influence of these parameters and the nature of the de-gluing agent on the structure of natural silk and the mechanism of their action.

An increase in the concentration of surfactants to 5 - 10.0 g/dm³ -although :contributes to the removal of sericin- up to a content of 4->% on silk, but at the same time the subsequent washing becomes more complicated. In whole solutions (pH 10.0), especially with the introduction of 1ionic surfactants, the rate of sericin removal increases significantly. This is due to the amphotericity of sericin as a fir-tree substance, the hydrolysis of which is enhanced by the combination of ionized salts with alkalis. Comparison of : inetic curves of raw silk decoction in solutions [azlic surfactants, allows us to conclude that the hydrophobic part of their molecules plays a decisive role in that process. In identical media of anionic surfactants, a lower rate of removal of yericin is characteristic of soap solution, and from nonionic IAB PEG-115. The presence of a developed hydrophobic part of the molecules:ieionic surfactants, such as Prevocella WO F-100 and tearox-6, enhances their wedging effect in the places of contact of hydrophobic regions of fibroin and sericin, facilitating the separation of the latter in the form of large formations of surges), which are then hydrolyzed in the cooking liquid. >this explains the characteristic feature of decoction in solutions of kinetic surfactants - rapid removal of sericin in the initial stage of the process to its content in silk of 6-12%, depending on the chemical nature of the exfoliating agent shs.1.). On the "vacant places" formed as a result of the rupture of sericin particles, molecules are immediately sorbed [AB with the formation of a new adsorption layer on the surface of silk, protecting it from further hydrolytic decay (Fig.2.). Moreover, the degree of glca protection depends on the nature of the hydrophilic part of the surfactant, when boiled in stearox-6 solution, there are no significant imputations of the molecular weight characteristics of fibroin, as shown in Table 2, "the characteristic viscosity of solutions of silk tiles boiled in • these conditions have a higher value.

Methods of sorption of water and dyes . the supramolecular structure of silk obtained by various methods was evaluated. As a result of the study of the isotherm of water vapor sorption, it was found that the values of the specific surface area, total pore volume, and average pore radius (gsr) of silk de-glued with enzyme and Stearox-6 are higher compared to silk obtained by the soap-soda method. These data, as well as higher values of the diffusion coefficient of the Active bright red 5CX (almost 2 times) and the evenness of the color (1.5 times) for enzymatic de-gluing silk, indicate that under the action of enzymes, not only the acceleration of the sericin hydrolysis process occurs, but also a significant restructuring of the structure of the amorphous part of the fiber. The difference in the packaging of the structural elements of silk obtained by de-gluing in surfactant and enzyme solutions was also evaluated by the methods of DTA, DTGA, TG, X-ray diffraction and double refraction.

Initially, a careful selection of brands of active dyes that meet the requirements of Khan-Atlas production in terms of coloristics and coloring ability was carried out. It was found that the degree of use of various active dyes in the dyeing of the bases of silk fabrics ranges from 24.2... up to 75.2% and the vast majority of brands have this figure below 50%. To increase the efficiency of the use of active dyes when dyeing the bases of silk fabrics by the periodic method and the "Scythe-buoy" method, the following were investigated:

1. Physical modification of natural silk by preliminary enzymatic treatment of textile threads;
2. Introduction of a bifunctional compound into the dye solution for the purpose of chemical fixation of a hydrolyzed dye on silk;
3. Pinning on. the silk of the sorbed dye with new cationic preparations.

The range of the catalytic action of maltavamorin under the influence of active dye molecules shifts towards higher temperatures by 25 - 32 ° C. Such an increase in the thermal stability of the enzyme under the action of the dye is indirect evidence of the formation of an intermediate complex more active than the dye molecule: dye-enzyme. The formation of the complex, on the other hand, contributes to the stability of the tertiary structure of the enzyme and its thermal stability.

Of particular interest in the technological plan is the implementation of active dyeing of the bases of abr fabrics with active dyes by preliminary activation of silk in a solution of maltavamorin. At the same time, there is no need for careful selection of the enzyme for each brand of dye due to the specificity of their action. The paper shows that when dyeing activated silk in a solution of maltavamorin, concentration 0.5 g / dm³, at a temperature of 25 ° C and pH 3, (5 for 5-8 hours (combined with the soak of the bases of abrov fabrics), the degree of fixation of various active dyes increases by 3.6...55%, and there are no changes in physical and mechanical properties. This made it possible to develop an accelerated acidic .the method of dyeing the basics of silk fabrics.

The shift of the absorption band in the electronic spectrum and a decrease in the absorption intensity when the active dye ethylene chlorohydrin is introduced into the dye solution, especially with an increase in its concentration and after temperature-time treatment, are associated with the reaction of "crosslinking" dye molecules with a bifunctional compound. A sharp decrease in the values of YAG chromatograms of solutions of active dyes containing ethylene chlorohydrin, as well as glycine and ethylene chlorohydrin compared to the initial solution confirms the above. The

results of chromatographic studies .It was shown that active dyes in all forms react with ethylene chlorohydrin: in active, partially and completely hydrolyzed. Glycine reacts mainly with the active form of the dye.

A new qualitative and quantitative method for determining the sericin content in silk based on a colorimeter has been developed in sulfuric acid sols of natural silk dyed with metal-containing monochlorotriazine active kraen gel. providing the possibility of analytical control of sericin content in raw materials and intermediates.

A comparative study of a number of physico-chemical properties of silk after. treatment with ethylene chlorohydrin and cationic fixative. It has been established that when fibrin interacts with the above substances, disorientation of structural elements does not occur.

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