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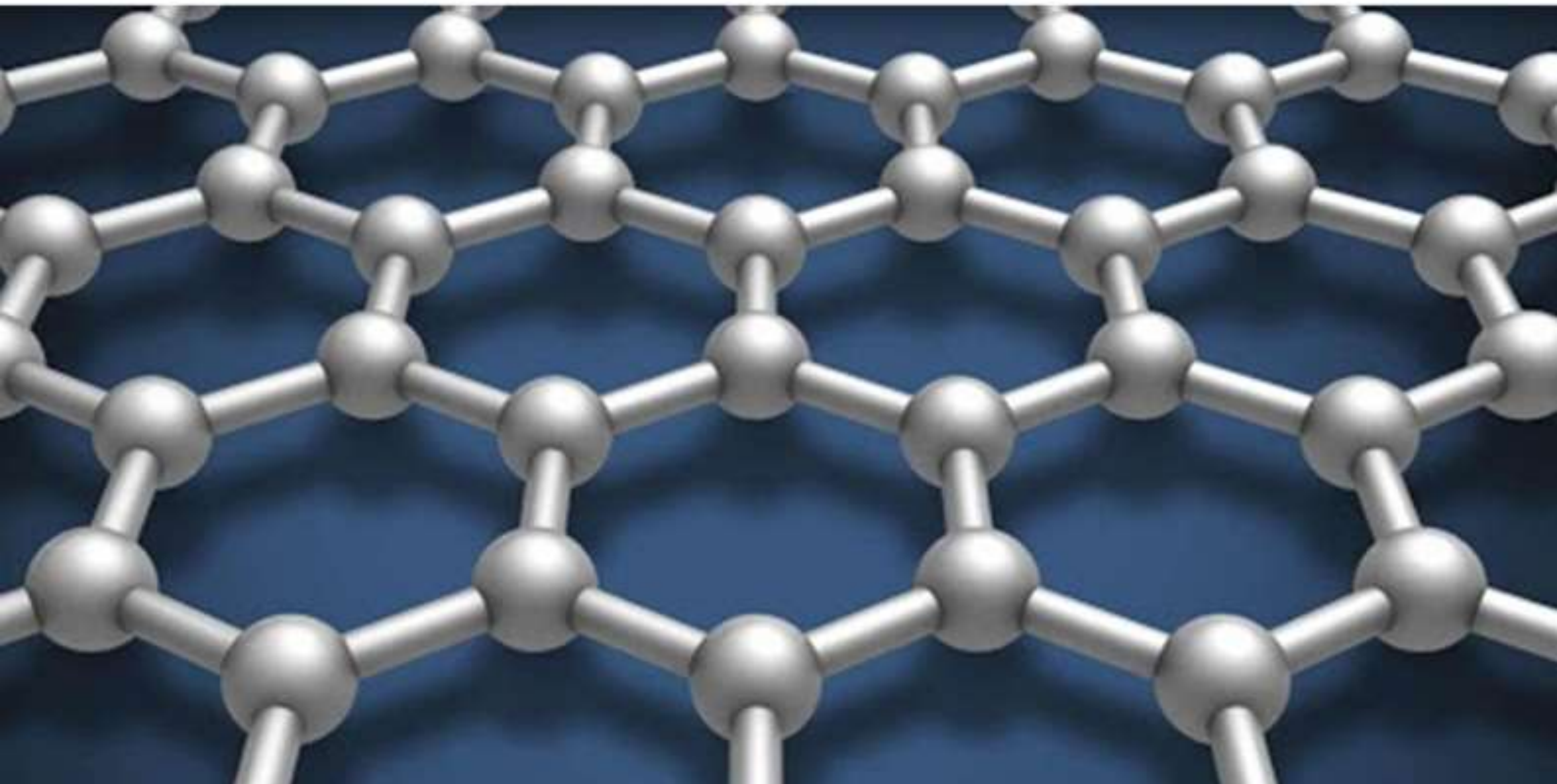

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DIFFERENT METHODS FOR OBTAINING OF CHITIN AND CHITOSAN FROM APIS MELLIFERA AND THEIR USE IN THE COLORING PROCESS OF FABRICS

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Recently, due to the growing requirements for the quality of manufactured products, there has been a tendency to create economical and resource-saving technologies that make it possible to obtain competitive textile products [1].

To improve the quality of textile products, you can use the natural polymer chitosan, obtained from completely renewable raw materials –crayfish krill, crabs and other crustaceans. Its use is known for coloring of cotton fabrics with direct and active dyes to improve the dyeability of textile material [2].Chitosan is a biologically active polysaccharide of natural origin, which has a complex of valuable properties in practical terms and attracts the increasing attention of researchers around the world. The interest of specialists working in the field of textile chemistry in chitosan is high due to its properties such as biodegradability, non-toxicity, good film-forming and thickening properties, and the ability to fix without reagents on natural fibers. Due to these properties, chitosan can be considered a promising finishing material for refining textile products and imparting new special properties to them [3].Chitosan is the most well-known and studied water-soluble derivative of chitin. Chitin is a natural biopolymer of animal origin, which is second only to cellulose in terms of prevalence and is reproduced from completely renewable natural raw materials.

Chitin is part of the supporting tissues and external skeleton of arthropods (crustaceans, arachnids), insects, and algae, where it is found in a complex with mineral salts [4]. However, despite its availability, the practical use of unmodified chitin is constrained by its poor solubility. There is no standard process for chitin (ChT) deacetylation, however, most traditional methods use concentrated solutions of sodium hydroxide in a wide range of concentrations from 35 to 50 %, temperatures from 20 to 140 ^{0}C, hydromodules from 3:1 to 10:1, treatment times from 0.5 h up to 10 days. Chitin can be obtained in various ways: chemical, biological, electrochemical, etc.

1. The chemical methodis based on deproteinization, demineralization and depigmentation using chemical reagents - acids, alkalis, peroxides, etc.

Demineralization is usually carried out using hydrochloric acid (HCl) at normal temperature to reduce the risk of hydrolysis of the chitin chain. The bleaching method for chitin is the process of bleaching with hydrogen peroxide (H_2O_2) in case there is a need.

2. The biotechnological method involves the use of enzymes for deproteinization of raw materials, for demineralization and chemical reagents for depigmentation.

To achieve a high degree of deproteination, the most effective methods are those involving the use of enzymes and enzyme preparations of microbiological and animal origin, such as pancreatin, acid proteinases, alkaline proteinases.The most interesting direction for obtaining chitin is the process of lactic acid fermentation of the shell. As a result of this process, the degree of deproteinization and demineralization of chitin is 90 and 80 %, respectively.

3. The electrochemical method is an alternative to the chemical and biotechnological ones, which makes it possible to obtain chitin of a sufficiently high degree of purification and nutritionally valuable proteins and lipids in one technological process.

The essence of the technology for producing chitin by the electrochemical method consists in carrying out the stages of deproteinization, demineralization and providing shell-containing raw materials in the form of a water-salt suspension in electrolyzers with an original design under the influence of an electromagnetic field, a directed flow of ions and a number of low molecular weight products formed as a result of the electrolysis of water H^+ and OH^- ions , which determine the acidic and alkaline reactions of the medium and its redox potential, respectively.

The complex of the analyzed sources makes it possible to obtain natural polysaccharide chitin with a number of unique properties, due to the fact that it is an intermediate polymer in the synthesis of a widely used chitosan derivative, which has its own biological activity, reactivity and film-forming properties.

The process of deacetylation of chitin has a number of features. For example, for the synthesis of highly deacetylated chitosan, a tenfold molar excess of NaOH is required, and the deacetylation process proceeds most rapidly during the first hour of the reaction, when the degree of acetylation (DA) reaches 0.15, then the reaction slows down and achieving lower DA values requires additional treatments or re-treatment with sodium hydroxide solution.

The harsh conditions of the deacetylation reaction cause:

- polymer degradation;
- change in its supramolecular structure;
- environmental pressures on the environment;
- a significant increase in the cost of chitosan, limiting the possible areas of its use.The reason for the difficulty of deacetylation to below 0.2-0.25 is the ordered supramolecular structure of chitin and the inaccessibility of the remaining N-acetyl groups for the action of NaOH unless particularly harsh conditions are used.

The study used chitosan synthesized from dead bees ApisMellifera in the scientific laboratory of TSTU[5], Silk and Cotton-silk fabric (base silk, weft cotton 55/45) produced at the joint venture Bukhara-China JSC "Bukhara Brilliant Silk", as well as an anionic dye "Reactive bright blue K (reactive blue K)".

In our studies, we used chitosan as an intensifier for dyeing silk and cotton-silk blended fabrics.

In solution, chitosan acquires a positive charge due to the amino group, since the fibers and most of the dye in solution have a negative potential. The study of the processes occurring between water-soluble dyes and the chitosan film, as well as the possibility of interaction between the chitosan film and the tissue, is of great importance, since it allows one to judge the nature of the bonds that arise in the "tissue - chitosan - dye" system, which can largely determine the quality of coloring. when coloring textile materials.

A 2 % solution of acetic acid was used to dissolve chitosan. In this work, a solution of chitosan (0.5–1.5 g/l) was used to treat tissues before the coloring process (Table).

Table

Dye Chitosan, g/l	Intensity, K/S	Na_2SO_4, g/l	K/S	Temperatura, K	K/S
2,0+1,5	8	20,0	7,5	303,0	8
2,0+1,0	10	15,0	10,3	313,0	10
2,5+0,5	9	20,0	10,2	323,0	9
3,0+0,5	10	15,0	10,9	333,0	10
Na_2SO_4 - 15 g/l, T= 60 ^{0}C		Dye – 2 g/l, T= 60 ^{0}C		Na_2SO_4 - 15 g/l, dye – 2 g/l,	

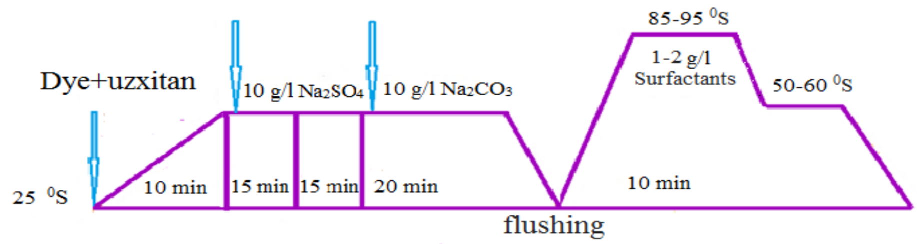

Fig.1. Coloring technology of cotton-silk fabrics using chitosan according to the periodic method

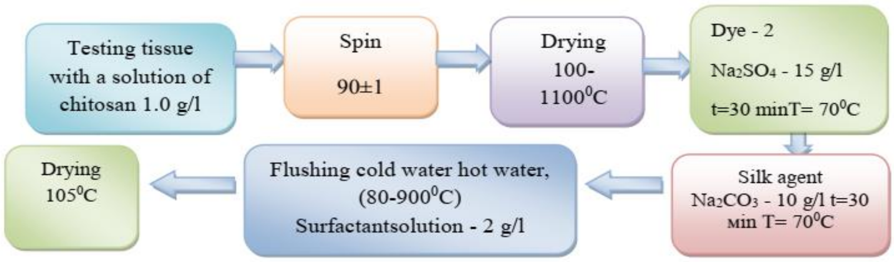

Fig.2. Coloring technology of cotton-silk fabrics by the semi-periodic method

It is known that silk is dyed with active dyes according to the acid and alkaline methods, depending on the nature of the dye, the degree of their fixation depends on the chosen method. Dyeing of natural silk with active dyes is carried out according to the periodic technology according to the alkaline method in two stages. In the second stage, in a slightly alkaline medium (at pH 10.0-10.5), a covalent bond is formed between the dye and silk fibroin, which ensures high color fastness to washing. Therefore, further studies were carried out according to this method. Active bright blue K was chosen as the dyes. Chitosan concentration varied from 0 to 1.5 g/l. A solution of chitosan in acetic acid (2 %) was applied to the fabric before dyeing and dried at a temperature of 100–110 °C until completely dry.

Thus, it can be concluded that chitosan can be used as an intensifier, reducing the expensive dye and electrolyte, as well as the temperature when dyeing mixed fabrics with active dyes, because the amino groups of chitosan react with the active dye to form hydrogen bonds, protonated NH_3^+ - groups form ionic bonds with an anionic reactive dye and the OH^- groups of chitosan are involved in the formation of hydrogen bonds with the amino group of cotton-silk fabric.