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INTRODUCTION AND STUDY OF CHITIN AND CHITOSAN FROM ANIMAL BEES

Mamatova Sh. B.
Karshi State University
sharopovr@bk.ru

ABSTRACT:

This article presents the results of producing chitin and chitosan biopolymers from a perspective new source – dried Apis mellifera bee. We used the dried and crushed dee collected during spring update of bee family and containing a significant amount of chitin. For extraction of chitin, in the first stage, sequentially separated protein (deproteinization) and mineral (demineralization) components of bee, i.e. translated them into a soluble state and removed. Demineralization carried out under influence of 2M hydrochloric acid for 5 hours at room temperature. Deproteinization carried out by treating the crushed material in presence 1 N sodium hydroxide for 1 hour at 80^{0}C. Each process is accompanied by washing the raw material until neutral wash water (pH = 7).

Keywords: chitin, chitosan, deproteinization, demineralization, deacetylation.

INTRODUCTION:

The use of natural biopolymers, especially polysaccharides and their derivatives, is growing. For example, polysaccharides of the cellulose and chitosan types, as well as polysaccharides based on polysaccharides, are widely used in mechanical engineering, the textile industry, the food industry and medicine, as well as in the synthesis of new environmental compounds. In particular, chitosan, a biopolymer of great importance for the future, and a physiologically active biopolymer, which is second only to cellulose in terms of assimilation and distribution in the world industry, is now considered as a new environmentally friendly biodegradable polymer. Their physical and chemical properties are widely studied.

The natural resources available for the extraction of chitin in our country are wide and varied. Squid skeletons, squid and fungal biomass with low and high mushroom content can also be used to obtain chitin abroad. Some insects can be used to accelerate the production of the important biomass containing chitin. In Uzbekistan, chitin can also be distinguished from the silkworm and silkworm [1].

In different countries of the world, there are different methods and sources for obtaining chitin and chitosan. Chitin-chitosan production in Japan was estimated at 2,500 tonnes per year in 1998, compared with 1,000 tonnes in the United States and 100 tonnes in Europe. In recent years, industrial production of chitin has been increasing in India, China and Thailand. Crabs and shrimps are processed in China and Japan to produce polymers as raw materials, while crabs and lobsters are used in the United States. The production of chitin-chitosan in Russia began in the 1970s and 1980s and is now 80 tons per year.

Scientists all over the world call chitin and chitosan the miracle of the 21st century. Chitosan can be used in many fields because of its many valuable properties.

The Scientific Center of Chemistry and Physics of Polymers of the National University of Uzbekistan, headed by Academician Sayera Rashidova, launched the production of chitin and chitosan from silkworms. Figure 1 shows a silkworm and its mushroom. Silkworm is extracted from chitin, and chitosan from chitin, on the basis of which the seed is processed, which improves the quality of sowing, is effective against soil infection, safe for the environment, spontaneously disappears after a while, that is, the drug «UzKHITAN», which breaks down into components that serve as environmentally friendly additives for plants. In a special experimental workshop created at the institute, in addition to chitosan, valuable waste oils were produced from the remaining waste, as well as pure protein, which is an excellent feed additive for animal husbandry [3].

Figure 1. Silkworm mulberry

In connection with the development of beekeeping in Uzbekistan, there is a high potential for the production of raw materials for the production of chitin. The average weight of a bee colony is 3.5-4 kg. In the summer, when the honey collection process is intensified, and in the spring after wintering, the bee colony is renewed by almost 60-70%, as a result, the annual raw material base of bees is 6-10 thousand tons. This allows us to consider beekeeping as a promising new source of chitin and chitosan.

Fig. 2. Apis mellifera bees and bee waste.

Chitin is a linear polysaccharide with an unbranched chain linked by 1,4-b-glycosidic bonds consisting of 2-acetamido-2-deoxy-D-glucose unitary units (Fig. 3). In this respect, chitin and cellulose are similar in structure. However, unlike chitincellulose, the elementary bond on the second carbon atom as a substituent is not a hydroxyl group, but an acetamide group. Several units in this macromolecule of natural chitin are composed of free primary amino groups.

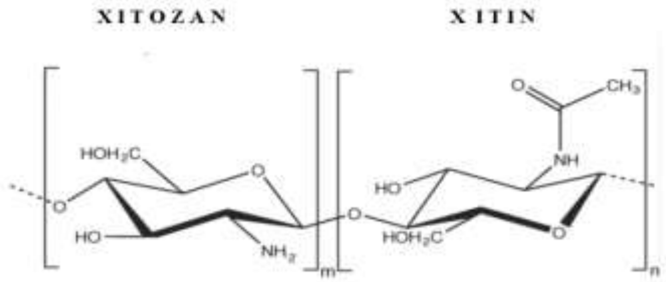
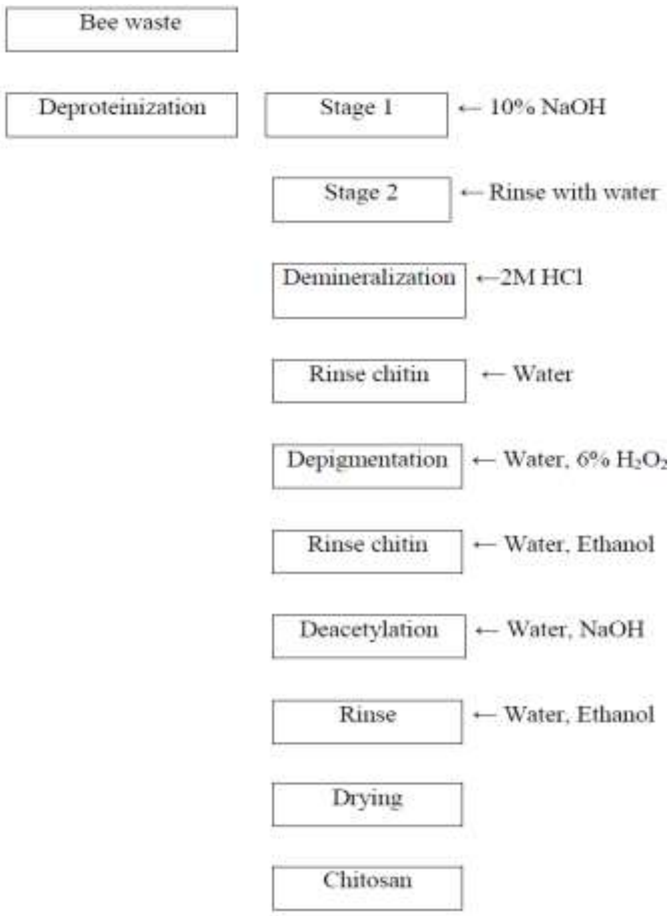


Figure 3. The structure of chitosan and chitin molecules

In the laboratory, we isolated chitin and chitosan from bees that died in the spring using the following mechanism.



Scheme 1. Scheme of obtaining chitosan from bee waste

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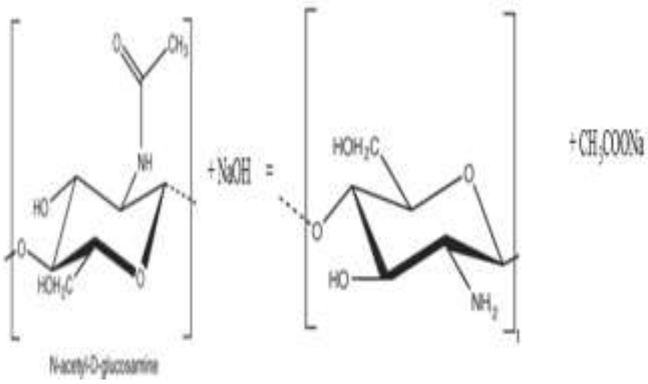
Deacetyllab chitosan (ARIZAN) was synthesized from isolated chitin by the following reaction.



The obtained chitosan was examined on a Panalytical Empyrean X-ray diffractometer. It was measured on an X-ray defractometer at 90 ° C for 43 minutes in a rotating position.

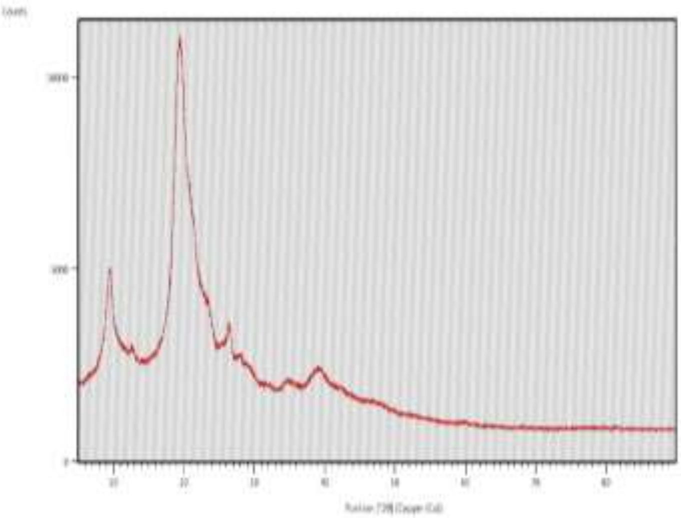
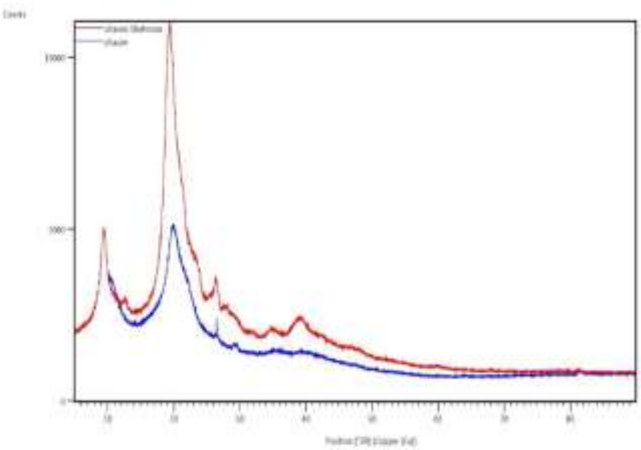


Figure 4. X-ray spectrum of chitosan

The X-ray spectra of chitosan isolated from bees were compared with the X-ray spectra of chitosan obtained from Bombyx mori.



Thus, chitosan obtained from bee waste is in all respects compatible with the structural structures of chitosan obtained from Bombyx mor. Chitin and chitosan from bee waste can be effectively and widely used in all spheres of human life. Considering the remarkable properties of chitin and chitosan, which have attracted the attention of scientists from all over the world, they can without exaggeration be included in the list of promising biopolymers of the 21st century.

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