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USE OF NEW LOCAL RAW MATERIALS OF NARROW CRAYFISH (PONTASTACUS LEPTODACTYLUS) IN THE PRODUCTION OF NATURAL BIOPOLYMERS OF CHITIN AND CHITOSAN.

Kurbonova Feruza Nurulloevna
Associate Professor (PhD) of the Department of Medical Chemistry of Bukhara state medical institute
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Abstract:

The unique properties of chitin and chitosan attract the attention of many specialists in various fields of science. The role of biopolymers in our lives is recognized by everyone. This article presents the results of obtaining chitosan biopolymer from a new promising source - narrow-clawed crayfish. Information about the narrow-clawed crayfish and its distribution in Uzbekistan is also provided.

Key words: Chitin, chitosan, biopolymer, crustaceans, narrow-clawed crayfish.

The ability to vary the properties of polymers and create immobilized compounds based on them makes it possible to develop drugs with controlled release of drugs. Particularly relevant in this direction is the use of hydrophilic swelling polymers, which have not only shape-forming ability, but also a range of functional properties and high biocompatibility with macroorganism tissues, such as polysaccharides and aminopolysaccharides, which include chitin and chitosan [1-2].

Biopolymers of chitin and chitosan began to attract the attention of scientists 2000 years ago. Chitin was first discovered in 1811 by H. Braccono and A. Odier. Chitosan was discovered by S. Rouget in 1859 and named by F. Hoppe-Seyler in 1894. Interest in chitin and its production increased in the first half of the 20th century. In particular, 3 Nobel laureates are directly involved in this process: in 1903, F. Fischer synthesized glucosamine, in 1929. P. Carrer carried out the cleavage of chitin with chitosan, and in 1939 V.Kh. Haworth created the general configuration of glucosamine [3].

The main sources of chitin are crustaceans, arthropods, insects and fungi. Currently, the best source of chitin and chitosins are arthropods, that is, crustaceans. Waste from processing the shells of marine crustaceans: crabs, shrimp, lobsters is used as an industrial raw material for the production of chitosan. The main feature of this raw material is that it does not require many resources to grow and direct it. In the horny cover of crustaceans there is an α-form of chitin, consisting of 19 molecular chains 0.3 μm long. The diameter forms nanofibrils of 3 nm. Chitin forms complexes with proteins, interacts with ascorbic acid or histidine residues with minerals (amorphous carbonates, calcium phosphate and pigments lutein, β-carotene, astaxanthin) and creates mechanical strength and elasticity [4-5].

In Uzbekistan, the sources of chitin and chitosan are silkworm pupae (Academician S.Sh. Rashidova and his students) and dead bees (Professor G.A. Ikhtiyarova and his students), extensive scientific research is being conducted in this area. [6].

The article presents information about the extraction of chitin and chitosan from the narrow-clawed crayfish (*Pontastacus Leptodactylus*), which lives in rivers, lakes and freshwater reservoirs of Uzbekistan, and its properties.


Figure-1. Narrow-clawed crayfish (*Pontastacus Leptodactylus*)

There is significant interest in aquaculture of the crayfish, Astacus leptodactylus, due to high demand and its high market price. Live Astacus Leptodactylus has been imported from Turkey for many years. Koksal (1988) describes its culture in Turkey, and Harlioglu (2004) recently commented on its current status in Turkey. The species is also cultivated in many Eastern European countries and stocked in many areas of Belgium, Switzerland and France. Astacus Leptodactylus is also cultivated on some farms in northern and central Italy. Astacus Leptodactylus was introduced into the UK mainly for the restaurant trade, but is not known to be cultivated to any extent. According to Holdich (2000), escapes occurred in the wild, where large, collectable populations exist [7] .

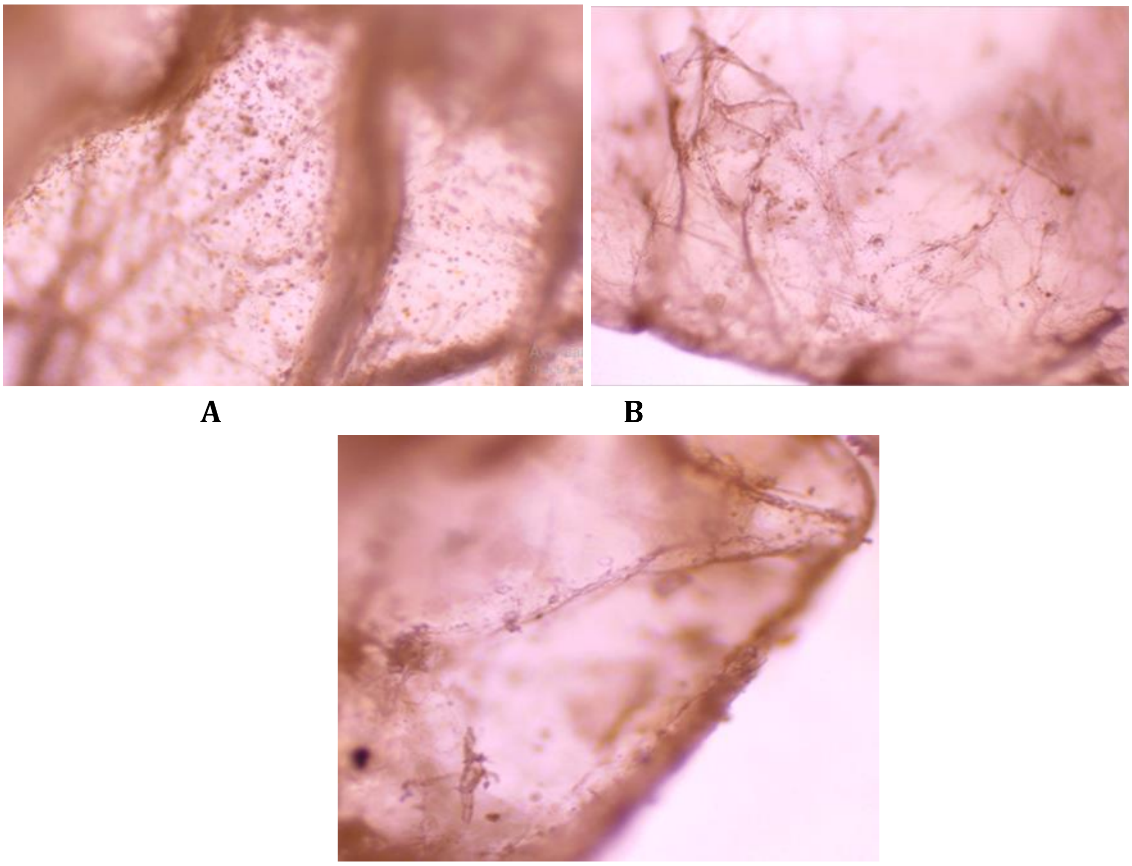
Astacus Leptodactylus typically reach a total length of 150 mm (and up to 170 mm in males), but cases up to 300 mm have been reported. They are known to live for more than 10 years. In females, maturity is reached at 3-5 years and 75-83 mm. Egg size is 2.2-3.3 mm. Astacus Leptodactylus can be recognized by its long and narrow claws. The upper surface of the claws is rough, and the underside is the same color as the body. Although body shape and color tend to vary, they are generally olive green or yellowish or brown with a slight red tint. The shell, claws and walking legs may be spotted. The ventral side of the body is white; The shell can be wide or narrow, the sides of which are covered with spines, the number of which varies. The carapace has two pairs of postorbital ridges behind the eyes. The rostrum is long and pointed, the basal part of which has serrated edges. The sides of the chest are rough. The foreheads of males are usually longer than those of females, although some males have been observed to have short foreheads [8].

Astacus Leptodactylus has a southeastern distribution and was originally distributed in a range corresponding to Turkey, Ukraine, Turkmenistan and southwestern Russia, as well as Iran, Kazakhstan, Georgia, Belarus, Slovakia, Bulgaria, Romania and Hungary. The initial distribution area also included the Caspian Sea, the Black Sea, the lower and middle Danube, as well as the lower reaches of the Don, Dniester, Volga rivers and their tributaries (Koksal, 1988; Holdich et al., 1999) [1].

Through transplantation and natural spread, Astacus Leptodactylus has spread both westward and northward and is now found in 29 countries, having been introduced into 14 of them. It has been introduced to the Czech Republic, Poland, Germany, Lithuania, Latvia and Finland, as well as Denmark, the Netherlands and England. Stocks of this species are also present in France, Switzerland, Austria, Spain and Italy. With the exception of England (Holdich et al., 1999), the widespread distribution of Astacus Leptodactylus in Europe has not led to environmental degradation [8].

The broad-fingered crayfish is much more widespread and is found almost throughout the entire territory of Russia, including in the reservoirs of Uzbekistan. This type of crayfish is not so picky about environmental conditions; it lives in both fresh and brackish water. Long-fingered crayfish are more resistant to diseases, and although crayfish plague causes the death of almost all populations infected with it, the revival of crayfish communities is possible in water bodies affected by this disease after 5 - 7 years [9].

The crustacean gammarus contains up to 6% chitin, which was isolated by sequentially treating the raw material with a 3% hydrogen peroxide solution, a 0.6 mol/l hydrochloric acid solution, and a 0.175 mol/l sodium hydroxide solution. Each stage was accompanied by washing the raw materials until the wash water reacted neutrally (pH = 7).



A B C

Figure-2. Appearance under a biomicroscope chitosans obtained from various raw materials A) Narrow-clawed Crayfish (*Pontastacus Leptodactylus*) B) Silkworm Dome C) Dead bees (*Apiss Mellifera*)

The isolated chitin was washed with ethanol and acetone under vacuum until the pigments were completely removed and dried. Then deacetylation of chitin with sodium hydroxide was carried out with a 50% solution at a temperature of 120–130 °C for one hour in an inert environment. For final purification, the chitosan was washed with ethanol and acetone and dried in air. From 400 g of initial raw material (gammarus) 25.13 g of chitin were obtained, and after deacetylation, 15.9 g of chitosan. The yield of chitosan based on chitin was 79.8% of the theoretical value [10].

Using the method outlined above, chitosan was synthesized from narrow-clawed crayfish caught in the reservoirs of the Bukhara region. The resulting chitosan was examined under a biomicroscope and compared with the microscopic manifestations of chitosan in silkworm pupae and dead bees (Fig. 2).

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The resulting chitosan is light brown in color, in the form of plates, and is readily soluble in 2% acetic and other inorganic and organic acids.

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