Properties of Collagen Extracted from Jellyfish Biomass

Yuliya Kulkova *

Institute of Living Systems, Immanuel Kant BFU, Russia, Kaliningrad, A. Nevskogo, 14

Anastasia Zhihreva

Institute of Living Systems, Immanuel Kant BFU, Russia, Kaliningrad, A. Nevskogo, 14

Olga Babich

Institute of Living Systems, Immanuel Kant BFU, Russia, Kaliningrad, A. Nevskogo, 14

Abstract:

Collagen is a promising biomaterial for wound healing. However, collagen and its derivatives are mainly obtained from pig and bovine skin and bones. Unfortunately, in recent years there has been an increased risk of human infection with bovine spongiform encephalopathy and transmissible spongiform encephalopathy from cows and pigs. Also, religious restrictions prevent the widespread use of biomaterials from pig and cow waste [1].

Marine organisms such as fish, jellyfish, sponges and other invertebrates are attractive sources of collagen because they do not carry diseases that can be transmitted to humans and are highly biocompatible [2]. Scaffolds composed of collagens isolated from marine sources exhibit high biodegradability and low immunogenicity [3].

In this regard, the purpose of this study was to evaluate the most promising method of extracting collagen, assess its physicochemical composition and biochemical properties.

The paper examines the prospects of extracting marine collagen from jellyfish biomass. *Aurelia aurita* by the acid extraction method. It has been established that from the point of view of achieving the maximum yield of collagen, the following conditions should be considered optimal: acetic acid concentration of 0.5 M, extraction time of 48 hours. In this case, the yield of collagen from the biomass of this species of jellyfish is very low and does not exceed 0.0185%.

The analysis of the physicochemical properties of the obtained collagen was carried out according to the following parameters: solubility and water absorption capacity of collagen, UV-visible spectroscopy, molecular weight analysis using gel electrophoresis. In vitro assessment of the biological activity of collagen was carried out using a wound healing test, quantitative PCR analysis, assessment of cytotoxicity and adhesive properties of collagen samples, antioxidant activity.

During the analysis of the physicochemical properties and biological activity of the obtained marine collagen, it was found that it has a very low solubility in water and organic solvents, which is natural. Collagen can only be dissolved in a solution of high concentration acetic acid (0.5 M or more). This property should not be considered a disadvantage, since there are areas of application where the resistance of a collagen sponge to dissolution in biological fluids is required.

Water absorption coefficient compiled 4,194, which is more than 2 times higher than medical gauze, and therefore can be successfully used as a hemostatic sponge.

Control of collagen composition by the method of UV-VISe spectroscopy showed that the collagen was of sufficient purity, as it had a clear peak in the region of 230-235 nm, which corresponds to the spectral characteristics glycine and hydroxyproline. Acid-soluble collagen has a molecular weight of 100-115 kDa and belongs to type I collagen, the most common type found in animal biomass.

Collagen samples do not have cytotoxic properties, do not disrupt cell adhesion, migration and proliferation, and do not alter the expression of cell differentiation markers.

Based on the analysis of the healing rate of the model wound, it was established that the samples have regenerative properties (an increase in the healing rate by 24.5% relative to the control).

The analysis of the obtained properties allows us to say with confidence that the collagen obtained from the biomass of jellyfish *Aurelia aurita* is characterized by high biological activity and is suitable for use in solving problems of regenerative medicine. At the same time, the yield of the product is very low (does not exceed 0.02%), which indicates that the use of this type of jellyfish for obtaining collagen is possible and economically justified only if their removal from the ecosystem has other prerequisites, for example, to ensure the recreational attractiveness of the seas or as part of the fight against their mass reproduction, which interferes with any human economic activity.

Keywords:

Jellyfish, marine collagen, biological activity, regenerative properties, cytotoxicity, extraction, regenerative medicine.

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