eJBio Electronic Journal of Biology, 2024, Vol. 20(5):1-2

Applications of Aquatic Biomaterials in Regenerative Therapies

Fernando Sandra*

Department of Biological Sciences, University of Liberia, Monrovia, Liberia

***Corresponding author:** Email: sandra_f@gmail.com

Citation: Sandra F (2024) Applications of Aquatic Biomaterials in Regenerative Therapies. Electronic J Biol, 20(5):1-2

Received date: September 30, 2024, Manuscript No. IPEJBIO-24-19984; **Editor assigned date:** October 02, 2024, PreQC No. IPEJBIO-24-19984 (PQ); **Reviewed date:** October 16, 2024, QC No. IPEJBIO-24-19984; **Revised date:** October 23, 2024, Manuscript No. IPEJBIO-24-19984 (R); **Published date:** October 30, 2024, DOI: 10.36648/1860-3122.20.5.139

Description

The field of regenerative medicine has gained considerable attention in recent years, particularly due to its potential to repair or replace damaged tissues and organs. Biomaterials, which are substances designed to interact with biological systems, play an important role in this domain by providing scaffolds that support tissue growth, healing and regeneration. While many synthetic and natural biomaterials are currently in use, aquatic-derived biomaterials are emerging as a promising resource due to their unique properties. These biomaterials, sourced from aquatic organisms like fish, algae and marine invertebrates, offer several advantages over conventional materials, including biocompatibility, biodegradability and the ability to promote cellular growth and tissue regeneration. This article analyses the potential of aquatic-derived biomaterials in regenerative therapies, focusing on their sources, properties, applications and challenges [1-3].

Aquatic biomaterials

Aquatic organisms, ranging from marine plants to animals, are rich sources of natural polymers that can be used as biomaterials. These materials are often derived from the extracellular matrices of marine organisms or their by-products and they exhibit unique mechanical, chemical and biological properties that make them suitable for regenerative medicine [4].

One of the most well-known sources of aquatic biomaterials is marine algae. Algae produce polysaccharides such as alginate, agar and carrageenan, which have been widely used in tissue engineering and regenerative medicine. Alginate, in particular, has gained prominence as a biomaterial due to its gelling ability and biocompatibility. It can form hydrogels in the presence of divalent cations, which mimic the natural Extracellular Matrix (ECM) of tissues and provide a supportive environment for cell growth. Alginate-based scaffolds are often used in wound healing, cartilage repair and nerve regeneration [5].

Agar and carrageenan, also derived from algae, are similar in structure to alginate and are used for applications like controlled drug release, cell encapsulation and tissue engineering. These materials can be processed into films, hydrogels and beads, providing versatile scaffolds for various regenerative applications [6].

Moreover, algae-based biomaterials are biodegradable, reducing the risk of long-term toxicity associated with synthetic alternatives. Marine organisms such as fish, mollusks and corals also provide valuable biomaterials for regenerative therapies. Collagen, a key structural protein in connective tissues, is abundant in fish skin and scales. Fish collagen has several advantages over mammalian collagen, including reduced immunogenicity and faster degradation rates, which make it ideal for use in tissue engineering applications [7]. Fish collagen can be processed into gels, sponges and films, which can support cell attachment and growth, making it useful for skin regeneration, wound healing and bone repair [8].

Marine invertebrates like sponges and corals are also rich in collagen-like materials. For example, the skeletons of corals contain calcium carbonate, which can be utilized as a scaffold material for bone regeneration. The unique structure of coral skeletons allows for high porosity and interconnectivity, promoting cell infiltration and nutrient transport. Coral-derived biomaterials are being described for their potential in bone tissue engineering and in the development of scaffolds for osteogenic differentiation.

Applications in regenerative therapies

Aquatic-derived biomaterials are being described for a variety of regenerative medicine applications, from wound healing and cartilage regeneration to bone and nerve repair.

The ability of aquatic biomaterials to promote tissue healing makes them ideal for use in wound care. Fish collagen, for instance, has been used in hydrocolloid dressings, which promote moist wound healing and reduce scarring. Alginate-based dressings are also widely used in the treatment of chronic wounds, as they form a gel-like barrier that protects the wound site while promoting cell migration and tissue regeneration.

Aquatic biomaterials possess several unique properties that make them ideal candidates for regenerative therapies. These properties include biocompatibility, biodegradability and the ability to promote cellular interactions that are critical for tissue healing and regeneration.

One of the most important characteristics of any biomaterial is its biocompatibility or its ability to integrate with living tissues without causing adverse reactions. Aquatic-derived biomaterials are inherently biocompatible, as they have evolved to interact with living organisms in their natural aquatic environments [9].

For instance, fish collagen and alginate have been shown to support the growth of human cells and tissues *in vitro*, indicating their potential for safe use in humans. Additionally, the relatively low immunogenicity of aquatic biomaterials reduces the risk of rejection by the body, a major concern with synthetic or xenogenic materials.

Another critical property of aquatic-derived biomaterials is their biodegradability. These materials are naturally broken down by enzymatic action or environmental factors, which helps to minimize the risk of long-term side effects in the body [10].

For example, alginate and agar degrade into simple sugars and other metabolites that are easily absorbed or excreted by the body. This property is particularly useful in regenerative medicine, as it ensures that the biomaterial is gradually replaced by the body's own tissues, eliminating the need for surgical removal.

Aquatic biomaterials have been shown to promote cellular interactions, which are need for tissue regeneration. Many of these materials mimic the natural Extracellular Matrix (ECM), providing a supportive environment for cell adhesion, proliferation and differentiation. For example, alginate-based hydrogels have been used to encapsulate stem cells, protecting them from the immune system while promoting their differentiation into the desired cell types. Fish collagen has been found to promote the growth and differentiation of various cell types, including skin fibroblasts, chondrocytes and osteoblasts, making it suitable for a wide range of tissue engineering applications.

References

[1]. Wang M, Carver JJ, Phelan VV, Sanchez LM, Garg N, et al. (2016) Sharing and community curation of mass spectrometry data with global natural products social molecular networking. Nat Biotechnol 34: 828-837.

[2]. Dona AC, Jiménez B, Schafer H, Humpfer E, Spraul M, et al. (2014) Precision high-throughput proton NMR spectroscopy of human urine, serum and plasma for large-scale metabolic phenotyping. Anal Chem 86: 9887-9894.

[3]. Johnson WM, Soule MCK, Kujawinski EB (2017) Extraction efficiency and quantification of dissolved metabolites in targeted marine metabolomics. Limnol Oceanogr Methods 15: 417-428.

[4]. Bauman KD, Butler KS, Moore BS, Chekan JR (2021) Genome mining methods to discover bioactive natural products. Nat Prod Rep 38: 2100-2129.

[5]. Kujawski W (2000) Application of pervaporation and vapor permeation in environmental protection. Pol J Environ Stud 9: 13-26.

[6]. Ma H, Burger C, Hsiao BS, Chu B (2011) Ultrafine polysaccharide nanofibrous membranes for water purification. Biomacromolecules 12: 970-976.

[7]. Dou B, Zhu Z, Merkurjev E, Ke L, Chen L, et al. (2023) Machine learning methods for small data challenges in molecular science. Chem Rev 123: 8736-8780.

[8]. Alonso-Alvarez S, Pardal E, Sánchez-Nieto D, Navarro M, Caballero MD, et al. (2017) Plitidepsin: Design, development and potential place in therapy. Drug Des Dev Ther 11: 253-264.

[9]. Yadav LR, Chandran SV, Lavanya K, Selvamurugan N (2021) Chitosan-based 3D-printed scaffolds for bone tissue engineering. Int J Biol Macromol 183: 1925-1938.

[10]. Zeng F, Wunderer J, Salvenmoser W, Hess MW, Ladurner P, et al. (2019) Papillae revisited and the nature of the adhesive secreting collocytes. Dev Biol 448: 183-198.