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Eureka Journal of Agricultural Science & Bio-Innovation (EJASB)

ISSN 2760-4969 (Online) Volume 2, Issue 3, March 2026

https://eurekaoa.com/index.php/7

TECHNOLOGY OF APPLICATION OF MICROALGAE IN MEDICINE

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Abstract

Currently, the development of modern drugs leads to many problems, including drug ineffectiveness, immunogenetic problems, and disruption of cytotoxicity and metabolic processes. These limitations limit its use in various systems. As a natural resource, microalgae are rich not only in bioactive compounds but also in many biological properties, such as richness in active compounds, high photosynthetic ability, as well as biocompatibility for the human body.

These properties allow the use of microalgae as targeted medicines. It also creates great opportunities for the diagnosis and treatment of various promising diseases. Therefore, information is provided on the use of microalgae as medicines and the optimization of their quality.

Keywords: Microalgae, Therapeutic, Delivery of medicines.

Introduction

Currently, special attention has recently been paid to marine compounds such as carbohydrates, peptides, lipids, and carotenoids, extracted from microalgae and possessing anti-cancer, anti-inflammatory, antimicrobial, and antioxidant

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properties in biomedical and pharmaceutical biotechnology. Furthermore, these photosynthetic marine microorganisms have multiple applications in biotechnology and are suitable hosts for the production of recombinant proteins/peptides, such as monoclonal antibodies and vaccines. Silicon-based nanoparticles derived from diatoms (a group of microalgae) are used as drug suppliers due to their biodegradability, easy functionalization, low cost, and simpler properties compared to synthetic ones, making these agents a suitable alternative to synthetic silicon nanoparticles. Therefore, diatomaceous-based nanoparticles are a suitable option for delivering anti-cancer drugs and reducing the side effects of cancer chemotherapy.[12.]

Microalgae are diverse groups of unicellular photosynthetic organisms found in a variety of aquatic environments that, despite their microscopic size, possess remarkable biosynthetic abilities, producing a range of bioactive compounds such as proteins, polyunsaturated fatty acids, pigments, vitamins, and polysaccharides [1].

These bioactive molecules not only support the survival of organisms in extreme ecological conditions, but also bring great benefits to human health. In recent decades, the scientific community has increasingly focused on microalgae as a sustainable source of high-value products for nutritional, pharmaceutical, and cosmetic applications due to their rapid growth rates, minimal land use requirements, and carbon fixation potential. [5]

Microalgae are a large source of bioactive compounds with anticancer properties, most of which are characterized by unique chemical structures and selective cytotoxicity. These natural products interfere with several cancerous symptoms such as cell proliferation, avoidance of apoptosis, angiogenesis, and metastasis, and offer promising alternatives or supplements to traditional chemotherapy.[4]

As is known, the main groups of phytochemical substances are alkaloids, aromatic acids, carotenoids, coumarins, essential oils, flavonoids, glycosides,

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organic acids, phenols and phenols, phytosterols, protease saponins, steroids, tannins, terpenes, and terpenoids.

Currently, medicinal plants are used to treat diabetes in countries around the world. Scientific research has shown that medicinal plants, vitamins, and essential elements have made tremendous progress in reducing blood sugar levels before and during disease onset.[6]

Among microalgae, β-glucans - natural polysaccharides with immunomodulatory and antioxidant properties - have attracted great attention due to their potential in functional food, nutritional agents, and pharmaceutical products, for example, for strengthening immunity and adding to supplements enriched with paramilon for intestinal health. Particularly, paramilon, β- (1→3) -glucan from Euglena, is distinguished by its high purity, ease of extraction, and versatile application.[5]

Microalgae are a group of photosynthetic autotrophic microorganisms recognized as the safest in the plant world. They are rich in highly valuable bioactive compounds widely used in food, healthcare, and pharmaceuticals. Recent studies have shown that microalgae have great potential as innovative biomaterials for biomedical applications.

The unique phototactic action of microalgae allows them to controlled delivery of drugs to target tissues in patients. In addition, microalgae produce oxygen through photosynthesis under the influence of light, which helps prevent diseases such as tumors and hypoxia, as well as improves the biomedical image using in vivo methods. In addition, the internal biophysical properties and modification of microalgae can be used for the development of biohybrid robots and bioprinting, which will expand their clinical application. Microalgae are especially widely used for medical applications such as drug delivery, targeting diseases such as tumor hypoxia, wound treatment, and immunotherapy.

The amazing biocompatibility, diverse biological functions, and economic efficiency of microalgae have created a promising platform for the future delivery of targeted medicines and the application of precision medicine.

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