

ALGAE AS AN ENVIRONMENTALLY FRIENDLY AND ALTERNATIVE FOOD SOURCE

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ABSTRACT

This article analyzes the scientific and practical significance of algae as an environmentally friendly and alternative food source based on statistical data. Recent studies indicate that the protein content of certain microalgal biomass reaches 50–60%, while in *Spirulina* and *Chlorella* species it exceeds 60%. According to statistical analyses, the global market for algae-based food products and biologically active supplements is growing at an annual rate of 8–10%. The low demand for land and freshwater resources, along with the high capacity of algae to absorb carbon dioxide, determines their ecological advantages. The article highlights the application of algae in the food industry and their potential role in ensuring environmentally sustainable development.

Keywords: algae, alternative food sources, environmentally friendly products, microalgae, *Spirulina*, *Chlorella*, food biotechnology, sustainable development.

АННОТАЦИЯ

В данной статье на основе статистических данных анализируется научно-практическое значение водорослей как экологически чистого и альтернативного источника пищи. Современные исследования показывают, что содержание белка в биомассе отдельных микроводорослей достигает 50–60 %, а у видов *Spirulina* и *Chlorella* превышает 60 %. Согласно статистическим данным, мировой рынок продуктов питания и биологически активных добавок на основе водорослей ежегодно растёт на 8–10 %. Низкие затраты земельных и пресноводных ресурсов, а также высокая способность водорослей к поглощению диоксида углерода определяют их экологические преимущества. В статье рассматриваются возможности применения водорослей в пищевой промышленности и их перспективная роль в обеспечении экологически устойчивого развития.

Ключевые слова: водоросли, альтернативные источники пищи, экологически чистые продукты, микроводоросли, *Spirulina*, *Chlorella*, пищевая биотехнология, устойчивое развитие.

At present, the rapid growth of the world's population, climate change, reduction of agricultural land, and limited natural resources have made the issue of global food security increasingly urgent. Traditional food production systems intensify environmental pressure, leading to excessive consumption of water and land resources. Therefore, the search for environmentally friendly, sustainable, and nutritionally valuable alternative food sources is considered one of the key priorities of modern science and practice.

One of the most promising alternative sources is algae, which are widely studied in the fields of algology and biotechnology as a potential food resource.

Biological and nutritional characteristics of algae. Algae are a group of lower plants that inhabit aquatic environments and possess photosynthetic capacity, including microalgae and macroalgae. They are characterized by rapid growth, high biomass productivity, and the ability to adapt to various environmental conditions.

Scientific studies indicate that the dry biomass of certain microalgae species, particularly *Spirulina*, *Chlorella*, and *Scenedesmus*, contains up to 50–70% protein, 10–20% carbohydrates, and 5–10% lipids. In addition, algae are rich in vitamins A, B-complex, C, D, and E, as well as essential mineral elements such as iron, calcium, magnesium, and iodine. These compositional features make algae a food source with high biological value.

Environmental advantages of algae. Food production based on algae offers several significant environmental advantages. According to statistical data, algae cultivation requires 10–20 times less land and freshwater resources compared to conventional agricultural crops. Moreover, their growth does not require the use of pesticides or mineral fertilizers.

During photosynthesis, algae absorb large amounts of carbon dioxide and release oxygen into the atmosphere. It is estimated that microalgae contribute nearly 40% of global oxygen production, highlighting their importance in mitigating climate change and maintaining ecological balance.

Application of algae in the food industry. Currently, algae are widely used in the food industry across many countries. They are applied in the production of dietary supplements, health foods, specialized nutrition for athletes, and functional food products.

The global market for algae-based products is growing at an annual rate of 8–10%. Demand for products derived from *Spirulina* and *Chlorella* is particularly high in Asian countries such as China, Japan, and South Korea. This trend indicates that algae are likely to play an increasingly important role in the future global food system.

Challenges and limitations. Despite their numerous advantages, the large-scale use of algae as food faces several challenges. These include consumer acceptance of their specific taste and odor, high initial costs of production technologies, and the potential accumulation of heavy metals in certain species. Therefore, careful environmental monitoring and strict quality control are essential during the cultivation and processing of algae.

Conclusion. In conclusion, algae represent an environmentally friendly, highly nutritious, and sustainable alternative food source. Their biological characteristics, rapid growth, and ecological advantages are of great importance for ensuring global food security. The future development of algae-based biotechnologies will contribute to environmental protection, rational use of natural resources, and the establishment of a healthy and sustainable food system.

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