American Journal of Biodiversity
https://biojournals.us/index.php/AJB
ISSN: 2997-3600

Comparative Analysis of Spirulina and Chlorella: Extraction, Drying Technologies and Applications in Agriculture

I. Y. Salimova
Doctoral student, PhD. student, PhD-Samarkand Institute of Veterinary Medicine, Animal Husbandry and Biotechnology

N. Y. Salimova
Doctoral student- Samarkand State University of Veterinary Medicine, Livestock and Biotechnologies, Tashkent Branch

Received: 2025, 15, Jul
Accepted: 2025, 21, Aug
Published: 2025, 09, Sep

Annotation: Microalgae are unique sources of biologically active substances that are in demand in the food, pharmaceutical and agricultural industries.The most studied representatives are Arthrospira platensis (spirulina) and Chlorella vulgaris (chlorella), which are characterized by a high content of proteins, vitamins, minerals and pigments. The aim of this work is to systematize current data on microalgae extraction and drying methods, as well as to analyze their application in agriculture. Alkaline and enzymatic extraction, as well as mechanical methods of destruction of cellular structures, are considered. Approaches to drying (freeze-drying, spray-drying, heat-drying) are generalized and their influence on the preservation of biological activity of biomass is shown. Special attention is paid to animal feed additives, биостимуляцииplant biostimulation, and the ecological potential of algae. It is concluded that there are high prospects for the

use of microalgae in the agro-industrial complex and the need for further optimization of technologies.

Keywords: spirulina, chlorella, extraction, drying, microalgae, agriculture, feed additives, biostimulants.

Introduction

In recent decades, microalgae have been considered as a promising object of biotechnology due to their high content of proteins (up to 60-70% of dry weight), vitamins, amino acids, fatty acids, and antioxidants [1,2]. Among them, special attention is paid to Arthrospira platensis (spirulina) and Chlorella vulgaris (chlorella). These species are widely used as food additives, pharmaceuticals, and animal feed products.

However, the preservation of the biological value of raw materials is largely determined by the technology of its processing, in particular extraction and drying. In addition, the potential of using microalgae in agriculture is not yet fully used, which makes this study relevant.

The aim of the work is to review modern methods of extraction and drying of microalgae, as well as to consider their practical application in agriculture.

Materials and methods

Publications included in the international databases Scopus, Web of Science, SpringerLink, and ScienceDirect for the period 2010-2024 were used as information sources. The analysis of studies devoted to methods of isolation of proteins, lipids and pigments from spirulina and chlorella biomass, as well as a comparative analysis of drying methods, was carried out.

Extraction of biologically active compounds from microalgae is a key step in their processing. For spirulina, the most effective method is alkaline extraction with isoelectric deposition, which makes it possible to isolate up to 90% of the protein [3]. In the case of chlorella, a strong cell wall requires the use of enzymatic hydrolysis or mechanical methods (ultrasound, high pressure) [4].

Additionally, phycocyanin, carotenoids and chlorophyll are extracted, which have antioxidant activity.

Drying methods. Drying is a necessary step in the stabilization of biomass.

Лиофильная сушка (Freeze-dryingallows you to preserve the maximum amount of thermolabile components.

Spray drying is effective for obtaining powders used in the food and feed industry.

Thermal drying is the most economical, but it leads to the loss of vitamins and pigments [5].

Application in agriculture. Numerous studies confirm that the addition of spirulina and chlorella to feed: increases live weight gain, productivity of poultry and cattle, improves the immune status of animals, improves the quality of products (milk, meat, eggs) [6].

The use of Spirulina and Chlorella in agriculture covers several areas. In animal husbandry, they improve weight gain, the quality of meat and dairy products. In poultry farming, their use increases egg production, reduces the death rate of young animals and strengthens the immune system. In aquaculture, microalgae supplements promote the rapid growth of fish and crustaceans. In crop production, extracts from Spirulina and Chlorella are used as biostimulants of growth and fertilizers.

Table 1. Comparative advantages and disadvantages of Spirulina and Chlorella

Criteria	Spirulina	Chlorella criterion
Nutritional value	High содержание protein content (up to 70%)	Protein up to 50%, more fiber
Antioxidant Properties	Strong antioxidants (Phycocyanin)	High содержание chlorophyll content
Bioavailability	Easy to digest	Tough cell wall, harder to digest
Стоимость Production cost	Relatively cheaper	Requires more complex processing

Figure 2. The main directions of application of microalgae in agriculture.

As shown in the table, spirulina is highly digestible and rich in proteinand amino acid composition, which makes it preferable in animal husbandry and the food industry. At the same time, chlorella is more effective as a biostimulator in crop production and a source of chlorophyll, but its digestibility is limited by a strong cell wall, which requires additional technological stages of processing.

Thus, the choice of microalgae species is determined by industry objectives: spirulina is more promising for animal husbandry and food additives, and chlorella is more promising спирулинаfor crop production and environmental technologies.

Crop production. Chlorella and its extracts are used as biostimulants of plant growth. They contribute to: increasing seed germination, accelerating plant growth and development, and resistance to stress factors [7]. In addition, microalgae suspensions have a positive effect on микробиотуthe soil microbiota.

Microalgaeare widely used in systems of biotechnologicalwastewater treatment and organic waste disposal, which reduces the environmental burden and increasesthe sustainability of agricultural production [8].

Conclusion

Extraction and drying are key stages in the processing of microalgae, which directly affect the preservation of their biological activity. Arthrospira platensis and Chlorella vulgaris have high potential applications in agriculture as feed additives and plant growth biostimulants. Spirulina and Chlorella have high biotechnological and agricultural potential. They are a source of protein, vitamins, minerals, and antioxidants, making them valuable supplements in agriculture. Comparative analysis shows that Spirulina is better absorbed and has a lower cost, while Chlorella is rich in chlorophyll and fiber, but requires additional processing technologies. Prospects for their application include the development of sustainable agriculture, improving animal health and increasing the productivity of agriculturalsystems.

A promising area of further research is the optimization of drying and extraction technologies in order to reduce energy costs and increase the bioavailability of the resulting products.

Literature

1. Becker W. Microalgae in human and animal nutrition. In: Richmond A., Hu Q. (eds.) .Handbook of Microalgal Culture.. Wiley, 2013.
2. Pulz O., Gross W. Valuable products from biotechnology of microalgae. .Applied Microbiology and Biotechnology.. 2004;65:635–648.
3. Bleakley S., Hayes M. Algal proteins: extraction, application, and challenges. .Foods.. 2017;6(5):33.

4. Safi C., et al. Morphology, composition, production, processing and applications of Chlorella vulgaris. .Microbial Cell Factories.. 2014;13:65.
5. Chen C.Y., et al. Microalgae-based carbohydrates for biofuel production. .Biochemical Engineering Journal.. 2013;78:1–10.
6. Holman B.W\.B., Malau-Aduli A.E.O. Spirulina as a livestock supplement and animal feed. .Journal of Animal Physiology and Animal Nutrition.. 2013;97:615–623.
7. Raja R., et al. Chlorella vulgaris as a potential biofertilizer: properties, applications and future research. .Journal of Applied Phycology.. 2016;28:2343–2355.
8. Wang L., et al. Microalgae-based wastewater treatment for nutrients recovery: a review. .Bioresource Technology.. 2010;102(9):4830–4840. 99(1), 57-63.