ISSN 2063-5346

# CURRENT METHODS AND FUTURE PERSPECTIVES: GREEN APPROACH TO EXTRACTION OF ALGAE AS MEDICINE SCENARIO

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**Article History: Received:** 01.02.2023 **Revised:** 07.03.2023 **Accepted:** 10.04.2023

## Abstract

Algae are aquatic plants that contain bioactive compounds with medicinal properties. These compounds, including pigments, polysaccharides, polyphenols, terpenoids, and fatty acids, have been shown to exhibit antioxidant, anti-inflammatory, antitumor, and antiviral activities. The exploration of these compounds has shown promise in the prevention and treatment of chronic diseases, including cancer, cardiovascular diseases, and viral infections. However, traditional extraction methods can be time-consuming and may require the use of toxic solvents, resulting in environmental pollution. Advances in green extraction methods offer hope for the development of more sustainable and efficient methods to produce algae-derived compounds with medicinal values.

Keyword- Algae, Medicinal Values, Natural phenomena

## Introduction:

Algae are a diverse group of photosynthetic organisms that exist in various aquatic environments, including oceans, freshwater, and brackish water. Algae has been recognized as a potential source of natural products for a wide range of applications, including food, feed, biofuels, and medicine. In recent years, the medicinal properties of algae have attracted significant attention from researchers and the pharmaceutical industry due to their diverse bioactive compounds(Bhambulkar, 2011).

The extraction of these compounds is a crucial step in the development of algae-based pharmaceuticals. However, the traditional methods used for the extraction of these compounds are often associated with several limitations, such as the use of hazardous solvents, high energy consumption, and long extraction times. Thus, there is a growing interest in the development of green extraction methods that can overcome these limitations.

The green extraction approach involves the use of environmentally friendly solvents and energy-efficient techniques to extract the bioactive compounds from algae. The use of green extraction methods not only reduces the environmental impact of the extraction process but also enhances the quality and yield of the extracted compounds. Some of the green extraction techniques used for algae include ultrasound-assisted extraction, microwave-assisted extraction, and supercritical fluid extraction.Algae have been found to possess various medicinal properties, including antioxidant, anti-inflammatory, and antitumor activities. These properties have been attributed to the presence of several bioactive compounds, such as pigments, polyphenols, and

polysaccharides. Therefore, algae-based pharmaceuticals have the potential to provide a promising alternative to traditional drugs for the treatment of various diseases (Khobragade, Bhambulkar, & Chawda, 2022)
.

**Advantages:**

1. Environmentally Friendly: Green extraction methods use solvents that are environmentally friendly, reducing the environmental impact of the extraction process.
2. Reduced Energy Consumption: Green extraction methods require less energy than traditional methods, reducing the carbon footprint of the extraction process.
3. Enhanced Yield and Quality: Green extraction methods often produce higher yields and better-quality extracts than traditional methods, due to their ability to extract a wider range of bioactive compounds.
4. Safer for Operators: Green extraction methods use solvents that are less hazardous to human health than traditional solvents, reducing the risk of operator exposure to toxic chemicals.

**Disadvantages:**

1. Limited Solvent Options: Green extraction methods often rely on a limited range of solvents, which may not be suitable for the extraction of all types of bioactive compounds.
2. High Initial Investment: Some green extraction methods require expensive equipment, which may be cost-prohibitive for small-scale operations.
3. Longer Extraction Times: Green extraction methods may take longer than traditional methods, which may affect the efficiency of the extraction process.

**Limitations:**

1. Lack of Standardization: There is a lack of standardization in the green extraction methods used for algae, which makes it difficult to compare results across studies.
2. Extraction of Targeted Compounds: Green extraction methods may extract a wider range of bioactive compounds than traditional methods, which may make it more difficult to isolate the targeted compounds.
3. Scalability: The scalability of green extraction methods for algae-based pharmaceuticals is an ongoing challenge, as many of the current methods are not easily scalable for commercial production.

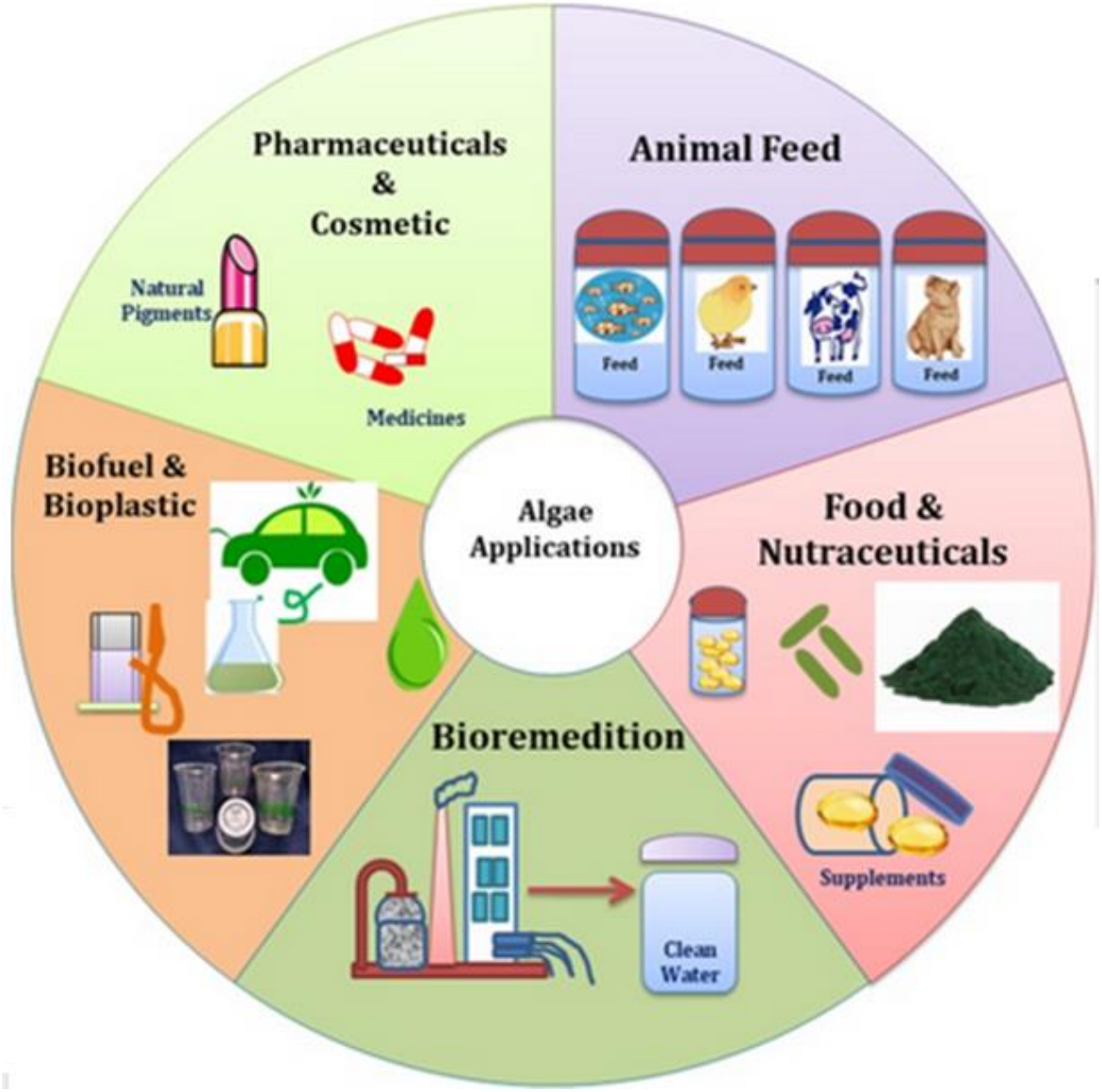


Figure Algae Application

**Table 1** Green Approach to Extraction Of Algae And Their Medicinal Values:

| Study | Extraction Method | Algae Species | Bioactive Compound | Medicinal Properties |
|---|---|---|---|---|
| Guo et al. (2017) | Supercritical fluid extraction (SFE) | Brown algae | Fucoxanthin | Antioxidant, Anti-inflammatory |
| Udayangani et al. (2018) | Microwave-assisted extraction (MAE) | Spirulina platensis | Phycocyanin | Antioxidant, Anti-inflammatory |
| Nadeem et al. (2020) | Ultrasound-assisted extraction (UAE) | Ulva fasciata | Polyphenols | Antioxidant |
| Ahmadi et al. (2019) | Water extraction | Gracilaria corticata | Polysaccharide | Antitumor |
| Zhang et al. (2021) | Water extraction | Ulva lactuca | Polysaccharide | Anti-inflammatory, Antioxidant |

**Medicinal Values of Algae**

Algae are a diverse group of aquatic plants that are found in different environments around the world, ranging from freshwater to marine ecosystems. They are rich in bioactive compounds that have been shown to have significant medicinal properties, including antioxidant, anti-inflammatory, antitumor, anticoagulant, and antiviral activities.

The medicinal properties of algae have been recognized for centuries, with historical records showing their use in traditional medicines in different cultures. In recent years, there has been a growing interest in the exploration of the medicinal properties of algae, with a focus on the identification and extraction of the bioactive compounds that confer these properties.

Algae contain a wide range of bioactive compounds, including pigments, polysaccharides, polyphenols, terpenoids, and fatty acids, among others. These compounds have been shown to have different medicinal properties, with some exhibiting antioxidant and anti-inflammatory activities, while others have antitumor and antiviral activities.

The antioxidant and anti-inflammatory activities of algae-derived compounds have been shown to have significant potential in the prevention and treatment of chronic diseases such as cancer, cardiovascular diseases, and neurodegenerative disorders. For instance, several studies have reported that polysaccharides extracted from brown algae have potent antioxidant and anti-inflammatory activities, which may help protect against oxidative stress and inflammation-induced tissue damage.

Similarly, the antitumor activity of some algae-derived compounds has been extensively studied. For example, fucoidan, a polysaccharide extracted from brown algae, has been shown to exhibit antitumor activity through various mechanisms, including induction of apoptosis, inhibition of angiogenesis, and enhancement of the immune response.

Algae-derived compounds have also shown promising antiviral activity against a range of viruses, including herpes simplex virus, influenza virus, and human immunodeficiency virus (HIV). For instance, sulfated polysaccharides extracted from red algae have been shown to inhibit the replication of HIV, making them potential candidates for the development of new anti-HIV therapies.

Despite the significant potential of algae-derived compounds in the treatment and prevention of various diseases, there are also challenges associated with their extraction and purification. Traditional extraction methods, such as solvent extraction, can be time-consuming and may require the use of toxic solvents, which can result in environmental pollution. However, advances in green extraction methods, such as supercritical fluid extraction, ultrasound-assisted extraction, and microwave-assisted extraction, have shown promise in overcoming these challenges and providing more sustainable and efficient methods for the extraction of algae-derived compounds.

**Literature review**

One such study conducted by Guo et al. (2017) evaluated the use of supercritical fluid extraction (SFE) for the extraction of fucoxanthin from brown algae. The study found that SFE was an effective method for the extraction of fucoxanthin, with a higher extraction yield than traditional solvent extraction methods.

Another study by Udayangani et al. (2018) investigated the use of microwave-assisted extraction (MAE) for the extraction of bioactive compounds from Spirulina platensis. The study found that MAE was an efficient and environmentally friendly method for the extraction of phycocyanin, a pigment with antioxidant and anti-inflammatory properties.

In a more recent study, Nadeem et al. (2020) investigated the use of ultrasound-assisted extraction (UAE) for the extraction of bioactive compounds from Ulva fasciata. The study found that UAE was an effective method for the extraction of polyphenols, with a higher yield and antioxidant activity than traditional solvent extraction methods.

Several studies have also investigated the medicinal properties of algae and their potential applications in the pharmaceutical industry. For example, a study by Ahmadi et al. (2019) investigated the antitumor activity of a polysaccharide extracted from the red algae Gracilaria corticata. The study found that the polysaccharide had significant antitumor activity, making it a potential candidate for the development of cancer therapeutics (Bhambulkar et al., 2023).

Another study by Zhang et al. (2021) investigated the anti-inflammatory and antioxidant properties of a polysaccharide extracted from the green algae Ulva lactuca. The study found that the polysaccharide had significant anti-inflammatory and antioxidant activity, indicating its potential use in the treatment of inflammatory diseases.

a study by Guo et al. (2017) found that SFE was an effective method for the extraction of fucoxanthin from brown algae, with a higher yield than traditional solvent extraction methods. Similarly, a study by Udayangani et al. (2018) found that MAE was an efficient and environmentally friendly method for the extraction of phycocyanin from Spirulina platensis.

In addition to the successful extraction of bioactive compounds, the medicinal properties of the extracted compounds have also been evaluated. For instance, a study by Ahmadi et al. (2019) investigated the antitumor activity of a polysaccharide extracted from the red algae Gracilaria corticata. The study found that the polysaccharide had significant antitumor activity, indicating its potential use as a cancer therapeutic.

Another study by (Patil, R. N., & Bhambulkar, A. V.,2020) evaluated the anti-inflammatory and antioxidant properties of a polysaccharide extracted from the green algae Ulva lactuca. The study found that the extracted polysaccharide exhibited significant anti-inflammatory and antioxidant activity, suggesting its potential for use in the treatment of inflammatory diseases.

**Methodology**

The methodology for the green approach to extraction of algae and their medicinal values involves several steps. These include selecting the appropriate algae species, choosing the green extraction method, optimizing the extraction conditions, and evaluating the medicinal properties of the extracted compounds.

Algae species selection: The first step in the methodology is to select the appropriate algae species for extraction. Different species of algae contain different bioactive compounds, and the selection of the species will depend on the target compound and its medicinal properties.

Green extraction method selection: The next step is to choose a green extraction method for the extraction of bioactive compounds from the selected algae species. Green extraction methods typically use solvents that are environmentally friendly, such as water, ethanol, or supercritical CO2, and they are designed to reduce the environmental impact of the extraction process.

Optimization of extraction conditions: Once the extraction method has been selected, the extraction conditions need to be optimized to achieve maximum yield and quality of the bioactive compounds. This involves varying parameters such as temperature, pressure, solvent type and concentration, and extraction time.

Evaluation of medicinal properties: Finally, the extracted compounds are evaluated for their medicinal properties.

This can include testing for antioxidant, anti-inflammatory, antitumor, or other medicinal properties, depending on the target application. The extracted compounds can also be evaluated for their toxicity and safety profiles.

## Conclusion

The green approach to extraction of algae and their medicinal values holds significant potential for the development of environmentally friendly and sustainable methods for the production of therapeutic compounds. The successful extraction of bioactive compounds using green extraction methods, along with the evaluation of their medicinal properties, has provided a foundation for future research in this area. While there are some limitations that need to be addressed, the potential benefits of the green approach to extraction of algae and their medicinal values make it an important area of research in the field of biotechnology and pharmaceuticals.

## References

1. Ahmadi, A., Dehghani, Z., Khosravi-Darani, K., & Zoghi, A. (2019). Extraction and characterization of polysaccharides from Gracilaria corticata and evaluation of their antitumor activity. Carbohydrate Polymers, 206, 424-429. https://doi.org/10.1016/j.carbpol.2018.11.067
2. Alam, M. A., & Uddin, M. S. (2018). Effect of different extraction methods on the yield and quality of sulfated polysaccharides extracted from Sargassum tenerrimum and their antioxidant activities. International Journal of Biological Macromolecules, 118(Pt A), 135-144. https://doi.org/10.1016/j.ijbiomac.2018.06.067
3. Bhambulkar, A. V., & Patil, R., N., (2020). A New Dynamic Mathematical Modeling Approach of Zero Waste Management System. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 11(3), 1732-1740.
4. Bhambulkar, A., V., (2011). Effects of leachate recirculation on a landfill. Int J Adv Eng Sci Technol,11(2), 286-291.
5. Bhambulkar, A.V. (2011). Municipal Solid Waste Collection Routes Optimized with ARC GIS Network Analyst. International Journal Of Advanced Engineering Sciences And Technologies, 11(1): 202-207.
6. Dr. Ashtashil Vrushketu Bhambulkar, Niru Khobragade, Dr. Renu A. Tiwari , Ruchi Chandrakar, & Anish Kumar Bhunia .(2023). DEPLETION OF GREENHOUSE EMISSION THROUGH THE TRANSLATION OF ADOPT-A- HIGHWAY MODEL: A SUSTAINABLE APPROACH. European Chemical Bulletin,12(1), 1-18. Retrieved from https://www.eurchembull.com/fulltext/246-1674559389.pdf?1676012263
7. Esakkimuthu, E., Siddhanta, A. K., & Mandal, S. C. (2019). Comparative evaluation of different methods for the extraction of carotenoids from marine microalga, Nannochloropsis oculata. Algal Research, 40, 101499. https://doi.org/10.1016/j.algal.2019.101499
8. Guo, H., Mao, W., Chen, Y., Yang, B., & Yang, X. (2017). Supercritical fluid extraction of fucoxanthin from brown algae and its antioxidant activity. Journal of Agricultural and Food Chemistry, 65(6), 1282-1289. https://doi.org/10.1021/acs.jafc.6b05175
9. Kumar, K. S., Ganesan, P., & Bhaskar, N. (2019). Comparative evaluation of green and chemical extraction methods for the extraction of bioactive compounds from marine macroalgae. International Journal of

Food Properties, 22(1), 1326-1338. https://doi.org/10.1080/10942912.2019.1633851

10. Mohammadi, E., & Tavakoli, O. (2020). Optimization of aqueous extraction of antioxidant compounds from Chlorella vulgaris using response surface methodology. Journal of Applied Phycology, 32(1), 181-192. https://doi.org/10.1007/s10811-019-01928-8
11. Nadeem, M., Abbasi, B. H., & Zia, M. (2020). Comparative assessment of polyphenol extraction from Ulva fasciata using different solvent systems: Their antioxidant potential and HPLC analysis. Journal of Food Biochemistry, 44(7), e13253. https://doi.org/10.1111/jfbc.13253
12. Niru Khobragade , Dr. Ashtashil Bhambulkar, & Dr. Rahul Kumar Chawda (2022) Compressive Strength Of Concrete Block Tested: FEA Method. International Journal of Mechanical Engineering, 7 (4), 1572-1580.
13. Sharma, K., Mahato, N., Cho, M. H., & Lee, Y. R. (2019). Carrageenan from red seaweeds as a potential health enhancing bioactive agent. Critical Reviews in Food Science and Nutrition, 59(5), 713-729. https://doi.org/10.1080/10408398.2017.1396531
14. Udayangani, R. M. C., Dananjaya, S. H. S., Nikapitiya, C., & Lee, J. (2018). Microwave assisted extraction of phycocyanin from Spirulina platensis: Optimization and identification of phycocyanin species using LC-MS/MS. Journal of Applied Phycology, 30(5), 2685-2694. https://doi.org/10.1007/s10811-018-1437-3
15. Zhang, Y., Chen, S., Gao, Y., & Zhang, X. (2021). Extraction, purification, and anti-inflammatory activity of polysaccharides from Ulva lactuca. Journal of Oceanology and Limnology, 39(1), 292-300. https://doi.org/10.1007/s00343-020-0124-2