Popular Article
TRENDS IN AGRICULTURE SCIENCE
Vol.3 Issue 12 December 2024, Page: 2352-2354

Role of Algae in Microbial Fuel Cell Production

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DOI:10.5281/TrendsinAgri.14605166

Introduction

Waste water can be used to grow algae species on non-agricultural land. Waste water will provide the necessary carbon dioxide and fertilizers for the growth of algae. Because of its high oil and starch content, high-quality biodiesel may be produced. It can also be utilized in microbial fuel cells based on algae species selected for the treatment. The majority of organisms are classified as aquatic and are photosynthetic eukaryotic. Its density will be lower than that of water because it can accumulate lipids and oil. There are more than 36,000 species that can proliferate quickly. With the aid of sunshine and photosynthesis, microalgae can absorb carbon dioxide emissions from a range of sources and transform them into biomass and I can be used for microbial fuel cell production

Microbial Fuel Cell

Although carbon-neutral and sustainable technologies are offered by renewable energy sources like wind, solar, and bioenergy, further research is necessary, particularly to reduce installation and operating costs and enhance process yields and efficiencies. As a result, it is crucial to create alternative sustainable systems with high energy conversion efficiencies, no CO_2 emissions, and low installation and operating costs, including microbial fuel cells (MFCs) and photosynthetic algal microbial fuels (PAMFCs) (Zhang et al., 2022).

Advantages of MFC

It includes

- Sustainable long-term bio-electricity production
- By products like Bio-hydrogen and value-added products are produced
- Algae serves as a biocatalyst for pollutant removal

Published: 31 Dec 2024
ISSN: 2583-7850

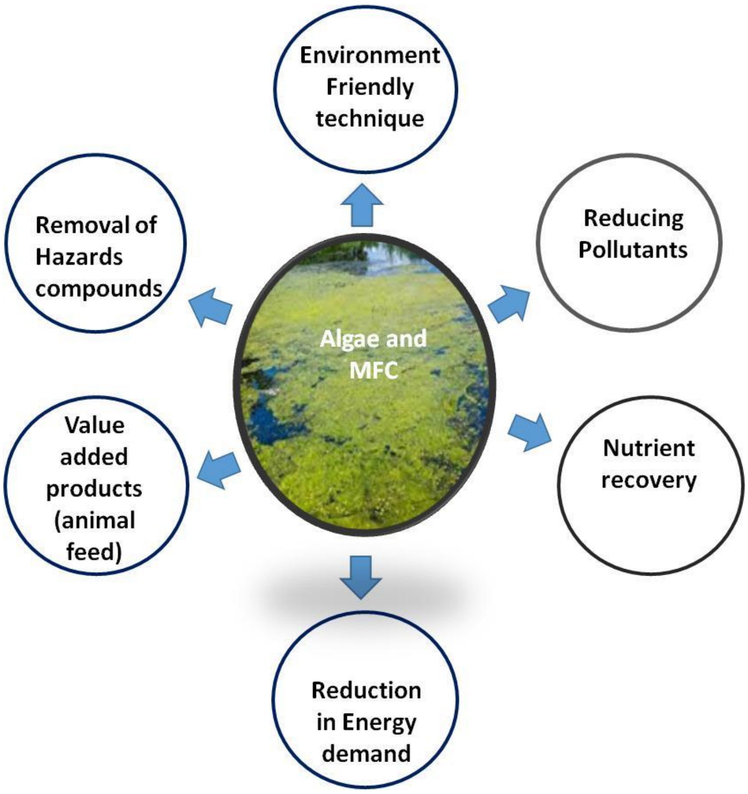

Fig 1. Scope of Algae in Environment

As the batteries generate electricity through chemical processes, microbial fuel cells (MFCs) generate electricity via biological processes. MFCs harness the waste energy released by microbes during their cellular respiration (Arun et al., 2020). This means that the bacteria take in nutrients from their environment and release electrons. The key to this process is capturing those electrons and utilizing them effectively. The fundamental requirements are that we need microbes, which can originate from various organic sources such as waste, compost, or sewage, and we must contain the microbes along with their environment in a manner that limits (reduces) oxygen availability. Oxygen is essential to this process as it competes for electrons. In the setup, there are a cathode, anode, a load, and connecting wires. The wires from the cathode connect to a load that permits a limited flow of electrons. As the microbes consume nutrients, they generate electrons; since these electrons are isolated from direct oxygen contact, they are attracted toward the oxygen as if drawn by magnets through the path of least resistance. This route leads them from the anode, via the wiring, to the cathode, ultimately reaching the oxygen, and as the bacterial population expands, the voltage will rise until it reaches its maximum potential. The fuel cell will keep generating energy as long as nutrients remain and conditions such as moisture and temperature are favorable.

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Published: 31 Dec 2024
ISSN: 2583-7850

Conclusion

Algae-based MFCs are efficient in generating energy. However, there are currently few large-scale implementations. Appropriate applications may be identified when there's a preference for the removal of CO2 and nutrients (N and P), or when the biomass harvested can be utilized for the extraction of valuable products or biofuels. Under these circumstances, the extra expenses associated with collecting algal biomass, constructing MFCs, and supplying CO2 will be offset by energy savings and benefits in resource recovery.

Reference

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