iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: V Month of publication: May 2023

DOI: https://doi.org/10.22214/ijraset.2023.53024

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

Production of Biodiesel from Algae

Pratik Chandane[1], Akash Ade[2], Prasad Khade[3] Vishwajeet Dolase[4]
Department of Chemical Engineering, Vishwakarma Institute of Technology, Bibwewadi, Pune

Abstract: Microalgae provide a large amount potential for the utilization, which contains the large amount of biodiesel, but the method is not very advance. In the this idea the knowledge we want is very less. In this paper we are going to look at the potential of microalgae to take the dynamic steps to improve our study about the microalgae to understand the patterns of changes. In doing this we required the combination of biology and engineering. In this review, We present an overview of potential algal biofuel pipelines and highlight current work to optimize algal biomass production and the molecular fuel content of algal cells. Using hexane as a solvent and simultaneous extraction and transesterification, the highest possible yield of biodiesel was achieved. To determine the potential of microalgae to produce biodiesel, Algal biomass, algae oil, and algae biodiesel were all thoroughly characterized.
Keywords: Biodiesel, algae, renewable energy.

I. INTRODUCTION

Algae are aquatic organisms that generate biomass by using light and carbon dioxide (CO2). They fall into two categories: macroalgae and microalgae. Large, multicellular algae known as macroalgae may reach lengths of several inches and are commonly found growing in ponds. Seaweed, like gigantic kelp, is an example of a macroalgae that may grow in a variety of ways and can attain lengths of over 100 feet. On the other hand, microalgae are minute, unicellular algae that are often found floating in bodies of water. They are measured in micrometers.

Numerous research has investigated the technological viability of growing algae in labs to produce biofuel and have identified no significant downsides to this strategy. Microalgae have great promise for the production of biofuels since they can generate oils that can be harvested and used to make fuel. From a few to hundreds of microns, microalgae exist. microns and can be found in marine and freshwater systems as individuals, groups, or flocks.

Because they concurrently absorb nitrogen, phosphate, and carbon dioxide in order to develop photoautotrophic ally and supply between 40% and 50% of the oxygen in the atmosphere, algae are appealing for reducing pollution and mitigating carbon dioxide emissions.

There has been a lot of interest in the potential of microalgae to be transformed into a range of renewable biofuels, including ethanol, butanol, green diesel, jet fuel, and methane biogas.

The graph below illustrates how well biodiesel made from algal oil performs as a biofuel. that it fulfills the International Biodiesel Standard for physical and chemical qualities, and vehicles that are equivalent to those of diesel produced from petroleum and first-generation crops.

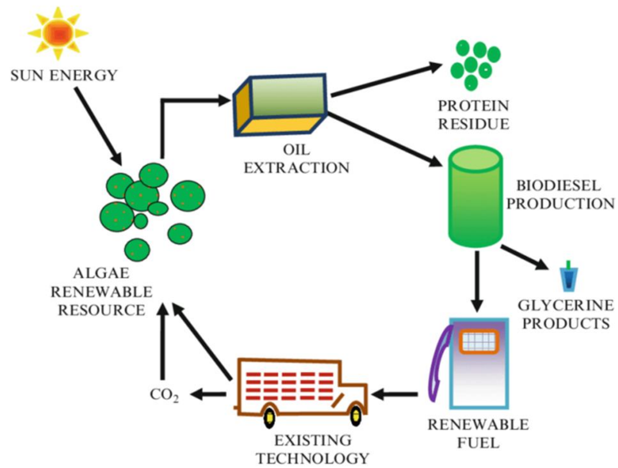
The reason for this study was to explore biofuel creation from microalgae.

II. METHODOLOGY

Microalgae biomass has the potential to be an energy source in a number of ways. The method of producing biodiesel involves direct combustion, chemical reaction, thermochemical conversion, and biochemical conversion. Figure (reference) is a flowchart outlining the steps involved in creating biodiesel from microalgae. The process typically entails steps like microalgae culture, harvesting, drying, and cell disruption, then transesterification-based lipid extraction for biodiesel generation.

1) Stage 1: Growing microalgae.
2) Stage 2: Cell disruption (removal of cells from the growing medium), drying, and harvesting.
3) Stage 3: Lipid extraction based on transesterification for the generation of biodiesel.
4) Stage 4: Production of bioethanol by starch hydrolysis, fermentation and distillation.

However, these methods are technically demanding and expensive. The creation of a practical biofuel production technology faces significant challenges.



Process flow diagram for making bio diesel from microalgae.

Although there are several methods for growing microalgae at this stage, Open-air systems and photobioreactor systems are the two most commonly used.

There are two subcategories of the:

Tabular and flat-column photoreactors are two types of photoreactor systems.

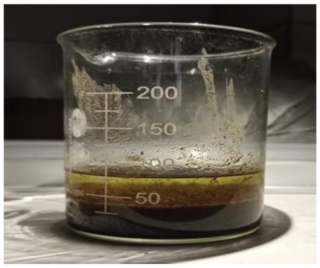
A. Micro-algae

Algae that can only be seen with a microscope are referred to as microalgae or macrophytes. They are a kind of phytoplankton that inhabits sediment and water columns in both freshwater and marine habitats. Depending on the species, microalgae can be found in chains, clusters, or unicellular species. Their diameters range from a few micrometers to several hundred micrometers. Microalgae lack leaves, branches, and roots, in contrast to larger plants, yet they have special adaptations that allow them to survive in a viscous environment. Due to their ability to produce food through photosynthesis, micro algae are essential for maintaining life on Earth. They utilize the greenhouse gas carbon dioxide to develop autotrophically and contribute about half of the oxygen in the atmosphere. The majority of marine photosynthesis is carried out by micro algae, such as cyanobacteria, which serve as the base of the food chain and supply energy to higher trophic levels. Chlorophyll levels are frequently employed as a measure of the biomass of micro algae, which can be a good indication of future output. According to research, fatty acids or lipids can make up high to 40% of a microalgae's body mass. It has been calculated based on this that microalgae may produce up to 200 times more lipids per acre than the finest terrestrial plants. Through the use of the proper procedures, these lipids/oils may be transformed into biodiesel.

B. Materials

1) Algae, 200 grams,
2) methyl alcohol, 50 milliliters,
3) n-Hexane, 50 milliliters, and
4) NaOH, 2 grams

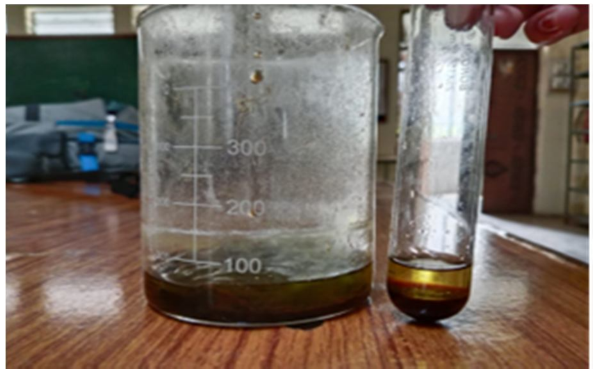
- *Step 1:* Using a grinder, 200 grams of algae from the ND Aquarium were ground up.



- Step 2: Add 50 milliliters of n-hexane with NaOH (2g) & 50ml of methanol of mixture.
- Step 3: Allow the combination to sit for 24 hours.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

C. Experimental Result



III. PAZAMETERS THAT CONSIDERED

1) *Viscosity:* Higher-viscosity fuels make automation more difficult and damage the fuel injector, resulting in incomplete combustion and engine damage from poor engine performance. As a result, biodiesel can be made from cooking oil with a viscosity of 4.63 mm2/s using liquids with lower kinematic viscosity.
2) *Point of Pour:* Due to its relatively high pour point, biodiesel is unsuitable as a fuel for numerous applications. As a result, microalgae is the least preferred option because it has the highest pour point.
3) *Acceleration Rate:* Due to the formation of fatty acid methyl esters and the agitation of the oil and catalyst mixture, which enhances the reaction, biodiesel produced from microalgae.
4) *Cetane-Number:* Cetane no works on the ignitability of methanol/Biodiesel mix and abbreviates the start defer period. Therefore, fuel does not improve with increased cetane. According to the previous study, microalgae have the highest cetane number 54.
5) *Density:* Higher thickness will cause to have more oxygen and mass per unit volume, so microalgae is better with regards to thickness.

QUALITY CONTROL PARAMETER	Microalgae (mgKOH.g-1)
Pour Point(^{0}C)	165
Calorific value (MJ/KG)	38.72
Acid Value/FFA (PH)	0.394
Agitation speed(rpm)	900
Viscosity (mm^2/s)	6.71
Cetane No	58
Flash point (^{0}C)	165 ^{0}C
Catalyst concentration (wt%) KOH	0.75%
Density (g/cm^3)	0.888

IV. FUTURE SCOPE

The production of microalgae biodiesel has been estimated to have the potential to completely replace petroleum diesel. However, the technology needed to produce large quantities of biodiesel from microalgae is still in its infancy. The growth of microalgae is the subject of a lot of research; However, a significantly smaller number of studies concentrate on large-scale oil extraction, biodiesel production from microalgae biomass, and microalgae evaluation.

V. CONCLUSION

Studies have shown that employing microalgae for the manufacture of biodiesel has several benefits over using other widely accessible feedstocks. The inferences that can be made are as follows:

1) Algae are easy to develop since they may flourish carelessly in sewage or saltwater that shouldn't be consumed by people.
2) They require far less land area than other feedstocks and have much greater development rates and efficiency.
3) Different species of microalgae can be adapted to survive in harsh conditions. With other existing biodiesel feedstocks like rapeseed, sunflower, or palm oil, it's not feasible to find the relevant species to particular growing circumstances or local ecosystems.
4) Ethanol, hydrogen, and methane are among the more sustainable fuels that microalgae can make.
5) Microalgae convert sunlight into chemical energy through a process known as photosynthesis, completing a growth cycle every few days. The addition or removal of nutrients can speed up growth rates and fat content, but they can also grow practically anywhere.
6) Microalgae may be utilized for a variety of things in addition to making biofuels. A explanation of a few of the options under consideration was given by Wang et al. like this: Algae bio fixation lowers the amount of greenhouse gases (GHG) released into the atmosphere by taking CO2 out of industrial flue gas emissions. Removing NH4+, NO3-, and PO43- from wastewater allows algae to feed on these toxins as nutrients. Due to its high nitrogen concentration, the algae biomass removed oil extraction can be burnt to generate heat and energy or used as organic fertilizer: P ratio. Depending on the situation, it may also be possible extract additional key substances such as lipids, polyunsaturated fatty acids, natural colors, sugars, colorants, carotenoids, antioxidants, high-value bioactive and other fine chemicals.

REFERENCES

[1] Journal of Mechanics Engineering and Automation 3 (2013) 179-188 Biodiesel from Algae Mladen Bošnjaković The Technical Department, University of Applied Science of Slavonski Brod, Slavonski Brod 35000, Croatia Received: February 13, 2013 / Accepted: March 13, 2013 / Published: March 25, 2013.
[2] JOURNAL OF PURE AND APPLIED MICROBIOLOGY, March 2015. Vol. 9(1), p. 79-85 Production of Biodiesel from Algae Ihsanullah1,3*, Sumaira Shah2 , Muhammad Ayaz3 , Iftikhar Ahmed3 , Murad Ali3, Naveed Ahmad4 and Irshad Ahmad5
[3] Evolving Energy-IEF International Energy Congress (IEF-IEC2012) Biofuel from algae- Is it a viable alternative? Firoz Alam*a, Abhijit Datea, Roesfiansjah Rasjidina, Saleh Mobinb, Hazim MoriaaAbdul BaquicElsevier use only: Revised 29th August 2012; accepted 31st August 2012
[4] Biomass and Biofuel ProductionTom Bradley, ... Anthony Paul Roskilly, in Comprehensive Renewable Energy (Second Edition), 2022
[5] Lee, D.H., Algal biodiesel economy and competition among bio-fuels. Bioresource Technol., 2011; 102: 43–49.
[6] Rawat,I., Kumar, R. R., Mutanda,T. and Bux,F. Biodiesel from microalgae: A critical evaluation from laboratory to large scale production. Appl. Energ., 2013; 103,:444–467.
[7] Patil, P.D., Gude, V.G., Mannarswamy, A., Deng, S.; Cooke, P., MunsonMcGee, S., Rhodes, I., Lammers, P., Nirmalakhandan, N. Optimization of direct conversion of wet algae to biodiesel under supercritical methanol conditions. Bioresource Technol., 2011; 102: 118–122.
[8] Patil, P.D., Gude, V.G., Mannarswamy, A., Deng, S.; Cooke, P., MunsonMcGee, S., Rhodes, I., Lammers, P., Nirmalakhandan, N. Optimization of direct conversion of wet algae to biodiesel under supercritical methanol conditions. Bioresource Technol., 2011; 102: 118–122.
[9] Demirbas, A., Fatih, D.M. Importance of algae oil as a source of biodiesel. Energ Convers. Manage., 2011; 52: 163-180