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BRIEF REVIEW ON ALGAE BASED BIOFUEL

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| Abstract

This utilization of algae as a sustainable biofuel source is summarized in this critical assessment. Biohydrogen is a third-generation feedstock for the manufacture of biofuels (bioethanol, biodiesel, or biogas). Biofuel made from gas cannot reach its maximum potential because of the higher costs of farming, reaping, extraction, and other stages. Consequently, this evaluation grants Deriving biofuels from algae biomass is explained in great detail in systems such as raceway ponds and photobioreactors, along with their bottlenecks. Evolution of biofuel The first section of this manuscript addressed feedstock's, from edible oils to algae. Here are some insights into the various generations of biofuels. Ultimately, algal cultivation pretreatments and future dimensions These steps were explained in detail in order to make carefully practical algal biofuel.

| Keywords

Sustainable, Biofuel, Biohydrogen, ALGAE

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Introduction

A class of renewable energy derived primarily from living materials is called bioenergy. The most common biofuels are corn ethanol biodiesel as well as biogas from organic side products. Renewable energy is more sustainable than fossil fuels. Global population expansions, as well as the rise of developing countries such as India and China, have resulted in a significant increase in energy demand. (Harun, Danquah, et al. 2010) Because of the diminishing reserves of fossil fuels About 90% of energy is generated from petroleum, coal, and natural gas. Chen, Yeh, et al. (2011) Current consumption trends suggest that the world's oil reserves could run out in 2050. (Ho, Chen, et al., 2011) Also, the main cause of climate change and pollution is the excessive consumption of fossil fuels. (Sivakumar, Vail, et al. 2010) Biomass may be converted into energy via either biological or thermochemical processes. Degradable materials are fermented to produce energy carriers such as bioethanol, biobutanol, or biohydrogen, and the extraction of oils in order to make biodiesel can be called a biological process. Direct and power combustion, as well as indirect processes such as pyrolysis (or gasification), are all part of thermochemistry. (Skjånes, Lindblad et al. 2007) In recent years, the world has seen an expanding energy need and the extraction of power from non-industrial nations, for example, India and Africa. (Li, Sakuragi et al. 2019) The most critical concerns with respect to the energy instability presently exit in fast industrialization utilizing petroleum derivatives, record high fuel measures, developing reliance on Middle East oil sources, adverse consequences of fossil assets upon

ozone depleting substance outflows driving the strain on society, more elevated levels of NOX and SOX in the atmosphere, as well as increased levels of metal particles due to the use of current day fuels. (Bórawski, Bełdycka-Bórawska et al. 2019) The challenges start with each other's thirst, changing environmental circumstances, and friction among nations in relation to fuel consumption. Answering the question, the world energy quest was once indefensible; without it, it is difficult to find a fuel source that can save the world from our present financial expert. The arising nations will offset the created nations in terms of monetary load by 2030. India and China both have the most significant hotspots for development in the helpless nation of speculation and trading. (Wang and Lin, 2019) The decision about biomass fuel stock relies on various components. These incorporate accessibility and the social and economic impacts of the cost of raw materials. However, there are challenges. The greatest current feedstock comes from the need to cultivate agricultural lands. freshwater for cultivation, which may compete with food and agriculture output, seasonal and geographical changes in productivity, and the need to apply herbicides. (Sun and Cheng, 2002) Fossil fuels form beneath the crust of the earth over time. The interaction known as fossilization requires a long time to deliver fuel. This fuel is The synthetic strategy is from biomass, and it's quicker than the lethargic technique. Biofuel alludes to a topographical cycle. According to the U.S. Energy Data Organization (EIA), the fuel is named and circled back to most nations. There are two sorts of fills: fluid and vaporous. These biofuels are otherwise called biofuels. They have incredible utility in the transportation area. These powers mix without any problem with existing liquids; they include diesel and gasoline. The different types of liquid fuels include bio-alcohol (bio-diesel), bio-oil, group gasoline, and kerosene diesel. Saccharification response is otherwise called "gasohol." The vaporous Biofuel is additionally known by the name biogas. It's rich in methane. Bio-liquor may incorporate bioethanol and biomethanol; nonetheless, biogas is significant. Items The biofuels can be relied upon to supply somewhere around one-fourth of the energy needs. This is the mid-twentieth century's worldwide energy interest. Three people in the future of biomass are in concentration to ensure the delivery of alternative fuels. (Maamoun 2019) This review will provide you with the most current and comprehensive information regarding metabolism, characteristics, and production technologies. Microalgal-based fermentable foods: Applications Particularly, recent developments in the production and utilization of these are the topics that cover Microalgae with a high carbohydrate content for biofuel promote the concept that microalgae can be used as a practical food source. (Ho, Chen, et al. 2012) Algal strains are one of the most used microbial resources for producing both. bioethanol, biodiesel. They are simple to cultivate in an open pond, and photobioreactors are huge. (Van Der Hulst 2012)

Algae-based biofuel Bioethanol potential in algae

Bioethanol remains ethanol, or else an ethyl whisky derivative, since it is a life source. It can be used for: This product can be used to replace or add gasoline. (Jannetta, Abbasy et al., 1977)

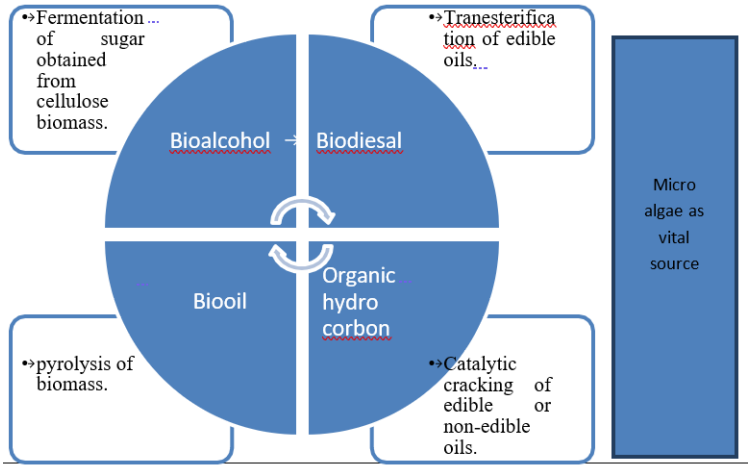
Bioethanol The source is important, but so is its influence on the atmosphere. They are remnant coals. It is lower in sulfur than gasoline. This reduces its potential for being harmful. combustion of greenhouse gases. It contains approximately 66% energy. Bioethanol is highly renewable and has great potential to be used. Bioethanol is created by the reduction of thickener or extradarlings in primary or second-generation feed stocks (e.g., corn, lingo, cellulosic, and biomass) (John, Anisha et al. 2011). The fermentation of sugar can produce bioethanol. Starch can be used as a storage material, or cellulose can be used to make up the cell

wall (Sharma 2015). Algae is a beneficial basis for bioethanol because it comprises a decent quantity of algae. Approximately of the most extensively recycled algae in bioethanol manufacture is sargassum. Glacilaria. Prymnesium gracilisporphyridium, Dunaliella, and Chlamydomonas Scenedesmus

Biodiesel comes from the transesterification and production of lipids, acquired from green growth. to make methyl ester of long-chain fat acids. The wellspring of fat determines the length and state of the chain. Biodiesel can emerge from oils from palms, soybeans, sunflower, or canola oil, just as oils Soybean, canola, sunflower, and repressed oil are more expensive than fossil fuels (Demirbas and Demirbas 2011). Biodiesel's yield from Each clump can be supported by upgrading certain boundaries. The development Green growth can be altered to deliver a more greasy gathering. This can occur through nitrogen starvation or controlled nutrients. These are the parameters that can affect the lipid production and accumulation in algae. The following are some examples: With varying parameters, several studies have been performed to evaluate the performance of microalgae (Hossain, Salleh, et al. 2008). Examined Oedogonium's performance, Spirogyra, in terms of quantity of biodiesel fashioned and residues designed for Oedogonium. It's well-suited for biodiesel production.

Bio-hydrogen potential of algae

It is not economically possible to produce bio-hydrogen because the price is extremely low. comparable to the dealessential. The second most important negative is packing and transference. Transport the non-condensable fluid gas to the setting you require. There are numerous methods to produce hydrogen. The innovative technique of algal biomass is used instead of electrolysis of water or coal gasification. Interest is growing in hydrogen production (Vassilev and Vassileva 2016). Bioenergy is found in algae biomass. Two main methods of producing hydrogen are used. Saladini, Patrizi, et al. (2016) The main systems that are involved in producing biohydrogen are fermentation and photosynthesis. Photofermentation, or darkening, is used to make bio-hydrogen. The fermentation process is followed by photosynthetic photolysis for the production of bio-hydrogen. And indirect biophotolysis (Saifuddin and Priatharsini, 2016; Ganesan, Manigandan et al., 2020).



1st generation (G1) biomass-derived biofuel

1st generation Biofuels may include liquid or gaseous versions of fuel. Biodiesel is a liquid that can be used to make vegetable oil, bio-ethers, and/or bio-alcohol. The I age (G1) biomass Oil-bearing seeds, palatable yields, starch, sugarcane Sunflower, rapeseed, and creature fats are largely conceivable. Each oil is made with complex fatty acid atoms of various alkyl chain lengths. Triglycerides (three fatty acid units) are These triglycerides, which can be linked to an ester molecule, are also available. With the methodology described, biofuels can be converted using the following methods:

For the production of fuels, there are several techniques: anerobic digestion, transesterification, or fermentation. The I-generation biofuels are available in a variety of forms, including without the need for blending. Blending is a great way to get creative (Pascoal, Oliveira et al. 2020). Diesel engines have been around since the 19th century. It can be run on vegetable oil. Biodiesel likewise turns on trans-esterified herbal emerald fats, for example, canola or hemp oil, physical oil/flabs, and tallow, which take a lengthy carbon cycle, are some examples. Esterified fuels can be made by combining chains. Herbal mollients assorted with methanol and sodium hydroxide are elements in biodiesel and glycerol. (Sharma 2015)

2nd generation biofuel (G2)

G2 fuels, also known as advanced fuels, are a safe choice for GI Powers. on the grounds that it is the wellspring of non-food biomass. The side-effects The food handling industry, wooden manufacturing plants, and food preparation incorporate unpalatable parts, e.g., dry wood, corn stalks, and wheat stalks. Biomass creation utilized oil items from cafés and creatures. Oil yields and squanders that could be utilized to make jojoba oil, jatropha, or ocean mango are likewise conceivable. This future resource is available in materials (Arunkumar, Kannan, et al. 2019). Non-edible lignocellulosic sources of feedstocks, such as G2 or advanced fuels, such as tree biomass, jatropha, bagasse, jatropha (rural buildups), demolition timber, straw, or grass, are used as starting materials for the second era. Biomass energizes natural matter from leaves, wood, litter, and woodlands. More sugar is needed to produce biofuels. These are readily available and can be used to increase the return on investment with reduced reliance on food crops. This organic substance is found in nature and then evicted. increase the utilization of manures and nitrogenous substances, which will build the opportunity of Just as critical biodiversity misfortunes, nitrogen oxide outflows can likewise be brought about by this. (Sharma 2015)

3rd generation biofuel

Photosynthetic microbes and algae are the feedstocks of third-generation biofuels. The multifold benefits of algae as a biofuel feedstock are apparent. They can tolerate extreme temperatures and have low area requirements. Algae, biofuel production, and algae can reduce CO2 (Liu, Ying, et al. 2017). Algae will grow in nearly all types of water, including freshwater, seawater, and even industrial water. Algae have a growth rate of approximately 20 percent in terms of oil content and growth. Algae have a 30x faster rate of food-yielding plants and a 30x higher oil content than regular crops. The regular first and subsequent ages feed stocks. The green growth leftovers After oil extraction, they can be utilized as manure in fish and clam

ranches or as fish feed. Since algal This biofuel source can be utilized to make biodiesel and is basically sulfur-free. The oil quality is also excellent (Sharma 2015).

Table 1. Biofuel Feedstock Types and Research

Type of Biofuel Feedstock	**Stages of Generations**	**Source of Feedstock**	**Research Works**
Nut Oil (Edible oil)	1st Generation	Almond	(Raman, Deepanraj et al. 2019)
Commercial Oils (Inedible oils)	1st Generation	Walnut	(Raman, Deepanraj et al. 2019)
Mustard	1st Generation	Mustard	(Pascoal, Oliveira et al. 2020)
Rice	1st Generation	Rice	(Pascoal, Oliveira et al. 2020)
Lemon Seed	1st Generation	Lemon seed	(Pascoal, Oliveira et al. 2020)
Coconut	1st Generation	Coconut	(Pascoal, Oliveira et al. 2020)
Soybean	1st Generation	Soybean	(Pascoal, Oliveira et al. 2020)
Cottonseed	1st Generation	Cottonseed	(Pascoal, Oliveira et al. 2020)
Honge	1st Generation	Honge	(Pascoal, Oliveira et al. 2020)
Mahua	1st Generation	Mahua	(Pascoal, Oliveira et al. 2020)
Jojoba	1st Generation	Jojoba	(Pascoal, Oliveira et al. 2020)
Neem	1st Generation	Neem	(Pascoal, Oliveira et al. 2020)
Rubber Seed Tree	1st Generation	Rubber Seed Tree	(Pascoal, Oliveira et al. 2020)
Castor	2nd Generation	Castor	(Sarno and Ponticorvo 2020)
Tall	2nd Generation	Tall	(Sarno and Ponticorvo 2020)

Algae Growth, Extraction, and Conversion

Algae have gained significant attention in recent years due to their potential for mass growth and use in biofuel production. The following steps outline the process of algal biosynthesis:

1. **Culturing of Algae**: Algae can be cultivated in a manner similar to aquaculture. Algae growth is facilitated by abundant natural resources such as light, dissolved CO2, and nutrients (Sasaki, Takagi et al. 2020).
2. **Harvesting of Algae**: After cultivation, algae are harvested for further processing and conversion into biofuels.
3.

Unprocessed algal oil as biofuel

The concept of using any form of oil from vegetables Paris saw the introduction of conversion and fuel processing for the engine. Rudolph Diesel used groundnut oil in the 19th century. Turn the engine on. However, raw oils may be used for their therapeutic benefits. Technically, such engines are impossible and create many problems. It has low cetane and viscosity, so it can be a long-lasting benefit. low flash point and value. It can also cause engine knocking or carbon deposits. piston The conversion of the piston requires a specific technique. Vegetable oil has been transformed into a biofuel with great fuel properties. The performance of the engine was assessed using raw algae material oils in an unprocessed state. digital software Diesel RK analogous to Yanmar Diesel engine by Tsaousis et al. (2013)

Harvesting, dewatering, or algae

The oil is extricated utilizing nheptane through the Soxhlet extraction method. Oil extraction rates are a lot lower than those utilizing the SCF procedure. 39.4% of the oil was derived from cyclopentyl ether (CPME) and ethanol from green growth (EtOH). very basic liquids to secure 32.8% CO2 (Santoro, Nardi et al. 2019). Algal oil can be acquired as an unadulterated fatty oil. Decreased impetuses can be utilized to work on the presentation of fluid energizers. Algal oil has been removed from the alga gathered at Simlapuri Nahar, Ludhiana, Punjab. Very good-quality hexane was utilized for 9 wt% oil and 8 wt% oil. Acetone and acetone are both cheap (Santoro, Nardi et al. 2019).

Alga oil through lipid extraction from dry algal mass

The multilayered cell walls of the biological micro-species are made from simicic acid, which is used to produce cellulose and polysaccharides. The lipid fatty acids are encased in the cell wall, and their removal is difficult to do by using algal oil. Also known under the phase-heavy classification

Additionally, the particular extraction and utilization of lipids are conceivable. Dissolvable extraction utilizing methanol or chloroform Interest in microwaves, granulating, and dot beating is high. For extraction by mechanical means This strategy doesn't need Add more chemicals, and the next extraction step becomes simpler. The oil is extracted by the Soxhlet extract method using n-heptane. Oil extraction rates are much lower than those using the SCF approach, which is used to solve problems; cyclopentyl was extracted at a rate of 39.4 percent. Mether, ether, and ethanol from algae (EtOH), which is the particular
extraction and utilization of lipids are conceivable. Dissolvable extraction utilizing methanol or chloroform

Interest in microwave, granulating, and dot beating is high for extraction by mechanical means; this strategy doesn't need to add more Simlapuri Nahar is in Ludhiana, Punjab. Oil containing 9 wt% to 8 wt% was obtained using expensive hexane. Acetone is cheap (Karmakar, Rajor, et al. 2018).

Algae cultivation system: open pond

These are the best locations for algal proliferation. Open ponds may have either fresh water or salt water, depending on what algal species are used. strain for biofuel synthesis. These ponds may simply be expanded to cover several hectares. Open systems can be a problem because of algae grazers, algal invasions, and fungal proliferation. contamination of the selected microalgae species. (Sharma 2015).

Because microalgae grow so fast, they can produce approximately 15-20 tons of annual dry biomass on approximately 1 hectare. The high-yielding varieties are around 50–60%. (Singh, Bauddh, et al., 2015) Dry mass is the oil content that reduces the cost of the entire process. You can also have an open pond system. It is considered a source of large amounts of biomass that can be used for biofuel but not for food or other therapeutic purposes. A Comparison of the Costs and Productivity of the Various Microalgal Culture Systems (Ghorbani, Rahimpour, et al. 2018)

Open ponds

Open lakes experience the ill effects of similar issues as covered lakes. Be that as it may, other green growth can flourish in these lakes. Attacks of parasitic development and different issues can be managed partially. Outdoor dissipation can cause gigantic misfortunes. These closed lakes address the issue of ponds. (Carballo, Mireles, et al., 2006) The microalgal colonies at the conclusion of the tank collect an inclined surface below the roof, which is subsequently pumped to the roof. It is important to maintain the proper evaporation ratio on sunny days as well as volumetric variations during rainy days. In the tank, that serves as a buffer factor. Scenedesmus species, a microalgal genus, are included in this tank. (de Marchin, Erpicum et al., 2015).

Conclusion

It is difficult to find enough biofuels for the first and second generations of biofuels in sufficient quantities to encounter the stresses of the worldwide marketplace. These are the requirements. These feed stocks are highly dependent on each other and could have an impact on the global carbon cycle. Algae can be described as photosynthetic living plants that have the potential to emerge. Biofuels production needs feedstock; the algal lipids can be combined with carbohydrates to make them. Bioethanol, biodiesel, and both bioethanols can be obtained using accurate procedures. In this object, we will examine the potential of algae used to make biofuels, including biodiesel (bioethanol), bioethanol, biohydrogen, and biogas. The challenges faced by these schemes were also emphasized. Open algal farming systems contain open Debates on pool and photobioreactors were extensive. Additionally, limits were identified and discussed. Although the idea of alga cultivation is not something that I would consider simple, it's not without its challenges. Harvesting and lipid-rich foods need to be addressed. Conversion of alga into algae is an exciting area where challenges can be enthralling. Algal biofuel does wonders for engines and is still very economical. Detailing the parameters of fuel compatibility is essential. We have much to do before we make algal fuel a reality. Alternatives that are commercially viable to fossil energy However, manifold R & D is the whole thing that needs to be overwhelmed by the limits in the algal biofuel manufacturing scheme.

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