

Alternative Fuel Extraction From Micro Algae

Venkatesh.S,¹ Boobesh kumar.R²

Dept. of Mechanical Engineering, VSB College of Engineering Technical Campus, Coimbatore, India.

Abstract

A non-renewable fuel like petroleum has been used from centuries and its usage has kept on increasing day by day. This also contributes to increased production of greenhouse gases contributing towards global issues like global warming. In order to meet environmental and economic sustainability, renewable, carbon neutral transport fuels are necessary. To meet these demands microalgae are the key source for production of biodiesel. This paper presents an overview on the potentiality of microalgae with particular emphasis as a sustainable renewable energy source for biodiesel. Microalgae have a number of characteristics that allow the production concepts of biodiesel which are significantly more sustainable than their alternatives. Microalgae possess high biomass productivity, oils with high lipid content, fast growth rates....etc. The viability of microalgae biodiesel production can be achieved by designing advanced photo bioreactors, developing low cost technologies for biomass harvesting, drying, and oil extraction. In addition, new emerging technologies such as algal-bacterial interactions for enhancement of microalgae growth and lipid production are also explored. Extraction of bio fuel from microalgae is rapid and highly less economic and also gives high yield than any other product. According to US DOE microalgae have the potential to produce 100 times more oil per acre land than any terrestrial plants. Biodiesel is usually used by blending with petro diesel, but it can also be used in pure form and can run any engine. It will satisfy the needs of the future generation and it will meet the demands of the future generations.

Keywords

Algae bio fuels; Biometrics analysis; Guerbet process; butanol

Introduction

Energy sources are used as fuels. Fuel is burned in machinery to create motion (such as in a car) or heat (such as in a home heating system). When fuels are used for producing electricity, heat or motion causes a generator to rotate, creating electricity for everyday use in homes and businesses.

Energy sources can be classified into two types: non-renewable and renewable. Non-renewable resources, such as fossil fuels and nuclear material, are removed from the earth and can be depleted. These resources have been the most used type of energy in the modern era.

Renewable resources, such as wind, water, solar, and geothermal, come from sources that regenerate as fast as they are consumed and are continuously available. Some, such as bio fuel produced from food crops and other plants, are replenished every growing season. In the early part of the twenty-first century, renewable sources have become more popular as non-renewable sources have begun to be depleted. Non-renewable energy is energy from fossil fuels (coal, crude oil, natural gas) and uranium. Fossil fuels are mainly made up of Carbon. It is believed that fossil fuels were formed over 300 million years ago, when the earth was a lot different in its landscape. It had swampy forests and very shallow seas. This time is referred to as 'Carboniferous Period'.

Fossil fuels are usually found in one location as their formation is from a similar process. Earth movements and rock shifts creates spaces that force to collect these energy types into well-defined areas. With the help of technology, engineers are able to drill down into the sea bed to tap the stored energy, which we commonly known as crude oil. As similar as crude oil many other sources are formed. Now a days petroleum and some other non renewable sources can satisfy our needs. What about our future generations? Now 95% of our energy demands are made from coal, natural gas, fossil fuels...etc

Reserves of oil, natural gas and nuclear energy will be exhausted by the end of 21st century and coal within two or three centuries.

Oil: 50 to 100 years,

Gas: 60 to 70 years,

Coal: 200 years.



Just imagine and think about our future generations. We would not able to sustain our life. And also many gases which taken out from the auto mobiles causes ill. It causes many respiratory diseases .By emission of carbon monoxide from automobiles causes global warming. This is a main drawback of using it, and so by moving our life style to use some bio products is a solution for this problem.

Bio Diesel - Introduction

Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a diesel additive to reduce levels of particulates, carbon monoxide, and hydrocarbons from diesel-powered vehicles. Biodiesel is produced from oils or fats using transesterification and is the most common bio fuel in Europe.

In 2010, worldwide bio fuel production reached 105 billion litres (28 billion gallons US), up 17% from 2009, and bio fuels provided 2.7% of the world's fuels for road transport, a contribution largely made up of ethanol and biodiesel.[citation needed] Global ethanol fuel production reached 86 billion litres (23 billion gallons US) in 2010, with the United States and Brazil as the world's top producers, accounting together for 90% of global production. The world's largest biodiesel producer is the European Union, accounting for 53% of all biodiesel production in 2010. As of 2011, mandates for blending bio fuels exist in 31 countries at the national level and in 29 states or provinces. The International Energy Agency has a goal for bio fuels to meet more than a quarter of world demand for transportation fuels by 2050 to reduce

dependence on petroleum and coal. The production of bio fuels also led into a flourishing automotive industry, where by 2010, 79% of all cars produced in Brazil were made with a hybrid fuel system of bio ethanol and gasoline.

Micro Algae – Bio Fuel

Algae are a large and diverse group of simple, typically autotrophic organisms. Some have one cell and others have many cells. The largest and most complex marine algae are called seaweeds. They are like plants, and “simple” because they lack the many distinct organs found in land plants. Algae are an autotrophic organism because it can able to prepare their food as their own. They are completely based on aquatic chain.

Heightened global awareness of climate change and consumption of finite resources has driven research in biomass-based forms of energy production. Current fossil fuel depletion rates and related emissions have prompted development of sustainable energy alternatives that are both carbon neutral and compatible with existing infrastructure. In past years, researchers have examined various biomass feed stocks such as corn, soybean, canola, and lignocelluloses crops for their bio energy potential. Major drawbacks to these first and second generation bio fuels including land use, water footprint, and influence in global food markets have prompted research in alternative forms of biomass [1]. Accordingly, algae-to-energy systems are receiving increased attention from both academic and industrial sectors. Microalgae’s promising characteristics, such as high productivity, easy to cultivate, no need of only fresh water.

Microalgae are touted as an attractive alternative to traditional forms of biomass for bio fuel production, due to high productivity, ability to be cultivated on marginal lands, and potential to utilize carbon dioxide (CO2) from industrial flue gas.

| CROP | OIL YIELD (L/HA*YR) |
|-------------|---------------------|
| Soya bean | 450 |
| Camelina | 560 |
| Sunflower | 955 |
| Rapeseed | 1190 |
| Jatropha | 1890 |
| Oil palm | 5950 |
| Micro Algae | 3800 - 5800 |

Lifecycle Of Micro Algae

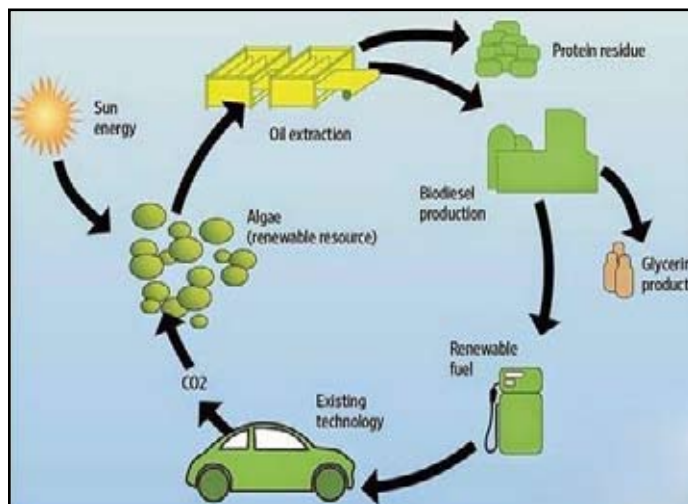


PHOTO BIO REACTORS

The production of algae in photo bio reactors is an easy way to cultivate it.

A photo bioreactor is a bioreactor that utilizes a light source to cultivate phototrophic microorganisms. These organisms use photosynthesis to generate biomass from light and carbon dioxide and include plants, mosses, macro algae, microalgae, cyanobacteria and purple bacteria.

Cultivation Of Micro Algae By Bio Reactors

A photo bioreactor (also known as PBR) is a piece of equipment that provides a controlled environment to cultivate algae.

- It is better than cultivating it in a small pond as it allows all the requirements of algae growth to be introduced into the system in a very controlled manner.



For example, parameters such as carbon dioxide, water,

temperature, exposure to light, mixing regime, etc. can be controlled very accurately.

- Better protection from outside contamination.
- Space saving - Can be mounted vertically, horizontally or at an angle, indoors or outdoors.
- Reduced Fouling - Recently available tube self cleaning mechanisms can dramatically reduce fouling.

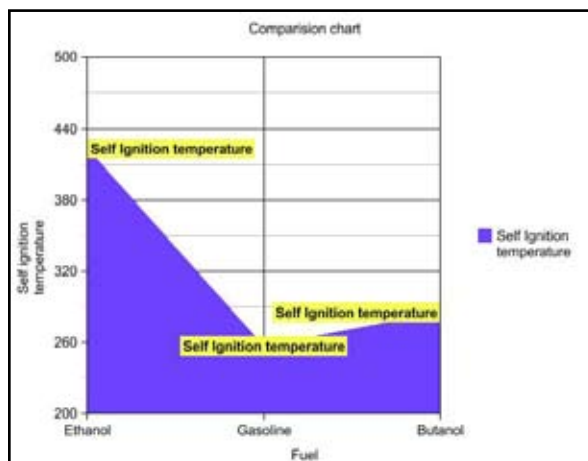


TABLE (1)

| FUEL | ENERGY DENSITY MJ/L | SPECIFIC ENERGY MJ/KG of air | AIR FUEL RATIO | CALORIFIC VALUE MJ/L | SELF IGNITION TEMP (°C) |
|------|---------------------|------------------------------|----------------|----------------------|-------------------------|
| 1. | 30 | 3.2 | 11-12 | 30 | 285 |
| 2. | 19.6 | 3 | 9-10 | 26.5 | 423 |
| 3. | 30 | 2.9 | 12-15 | 34.5 | 257 |

The production of oil from algae by deep distillation process. From this process ethanol can be extracted from that source. This is a single step extraction process.

TABLE (1) REFERENCE

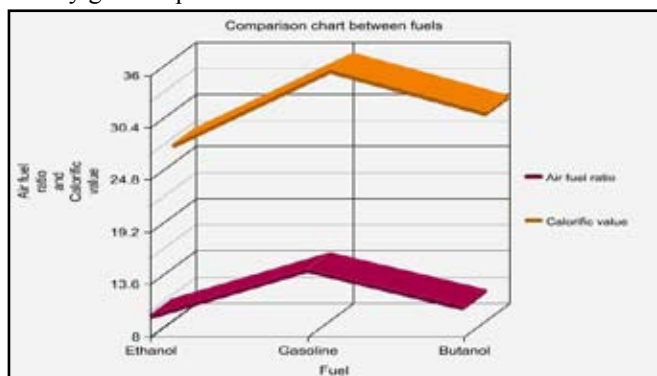
1. Butanol 2. Ethanol 3. Gasoline

Some of the benefits are :

- No initial dewatering required
- Significant energy savings
- No caustic chemicals
- Tunable to wide range of feed stock
- Small foot print
- Easy installation
- Greatly reduce capital expenditure.

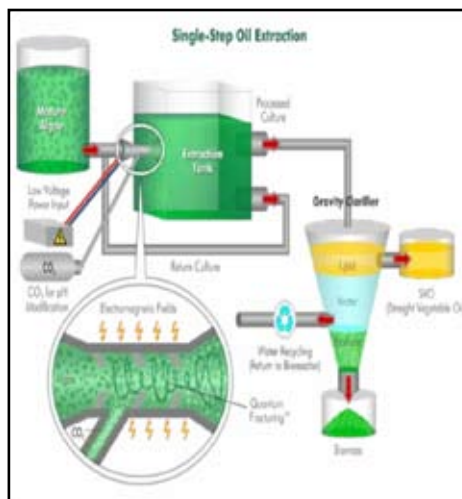
Butanol For Better Efficiency

- If ethanol is used as an engine fuel it emits harmful emission gases and also makes corrosion on engine.
- And it also has a low volatile, higher energy density and no by products are formed compared to ethanol.
- So, for a better performance ethanol is converted into butanol by guerbet process.



- Clean fuel that is an excellent alternative to petroleum
- 100% renewable
- A positive impact on the environment
- Provides significantly reduced emissions of carbon monoxide, particulate matter, unburned hydrocarbons and sulphates.
- Helps to reduce the risk of global warming by reducing net carbon emission to the atmosphere.
- Blending of bio butanol to other fuels can be easily to any proportions.
- Sometimes it can be directly used as a fuel.
- Rapid degradation is very low for butanol when compared to ethanol hence the efficiency will be improved.
- Danger will be caused when fuel spilling causes in ethanol but in butanol that issue may not occurs.
- Butanol is an alcohol that can be directly used as a transport fuel.

Extraction of Butanol



Guerbet Process

The Guerbet reaction is an organic reaction converting a primary aliphatic alcohol into its β -alkylated dimer alcohol with loss of one equivalent of water. This reaction requires a catalyst and elevated temperatures. The conversion of n-butanol to 2-ethyl-1-hexanol. The alcohols derived from this reaction are called Guerbet alcohols. Application of long-chained aliphatic alcohols gives access to surfactants.

The reaction requires alkali metal hydroxides or alkoxides and hydrogenation catalysts such as Raney Nickel at higher temperature (220 °C) and pressure. From this process ethanol can be easily converted into bio butanol. Hence it can be used directly used as a fuel.

Recent Trends in Bio Fuel

- Some companies like ford, BMW, Volkswagen, Volvo, Mercedes...etc has been able to induce things like algae to produce fuel that is so close to gasoline.
- According to US DOE microalgae have the potential to produce 100 times more oil per acre land than any terrestrial plants.
- In 2015, SAPPHIRE ENERGY set up a hybrid car runs by algae bio fuel and found better efficiency by using bio butanol form algae.

Conclusion

In conclusion, biodiesel is a very small industry compared to its bio butanol companion in renewable fuels. Current government policy combined with economics of traditional fuel markets are helping garner interest in growing the biodiesel market. Current projections show that biodiesel may grow relatively rapidly over the next few years, but it will likely remain a small part of the overall diesel market. The growth of biodiesel may not have as much impact on Midwestern agriculture as ethanol because there are numerous alternatives to soybean oil as a feedstock that could be used for biodiesel production. For the foreseeable future, soybean oil will likely be the dominant feedstock, but the search for technological improvements may lead to alternative crops being the primary source for biodiesel production in the future.

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University of Athens, Zografou Campus, 9 Heroon Polytechniou St., 15780 Athens, Greece,

[7]. *E.G. Giakoumis, A.M. Dimaratos, D.C. Kyritsis, University of Illinois at Urbana Champaign, Department of Mechanical Science and Engineering, 1206 West Green Street, Urbana, IL 61801, USA*

[8]. *Anju Dahiya, University of Vermont, USA, GSR Solutions, USA.*