International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 2 Issue: 12 5279 – 5282

Study and Impact of Biofuel as Energy Sources via Algal Materials or Lignocellulosic Substrates Utilization

Rajesh K. Srivastava[a],
[a] Department of Biotechnology, GIT, GITAM University, Gandhi Nagar Campus, Rushikonda, Visakhapatnam - 530045 (A. P.), India, Off.: 0891-2790202, Fax: 0891-2790037, Mob: +919703842963

*corresponding author Email: rajeshksrivastava73@yahoo.co.in

Abstract: A biofuel is organic compounds, generated in a short period of time. It is mostly produced from plants or its waste material or useful material such as food grain or other products which has been grown today or any times. It helps in reduction of greenhouse gas emission in our atmosphere that need for our society. As conventionally fuel, fossil energy sources has been consumed in different purposes of our life need. Gasoline, coal or natural gases has been used from ancient periods and availability is limited so need for alternate fuel resources with less costly price. Biofuel can fulfill the need of our society and avoid our dependence in future. Ethanol with other advanced biofuel such as propanol and butanol can replaced the fossil fuel with effective utilization as conventionally way effort. Biodiesels or fatty acid methyl esters is derived from oleaginous microbes (microalgae, yeast, and bacteria) and it is being actively used as potential renewable substitutes for petroleum diesel.

Key words: *Biofuel, Lignocellulosic materials, fossil oil, Energy, resources*

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I. Introduction

Primary energy sources are classified as fossil, nuclear fuels as non-renewable and renewable energy sources. Globally, most energy is provided from the fossil energy sources whereas nuclear power plants contribute to only a very small percentage. Energy supply from renewable energy sources has been improved significantly; its contribution is quite limited. Water, sun, wind, geothermal heat, tides, and biomass are reported as the renewable energy sources. Since demand for energy is expected to increase more than 50% by 2025 (Khanal, 2008). Gasoline and diesel are actually ancient biofuels. But they are known as fossil fuels because they are made from decomposed plants and animals that have been buried in the ground for millions of years. Fossil fuels are obtained from ground via pumping with having more cost value and greenhouse gas emission. It could cause the difficulties with more chances of shortage of its availability in future (Mueller and Cuttica, 2006). Biofuels is different from fossil fuels (i.e. not renewable fuel).

A biofuel, a hydrocarbon fuel is produced from organic matter (living or once living material) in a short period of time (days, weeks, or even months). Biofuels can be made from plants which are grown today. Biofuel provided 1.8% of the world's transport fuel in 2008. Investment into biofuel production capacity exceeded $ 4billion worldwide in 2007 and is growing till today. First generation biofuel is made from sugar, starch and vegetative oils, where as the second generation biofuel is made from non-food crops (Jojima et al., 2008). And third generation biofuel is produced from algae such as *Botryococcus braunii* and *Chlorella valgaris* but they have more problem to extract the algal oil from it and algae is low in-put, high yield feed-stocks to produce the fuel. Renewable fuel produced from algal lipids could fulfill the future transportation fuel requirements (Darzins et al., 2010). But there are some challenges like identification and development of robust and productive algal species as well as extraction methods to recover the produced lipids. Non food crops may be waste biomass, stalk of wheat, corn, wood and special- energy or biomass crops such as Miscanthus and all are made up of lignocellusoic materials (Cornell and Clayton, 2008). Author will discuss here different types of biofuels which could be best alternate for energy for daily need.

Biofuel and its properties

All forms of biofuels are biodegradable and less harm to environment once they spilled. Production of biofuels is found as an alternative solution to solve the energy shortage and also to reduce the greenhouse gas emission**.** Countries around the world are using various kinds of biofuels. Important or awareness among the people in different countries for Biofuels could be increased by focusing on the development of advanced generations of biofuels (Pensupa et al., 2013). A biofuel is produced through agriculture and

 ISSN: 2321-8169
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anaerobic digestion. Making biofuels can be achieved from grasses and saplings which contain more cellulose. Many second generation (2G) biofuels are biohydrogen, biomethanol, Dimethylformamide (DMF), BioDMF wood diesel, mixed alcohols and biohydrogen diesel (Carriquiry et al.,2011).

Bioethanol

Bioethanol is widely used in the USA and in Brazil. It is reported that increase fuel ethanol use to over 1.7 billion gallons per year by 2001 by promotion of US government (Wang et al., 2007).

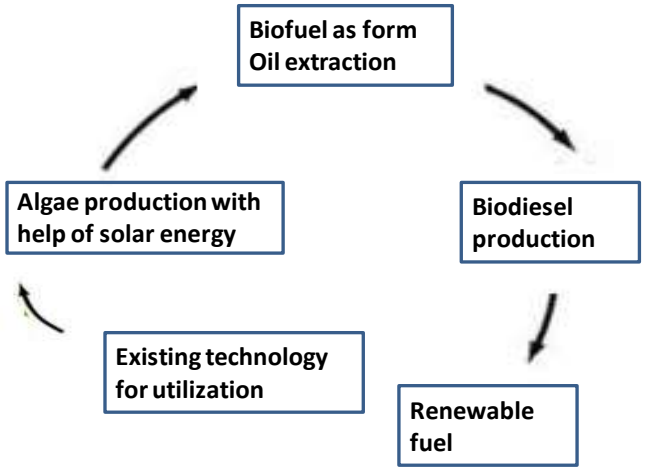

Figure 1 Schematic representation of biofuel as biodiesel from algal resources

For example the biofuel bioethanol is an alcohol made by fermentation. It is produced around 85 billion litres at worldwide as 1st generation biofuel via use of food-based crops such as corn, sugar cane and wheat as the starting material (Dorado et al., 2009). Ethanol can be used as a fuel for vehicles in its pure form, but it is usually used as a gasoline additive to increase octane and improve vehicle emissions. Brazil has turned sugarcane into ethanol, and some cars there can run on pure ethanol rather than as additive to fossil fuels. Conversion of food materials into biofuel could be triggered the concern of global food security and it could affect the public acceptance of biofuel. To solve the mentioned issue, we could promote the non-food biofuel processes (Singh and Bishnoi, 2012).

n-Butanol

Biobutanol *has been recently recognized* as second generation biofuel and it has more attractive biofuel replacement in present and future having slightly less energy than gasoline. n-butanol is a commercially viable biofuel because of on alcoholic fuel with a higher energy density and lower volatility and also having potential to reduce the carbon emissions by 85% when compared to gasoline. N-Butanol can run in any car that uses gasoline without the need for modification to engine components Biologically, n-butanol is produced by several genera of bacteria, particularly *Clostridium acetobutylicum*, *E. coli* strain, *Bacillus subtilis*, *Pseudomonas putida* and *Lactobacillus brevis* or *Sccharomyces cerevisae* (Jojima et al., 2008).

n-Butanol can be utilized in internal combustion engines as both a gasoline additive and or a fuel blend with gasoline. The energy content of butanol (i.e. 28.2 MJ/liter) is 10-20% less than that of regular gasoline (i.e. 34.8 MJ/liter). In India lignocellulosic residue of edible or non-edible crop wastes (e.g. bagasse from sugar manufacture) are cheap waste substrates source and found in huge quantity. And its conversion into sugar mixtures or polyols and fatty acid would be very economic feasible and beneficial process for biobutanol production (Gonzalez et al., 2008). DuPont and British Petroleum (BP) are working together to help develop butanol. *E. coli* strains have also been successfully engineered to produce butanol by modifying their amino acid metabolism.

Biomethane

The potential of bio-methane as bio-fuel/bio-energy is known for reducing greenhouse gas emissions (Tilche and Galatola, 2008). Methanol is also alcoholic chemicals used in chemical industry, having currently production about 45 million tonnes per year with its main source is mainly natural gas (Bromberg and Cheng, 2010).

Biomethanol

Methanol can also be produced from feedstock, such as biogas, biomass, waste streams and CO_2. Bio-methanol (also called renewable methanol) is chemically identical to conventional methanol. Bio-methanol could reduce the use of fossil fuel with less greenhouse gas emissions. There are many reports mentioned the possibility to convert a range of renewable feedstock into bio-methanol. And methanol can be produced by gasification of renewable feedstock (Kumabe et al., 2008). Methanol can used in transportation due to having the following properties such as blended with gasoline and ethanol with today's vehicle technology at minimal incremental costs with safe fuel, having high octane fuel and produced from renewable source (Sheehy et al., 2010).

Biodiesel synthesis

Biodiesel is the most common biofuel in Europe. It is produced from oils or fats using transesterification and is a liquid similar in composition to fossil/mineral diesel. Feedstocks for biodiesel include animal fats, vegetable oils, soy, rapeseed, jatropha, mahua, mustard, flax, sunflower, palm oil, hemp, field pennycress, Pongamia pinnata and algae (Herskowitz et al., 2006; Brady et al., 2009). Pure

biodiesel (B100) currently reduces emissions with up to 60% compared to diesel Second generation B100. Hydrogenation-derived renewable diesel (HDRD), also known as green diesel or second-generation biodiesel. It is the product of fats or vegetable oils—alone or blended with petroleum. Green diesel is produced through hydrocracking biological oil feedstocks, such as vegetable oils and animal fats. Green diesel is being developed in Louisiana and Singapore by ConocoPhillips, Neste Oil, Valero, Dynamic Fuels, and Honeywell UOP as well as Preem in Gothenburg, Sweden, creating what is known as Evolution Diesel. Knothe describes fatty acid methyl esters (FAME) as "biodiesel" and oxygen-free hydrocarbons produced by hydrotreating triacylglycerol (TAGs) as "renewable diesel" (Knothe, 2010).

The Neste Oil NExBTL process produces renewable diesel by hydrotreating vegetable oils or waste fats, resulting in a 40-80% lifecycle reduction in CO_2 depending on the feedstock.16 Neste Oil recently opened a plant in Singapore using NExBTL technology that will produce more than 800,000 tons per year of renewable diesel from feedstocks such as palm oil and waste animal fat. Annual worldwide production of vegetable oils (such as palm oil, soyabean oil, canola/rapeseed oil, and sunflower oil via mixing it) is about 145 million tonnes. And NExBTL technology can use all vegetable oils and animal fats as an input (Nylund et al 2011). NExBTL technology is developed by R&D group people in Neste Company and they are focused on alternative feedstocks such as non-food oil crops cultivation, like Jatropha and algae, microbes, bacteria (Nestleyoil, 2010).

Lignocellulosic materials and its components

Cellulose is the tough material that makes up plants cell walls, and most of the weight of a plant is cellulose. Now days, the bioethanol production is obtained by use of lignocellulosic raw materials such as wheat straw, corn stover and bagasse as promising options (Marker et al., 2009; Dorado et al., 2009).

II. Conclusions

A biofuel is generated in a due period of time. It is utilized whole plants or its waste material or useful material such as food grain or other products for its production. Microalgae, yeast, and bacteria are used for biological mode of biofuel synthesis by utilizing the very cheap materials.. Fossil energy source needs to replaced and frequently use for different purposes of our life need. Gasoline, coal or natural gases has been used as conventional energy sources and its availability is limited and need to depend on alternate fuel resources like biofuel having currently more cost value. So we need to use raw materials with less cost price for its large scale production. Biofuel can avoid our dependence in future. Fatty acid methyl esters and advanced biofuel such as propanol and butanol can replaced the fossil fuel in future.

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