

# Some Benefits of Biodiesel with Advantages and Challenges of Biodiesel as an Alternative Fuel in Injection Modeling

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**Abstract:** In present years, biodiesel is utilized as a fuel in fuel in internal combustion engine. In this paper we are talk about the advantages and challenges of biodiesel as an alternative fuel, in this paper we will likewise examine the a few benefits of biodiesel. Biodiesel is an unsaturated fat methyl ester which is gotten from vegetable oils and animals fats, waste oils and deposits in consistence with EN 14214 norms. Etherification innovation is utilized in biodiesel generation. This investigation incorporates an examination of the various types of biofuels and their belongings with respect to ecological related perspectives. The biodiesel has potential as an alternative fuel and can be utilized in conventional internal combustion engines. The properties of biodiesel are discovered like that of diesel. The injection systems have had a solid advancement lately, going from low-pressure arrangement of a mechanical drive to complex high-pressure electronic frameworks.

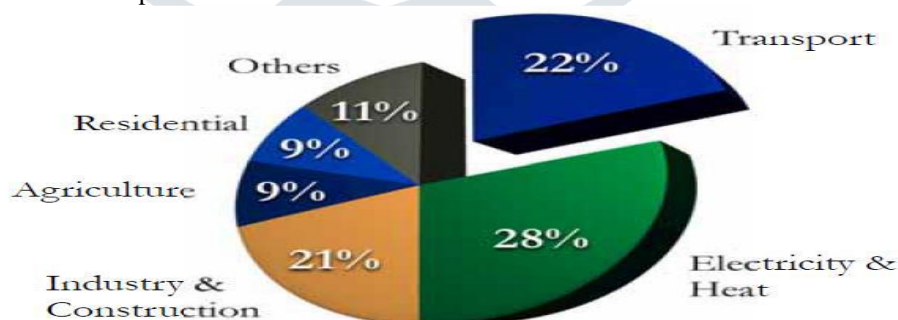
**Index Terms - Biodiesel, Biofuels, Engine, Injection, Low Pressure, vegetable oils etc.**

## I. INTRODUCTION

Being one of the most primary inputs of everyday life and the industrial world, energy has been used in various ways since the first existence of human beings. When we look at the types of energy used today, we can see that the mainly used types of fuels are fossil based. CO<sub>2</sub> is emitted as a result of the combustion of fossil-based fuels. The increasing amounts of CO<sub>2</sub> in the atmosphere create a greenhouse effect.

Biofuels have been becoming prevalent rapidly because of constantly gaining economic value and concordantly having less negative effects on the environment. All plant and animal based substances with carbohydrate compounds as main components are biofuel resources. This study includes an examination of the different kinds of biofuels and their effects regarding environmental-related aspects.

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**Figure 1.1** Greenhouse gas emissions in the European Union by sector (Internet Resources)

## II. BIOFUELS

Biofuels have been becoming prevalent rapidly because of constantly gaining economic value and concordantly having less negative effects on the environment. All plant and animal based substances with carbohydrate compounds as main components are biofuel resources. Wood, oilseed plants, carbohydrate plants (potatoes, wheat, corn, beet etc.), fiber plants (linen, hemp, sorghum, etc.), protein plants (green peas, beans, etc.), and herbal wastes (twig, stem, straw, root, crust, etc.) constitute the plant biofuel resources. Herbal biomass occurs as the result of a process through which green plants convert solar energy into chemical energy and store this obtained chemical energy. Social, economic and environmental effects of biofuels are presented in Figure 1.2

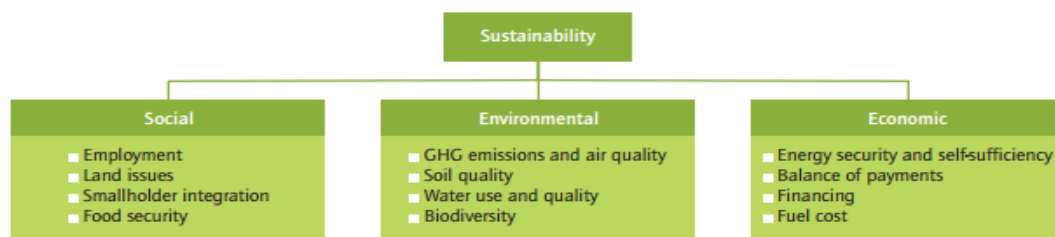


Figure 1.2 Social, economic and environmental effects of biofuels

III. BIODIESEL

Biodiesel is a fatty acid methyl ester which is derived from vegetable oils and animal fats, waste oils and residues in compliance with EN 14214 standards. Esterification technology is used in biodiesel production. The oil sources that can be used in biodiesel production are (Singh and Gu, 2010):

- Vegetable oils: Sunflower, soybean, rape, safflower, cotton and palm oils
- Recycled oils: By-products of the vegetable oil industry (Soapstock, waste oil)
- Urban waste and industrial waste-based recycled oils: Brown grease, Black grease
- Animal Fats: Tallow, fish oils and poultry oils
- Waste vegetable oils: Yellow grease and
- Algae.

Biodiesel can be used as fuel in engines either directly (B100) or through blending with diesel fuel at certain ratios (B20, B50, etc.). Biodiesel can be used in current diesel engines without requiring any modifications on the engine design. Countries that have a high biodiesel production potentials are given in Table 1.1. As the table shows, Malaysia comes first in terms of its biodiesel production potential (Aytav and Kocar, 2013). Important characteristics of biodiesel are as follows (Demirbas, 2009):

- It is obtained from renewable raw material sources
- Decreases the dependence on petroleum products
- Considerably decreases emissions
- Does not contain sulfur
- Has good lubricant properties and increases the lubricant effect when blended with diesel fuel
- Has safe transportation, storage and easy usage properties due to its high ignition temperature
- Has a calorific value close to that of diesel fuel and a higher cetane number than diesel fuel
- The use of biodiesel fuel causes a decrease in the amount of PM, CO and HC existing in exhaust gases

Table 1.1 Countries with the highest biodiesel production potential

Country	Feedstocks
Malaysia	14.54
Indonesia	7.60
Argentina	5.36
USA	3.21
Brazil	2.57
Netherlands	2.50
Germany	2.02
Philippines	1.23
Belgium	1.21
Spain	1.07

Bioethanol

Bioethanol is a biofuel that can be obtained through the fermentation of plants containing sugar and starch or the acidic hydrolysis of cellulosic sources. Plants like sugar beet, sugar cane, corn, wheat and potato, wood-like plants such as stem, straw and bark, agricultural wastes and molasses, a byproduct of sugar production, can be used as raw material for bioethanol production.

It is more convenient to use bioethanol in gasoline engines owing to its high octane number. However, bioethanol has a considerably low cetane number. For this reason, its use in diesel engines has certain limitations. Important characteristics of bioethanol can be listed as follows (Demirbas, 2004):

- It is obtained from renewable raw material sources.
- Decreases the dependence on petroleum products
- Considerably decreases emissions
- Increases the octane number of the fuel
- It facilitates the more efficient and cleaner combustion of gasoline because of its oxygen content.

### Methanol

Although methanol has a high octane number, it has a very low cetane number. For this reason, there are certain problems regarding its use in diesel engines. Methanol can easily be used in Otto engines. However, its use in diesel engines is only possible through the use of spark plugs or by blending methanol with diesel fuel at certain ratios (Serra and Zilberman, 2013).

### Hydrogen

Hydrogen, which is the lightest element in nature, was discovered in 1766 by British scientist Sir Cavendish. Hydrogen is a colorless, odorless, flavorless and clear gas which is represented by the symbol "H" in the periodic table. Its atomic weight is 1.00797 kg/kmol and its atomic number is 1. Because of its low weight, it rarely occurs in a free state in nature. Hydrogen, which is an invisible and odorless gas, is observed in compounds with other elements in nature. Its density at 0 oC is 0.08987 kg/m<sup>3</sup>. Hydrogen has a considerably high combustion temperature and it does not have a poisonous effect. The only outcome of hydrogen combustion is water vapor. Hydrogen is an element which is highly difficult to condensate. It transforms into liquid phase at a temperature of approximately 20 Kelvin and at a pressure of 2 bars. Hydrogen is a considerably good thermal conductor (Govinda et al. 2011).

### Biogas

Biogas is a gas mixture which occurs as the result of the decomposition of animal and plant wastes in an oxygen-free environment. Biogas contains 60-70% methane (CH<sub>4</sub>), 30-40% carbon dioxide (CO<sub>2</sub>), 0-2% hydrogen sulfide (H<sub>2</sub>S) and a very small amount of nitrogen (N<sub>2</sub>) and hydrogen (H<sub>2</sub>). The term 'biogas' basically refers to the production of usable gasses from organic wastes. Since obtaining biogas depends on the decomposition of organic substances, plant wastes and animal manures can be used as the basic material for biogas production. Today, biogas production is utilized for heating a single residence, producing electricity using a generator etc (Serra and Zilberman, 2013).

### Butanol

Butanol is the most complex of all alcohol fuels. As its CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH structure shows, butanol is a 4-carbon alcohol. Butanol is more poisonous compared to some other alcohols like methanol and ethanol. Butanol has a boiling point of 118 oC and a melting point of -89 oC. Butanol is commonly used as a solvent. It is also a candidate to be used as fuel. Butanol can be produced through the fermentation of agricultural products or from crude oil. It can be used as fuel in internal combustion engines operating with gasoline without performing any modifications on the engine. Butanol has higher energy content and a lower vapor pressure compared to ethanol and methanol.

## IV. FUEL PROPERTIES

The stoichiometric air-fuel ratios of biofuels are presented in Table 1.2. The cetane and octane numbers, lower calorific values and liter prices of these fuels can be seen in Table.

**Table 1.2:** The stoichiometric air-fuel ratios of selected biofuels

Gasoline has an air fuel ratio of	14.7 : 1
Natural Gas has an air fuel ratio of	17.2 : 1
Bio-Ethanol has an air fuel ratio of	9:01
Methanol has an air fuel ratio of	6.4 : 1
Hydrogen has an air fuel ratio of	34:01:00
Diesel has an air fuel ratio of	14.6 : 1
Methane has an air fuel ratio of	17.4 : 1
Biogas has an air fuel ratio of	10:01
Biodiesel has an air fuel ratio of	12-13:1
Bio Ethanol (22 % mix) has an air fuel ratio of (as it is an oxygenated fuel as compared to Gasoline)	12.7 : 1
E85 has an air fuel ratio of	9.765

## V. RATIONALE

In this scenario the interest in this world to invent substitute fuels for the diesel engines. So there are vegetables oil is favorable option as it has many advantages. It is reusable, ecofriendly, and cheaper to make and easily produce in villages, where there is no acute need for modern form of energy. Some institution and research organizations they produced bio diesel with properties that very close to use of diesel. Such types of fuels are already in use due to compatibility, largely because of cheaper as compare to diesel and continued availability to the future. In addition the international pressure to reduce the carbon dioxide emitting hydrocarbons has made it essential to examine the properties of different green energy fuels, having potential in of using these in diesel engines. While biodiesel has much gain over diesel fuel, but there are many problems that need to address, such as its higher flash point, high viscosity, and poor cold flow properties, lower calorific value, poor oxidative stability and sometimes its moderately higher secretion of nitrogen oxides. As a result many fuels are being scrutinized auxiliary for fossil fuels, especially diesel vegetable oils may give one such substitute and their potential has been test in the past few years by several researchers.

## VI. SOME BENEFITS OF BIODIESEL LISTED BELOW

1. It decreases the dependency on imported petroleum.
2. It is regenerative and underwrites less to global warming than petroleum fuel due to its closed carbon cycle. In the initial feedstock can grow time to time and most of the carbon in the fuel was uniquely removed from the air by the plant.
3. It imparted good engine performances and can use without engine modification.
4. It imparted a production of more vegetable oils and animal fats so the economy of rural areas increases.
5. It is biodegraded and harmless.
6. It demonstrate lower combustion profile, specially Sox

## VII. ADVANTAGES OF BIO DIESEL

There are many technical advantages of bio diesel fuel:

- It extends engine life and reduces the need for preservation (bio-diesel have good lubricating qualities than fossil fuel)
- It is innocuous to handle, being minor harmful, major bio degradable, and having a higher Flash point,
- It reduces some exhaust emissions (although it may, in some circumstances, advance others).
- Bio diesel is an efficient, hygienic, 100% natural energy substitute to petroleum fuels. As well as the many advantages of bio diesel fuel include the following: safe for use in entirely conventional diesel engines, approach the same performance and engine robustness as petroleum diesel fuel, non-flammable and non-toxic, reduces tail pipe emissions, observable Smoke and noxious fumes and redolence.
- Bio diesel as good with respect to diesel fuel in terms of sulfur content, flash point, odors content and bio-degradability.

## VIII. CHALLENGES OF BIODIESEL AS AN ALTERNATIVE FUEL

At high temperatures, biodiesel can oxidize if air is present, causing the formation of acids and solids, which can corrode and plug fuel system components. Additives can help prevent this deterioration. Much as vegetable oils become cloudy in the refrigerator, biodiesel will form wax at cold temperatures. These wax crystals plug fuel filters, so flow-improving additives are necessary in cold weather. Biodiesel crops yield comparatively less energy per unit of crop area than that available for ethanol crops.

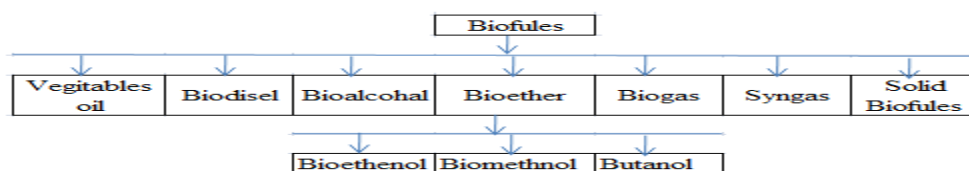


Figure 1.3: Block diagram of various outcomes of biofuels. (source of internet)

## IX. CONCLUSION

In this paper we are discussed Some Benefits of Biodiesel with Advantages and Challenges of Biodiesel as an Alternative Fuel in Injection Modeling. In this paper shows the block diagram of various outcomes of biofuels. Biodiesel is a fatty acid methyl ester which is derived from vegetable oils and animal fats, waste oils and residues in compliance with EN 14214 standards. There are many technical advantages of bio diesel fuel. It imparted a production of more vegetable oils and animal fats so the economy of rural areas increases. This study includes an examination of the different kinds of biofuels and their effects regarding environmental-related aspects. Etherification innovation is utilized in biodiesel generation. This investigation incorporates an examination of the various types of biofuels and their belongings with respect to ecological related perspectives. The biodiesel has potential as an alternative fuel and can be utilized in conventional internal combustion engines.

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