

Review for Biodiesel is an Economical Fuel to the Diesel Engines

Mr. Aniket Sangram Pawar¹ Mr. Pratik Prakashkumar Mane²

^{1,2}Student

^{1,2}Department of Mechanical Engineering

^{1,2}Shivaji University, Kolhapur

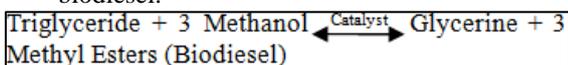
Abstract— In India much more attention has been focused on the thought of it one day replacing fossil fuels as the primary transport energy source. To be part of that revolution we are introducing importance of Biodiesel, how biodiesel can reduce the dependency on the main fossil fuels such as petrol (gasoline), diesel. Bio-diesel is a manmade fuel which can be replaced over the use of petrol and diesel effectively and also helpful to reduce dependency on another country by means of lowering the importing of fuels alternately savings in Indian currency. Bio-diesel is safe and can be used in diesel engines with few modifications. Biodiesel is a fuel equivalent to petro-diesel with the exception i.e. it can be derived from biological sources with combination of both non-toxic and toxic elements. Department of energy study showed that the production and use of bio-diesel, compared to the petroleum diesel, resulted in 78.5% reduction in carbon dioxide emission.

Key words: Biodiesel, Reaction of Biodiesel Formation, Advantages, Disadvantages

I. INTRODUCTION

ASTM International (American Society for Testing and Materials) defines biodiesel as a mixture of long-chain mono-alkali esters from fatty acids obtained from renewable resources, to be used in diesel engine. Biodiesel refers to any diesel fuel substitute derived from renewable biomass. Biodiesel is an alternate fuel similar to conventional diesel. Biodiesel can be produced from vegetable oil, animal oil/fats and waste cooking oil. The process used to convert these oils to Biodiesel is called transesterification. The largest possible source of suitable oil comes from oil crops such as rapeseed, palm or soybean. Most biodiesel produced at present is produced from waste vegetable oil sourced from restaurants, chip shops, industrial food producers. Waste vegetable oil can often be sourced for free or sourced already treated for a small price. Main benefit of biodiesel is that it can be described as 'carbon neutral' i.e. fuel produces no longer output of carbon in the form of carbon dioxide (CO₂). This effect occurs because when the oil crop grows it absorbs the same amount of CO₂ as is released when the fuel is combusted. Biodiesel is rapidly biodegradable and completely non-toxic, means the biodiesel spillages represent far less of a risk than fossil diesel spillages. Biodiesel has a higher flash point than fossil diesel and so is safer in the case of accident. As mentioned above biodiesel can be produced from vegetable oil, animal oil/fats and waste oils. There are three basic routes to biodiesel production from oils and fats:

- Base catalyzed transesterification of the oil.
- Direct acid catalyzed transesterification of the oil.
- Conversion of the oil to its fatty acids and then to biodiesel.



Generally, base catalyzed transesterification method is used. As it is the most economical process requiring only low temperatures and pressures and producing a 98% conversion yield. The Transesterification process is the reaction of a triglyceride (fat/oil) with an alcohol to form esters and glycerol.

The process of biodiesel formation is described with the help of following tree structure:

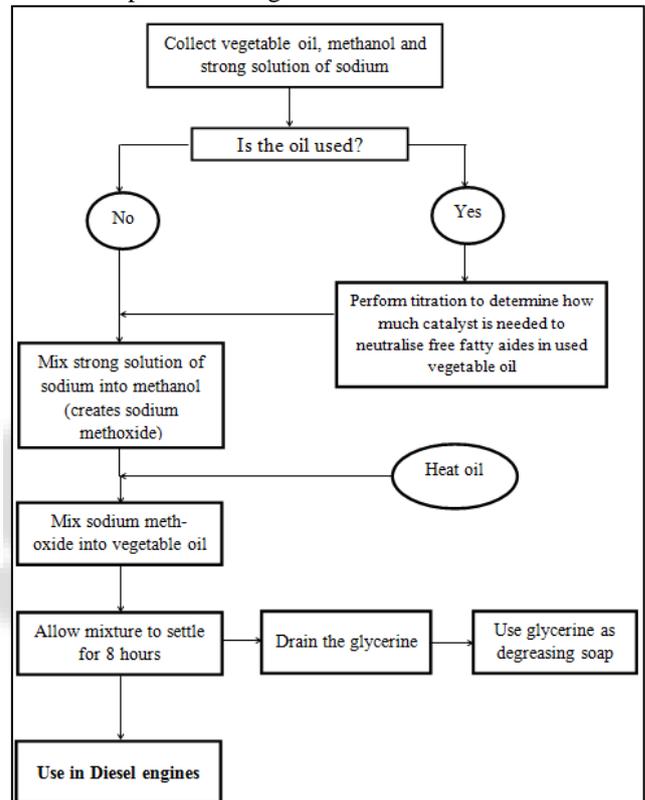


Fig. 1: Production Process of Biodiesel

A. Advantages

- Compare to diesel fuel it has low toxicity (about 10 times less toxic than table salt), degrades more rapidly and minimizes the environmental consequences of bio-fuel spills.
- Lower emissions of contaminants such as carbon monoxide, particulate matter, polycyclic aromatic hydrocarbons, aldehydes.
- Due to reduced emissions of carcinogenic substances it results in reduction of cancer disease.
- No sulphur dioxide (SO₂) emissions.
- Higher flash point (100°C minimum).
- It blended with diesel fuel at any proportion; both fuels may be mixed during the fuel supply to vehicles.
- It poses good lubricant property and it is estimated that a biodiesel blend of just 1% could increase fuel lubricity by as much as 65%.

- It is the only alternative fuel that can be used in a conventional diesel engine.
- Biodiesel could also lower our dependency upon imported oil and increase our energy security.
- It acts as a solvent, which helps to loosen deposits from the insides of an engine that may normally cause clogs.

B. Disadvantages

- Due to low calorific value more fuel consumption takes place.
- Higher freezing point than diesel fuel, so it is inconvenient in cold climates.
- It is less stable than diesel fuel, so long-term storage (more than six months) of biodiesel is not recommended.
- Dissolvent of deposits sediments and other contaminants from diesel fuel in storage tanks and fuel lines, where they can cause problems in the valves and injection systems. So, the cleaning of tanks prior to filling with biodiesel is necessary.

II. LITERATURE REVIEW

[1]Mr Matthew et al. overviewed the world is facing declining liquid fuel reserves at a time when energy demand is exploding. Coal, both non-renewable and environmentally destructive, is the most likely near-term candidate for replacing oil as a primary energy source. Biodiesel derived from green algae biomass has the potential for high volume, cost effective production. It can be carbon neutral and produced intensively on relatively small areas of marginal land. As petroleum fuel costs rise and supplies dwindle, alternative fuels will become more attractive to both investors and consumers. For biodiesel to become the alternative fuel of choice, it requires an enormous quantity of cheap biomass. Using new and innovative techniques for cultivation, algae may allow biodiesel production to achieve the price and scale of production needed to compete with, or even replace, petroleum.

[2]Mr. R. Maceiras et al. has innovated the production of energy from renewable and a waste material is an attractive alternative to the conventional agricultural feed stocks. He describes an approach to extract oil from marine algae and to convert it into biodiesel. The amount of oil in the algae source varies from 0.5 to 3.0 wt. % depending its types this process yields 10-15% oil depending on the algae species. The obtained biodiesel (100% conversion of oil to biodiesel) Biodiesel production from oil extracted from marine algae is feasible by transesterification. Moreover, this study indicates that the oil extraction can be carried out simultaneously with the transesterification. He consider that algae biodiesel stocks may become in the future a very attractive investment due to the technique positive points related to the technology.

[3]Mr Yusuf Chisti successfully reviewed continue use of petroleum sourced fuels is now widely recognized as unsustainable because of depleting supplies and the contribution of these fuels to the accumulation of carbon dioxide in the environment. Renewable, carbon neutral, transport fuels are necessary for environmental and economic sustainability. Biodiesel derived from oil crops is a potential renewable and carbon neutral alternative to

petroleum fuels. Biodiesel from oil crops, waste cooking oil and animal fat cannot realistically satisfy even a small fraction of the existing demand for transport fuels. Micro-algae appear to be the only source of renewable biodiesel that is capable of meeting the global demand for transport fuels. Like plants, micro-algae use sunlight to produce oils but they do so more efficiently than crop plants. Oil productivity of many microalgae greatly exceeds the oil productivity of the best producing oil crops.

[4]Mr. Braulio Ferreira de Souza Dias observed that bio-fuels have been welcomed by many countries as part of global response for sustainable energy. However, there are concerns that their production and use could have significant impacts on biodiversity. Liquid transport fuels like ethanol and biodiesel have been heavily promoted in recent years as a means of increasing energy security, supporting agricultural producers, generating income and reducing greenhouse gas emissions. As many current bio-fuels are based on agricultural products, there are related concerns about the use of fertilizers, pesticides and water, as well as deforestation due to competing needs for land, an increasingly scarce resource.

[5]Mr. Shawn P. Conley stated the use of vegetable oil as a fuel source in diesel engines is as old as the diesel engine itself. The demand to develop and utilize plant oils and animal fats as biodiesel fuels has been limited until recently. The technical definition of biodiesel is: "The mono alkyl esters of long fatty acids derived from renewable lipid feedstock such as vegetable oils or animal fats, for use in compression ignition (diesel) engines" (National Biodiesel Board, 1996). In simple terms, biodiesel is a renewable fuel manufactured from methanol and vegetable oil, animal fats, and recycled cooking fats (U.S. Department of Energy, 2006). Though the implementation and use of biodiesel in the United States are significant steps forward, it is critical to understand that biodiesel is only a partial solution to our fuel problem. If we converted all U.S. soybean acres to biodiesel, we would only replace 6% of the U.S. demand for diesel (Hill, Nelson, Tilman, Polasky, & Tiffany, 2006). Therefore, they must continue to look towards new sources of fuel to decrease our reliance on petroleum-based fuels.

[6]Mr. Jiantong Song studied biodiesel is a renewable and environmentally friendly alternative fuel derived from natural fats or vegetable oils and it is considered as an attractive alternative to replace diesel fuels. To optimize the application of biodiesel on vehicle diesel engines, the power and fuel economies performances of a diesel fuelled with soybean biodiesel were investigated under different engine loads and speeds. Experimental results show that, compared with diesel fuel, with increase in the biodiesel in the blends, the brake power and torque and the brake specific energy consumption increase, the smoke density under free acceleration decreases except B10, the NOX emissions increase. The trade-off relationship is clear between the NOX and smoke density when the diesel engine fuelled with different biodiesel percentage in the blends. From the trade-off relationship between NOX and smoke density, the optimum blend ratio is B20 in the experimental study. The supercharged vehicle diesel engines with no modification fuelled with biodiesel-diesel blends operate perfectly.

III. CONCLUSION

- Biodiesel has an ability to become the alternative fuel; it requires an large quantity of cheap biomass. Using new and innovative techniques for cultivation, it also replaces petrol fuel by some modification.
- Though the implementation and use of biodiesel in the India large amount of currency can be saved i.e. exporting of oil becomes minimizes.
- Due to low hazardous and non-toxic to the environment, biodiesel become economical fuel to the diesel engines.

REFERENCE

- [1] Matthew N Campbell, "Biodiesel: Algae as a Renewable Source for Liquid Fuel." Guelph Engineering Journal, (1), 2 - 7. ISSN: 1916-1107.
- [2] R. Maceiras, A. Cancela, M. Rodríguez, A. Sánchez and S. Urréjola, "An Innovative Biodiesel Production".
- [3] Yusuf Chisti, "Research review paper Biodiesel from microalgae" Biotechnology Advances 25 (2007) 294–306
- [4] [Braulio Ferreira de Souza Dias, "Biofuels and Biodiversity" The Secretariat of the Convention on Biological Diversity ISBN 92-9225-427-6
- [5] Shawn P. Conley," What is Biodiesel?" Purdue extension ID-337
- [6] Jiantong Song, Jvbiao Yao, Jiangyi Lv and Chunhong Zhu, "Experimental Study on A Diesel Engine Fueled with Soybean Biodiesel" Research Journal of Applied Sciences, Engineering and Technology 6(16): 3060-3064, 2013 ISSN: 2040-7459; e-ISSN: 2040-7467.

