

Digital Assignment-1

Biodiesel – Merits and Demerits

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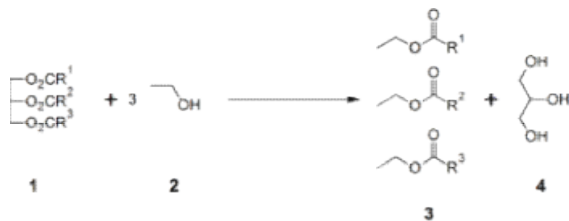
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INTRODUCTION

Biodiesel is an alternative fuel similar to conventional or 'fossil' diesel. Biodiesel can be produced from straight vegetable oil, animal oil/fats, tallow and waste cooking oil. The process used to convert these oils to Biodiesel is called **trans-esterification**. The largest possible source of suitable oil comes from oil crops such as rapeseed, palm or soybean. In the UK rapeseed represents the greatest potential for biodiesel production. Most biodiesel produced at present is produced from waste vegetable oil sourced from restaurants, chip shops, industrial food producers such as Birdseye etc. Though oil straight from the agricultural industry represents the greatest potential source it is not being produced commercially simply because the raw oil is too expensive. After the cost of converting it to biodiesel has been added on it is simply too expensive to compete with fossil diesel. Waste vegetable oil can often be sourced for free or sourced already treated for a small price. The result is Biodiesel produced from waste vegetable oil can compete with fossil diesel. More about the cost of biodiesel and how factors such as duty play an important role can be found [here](#).

Biodiesel production is the process of producing the biofuel, biodiesel, through the **chemical reactions trans-esterification** and esterification. This involves vegetable or animal fats and oils being reacted with short-chain alcohols (typically methanol or ethanol). The alcohols used should be of low molecular weight, ethanol being one of the most used for its low cost. However, greater conversions into biodiesel can be reached using methanol. Although the transesterification reaction can be catalyzed by either acids or bases the most common means of production is base-catalyzed transesterification. This path has lower reaction times and catalyst cost than those posed by acid catalysis. However, alkaline catalysis has the disadvantage of its high sensitivity to both water and free fatty acids present in the oils. The alcohol reacts with the fatty acids to form the mono-alkyl ester (biodiesel) and crude glycerol. The reaction between the [biolipid](#) (fat or oil) and the alcohol is a [reversible reaction](#) so excess alcohol must be added to ensure complete conversion. Triglycerides (1) are reacted with an alcohol such as ethanol (2) to give ethyl esters of fatty acids (3) and glycerol (4):

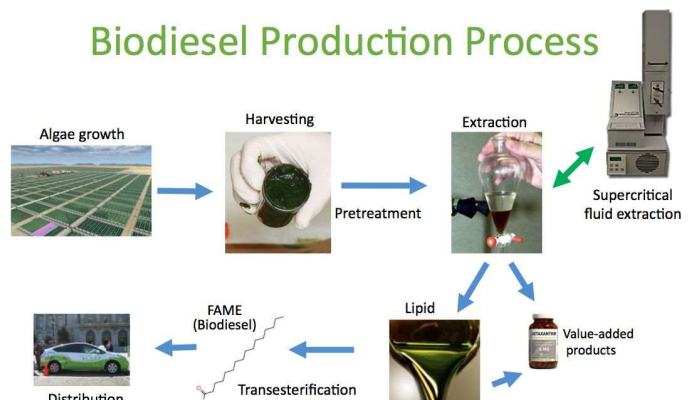


Here, R^1, R^2, R^3 : [Alkyl group](#)



Rapeseed used for the production of biodiesel.

Biodiesel Production Process



Production of the Biodiesel

BENEFITS/MERITS OF BIODIESEL

- **Easy to Use:**

One of the great advantages of biodiesel is that it can be used in existing engines, vehicles and infrastructure with practically no changes. Biodiesel can be pumped, stored and burned just like petroleum diesel fuel, and can be used pure, or in blends with petroleum diesel fuel in any proportion. Power and fuel economy using biodiesel is practically identical to petroleum diesel fuel, and year round operation can be achieved by blending with diesel fuel. When biodiesel is first used in a vehicle, it may release fuel tank deposits which can lead to fuel filter plugging. After this initial period, a user can switch between biodiesel and petroleum diesel whenever needed or desired, without modification.

- **Produced from Renewable Resources:**

Biodiesel is a renewable energy source unlike other petroleum products that will vanish in years to come. Since it is made from animal and vegetable fat, it can be produced on demand and also causes less pollution than petroleum diesel.

- **Can be Used in existing Diesel Engines:**

One of the main advantage of using biodiesel is that can be used in existing diesel engines with little or no modifications at all and can replace fossil fuels to become the most preferred primary transport energy source. Biodiesel can be used in 100% (B100) or in blends with petroleum diesel. For e.g.: B20 is called as 20% blend of biodiesel with 80% diesel fuel. It improves engine lubrication and increases engine life since it is virtually sulphur free.

- **Less Greenhouse Gas Emissions** (e.g., B20 reduces CO₂ by 15%):

Fossil fuels when burnt release greenhouse gases like carbon dioxide in the atmosphere that raises the temperature and causes global warming. To protect the environment from further heating up, many people have adopted the use of biofuels. Experts believe that using biodiesel instead of petroleum diesel can reduce greenhouse gases up to 78%.

- **Grown, Produced and Distributed Locally:**

Fossil fuels are limited and may not be able to fulfill our demand for coal, oil and natural gas after a certain period. Biodiesel can work as an alternative form of fuel and can reduce our dependence on foreign suppliers of oil as it is produced from domestic energy crops. It is produced in local refineries which reduce the need to import expensive finished product from other countries.

- **Cleaner Biofuel Refineries:**

When oil is extracted from underground, it has to be refined to run diesel engines. You can't use it straight away in the crude form. When it is refined, it releases many chemical compounds including benzene and butadiene in the environment which are harmful for animals, plants and human life. Biofuel refineries, which mainly uses vegetable and animal fat into biofuel releases less toxic chemicals, if spilled or released to the environment.

- **Biodegradable and Non-Toxic:**

When Biofuels are burnt, they produce significantly less carbon output and few pollutants. As compared to petroleum diesel, biodiesel produces less soot (particulate matter), carbon monoxide,

unburned hydrocarbons, and sulfur dioxide. Flashpoint for biodiesel is higher than 150°C whereas the same is about 52°C for petroleum diesel, which makes it less combustible. It is therefore safe to handle, store and transport.

- **Better Fuel Economy:**

Vehicles that run on biodiesel achieve 30% fuel economy than petroleum based diesel engines which means it makes fewer trips to gas stations and run more miles per gallon.

- **Positive Economic Impact :**

Biofuels are produced locally and thousands of people are employed in biofuel production plant. Since biodiesel is produced from crops , an increase in demand for biodiesel leads to increase in demand for suitable biofuel crops. Moreover, it creates less emission by reducing the amount of suspended particles in the air. This reduces the cost of healthcare products.

- **Reduced Foreign Oil Dependence:**

With locally produced biofuels, many countries have reduced their dependence on fossil fuels. It may not solve all problems in one blow but a nation can save billions by reducing their usage on foreign oil.

Image depicting the goodness of Biodiesel:

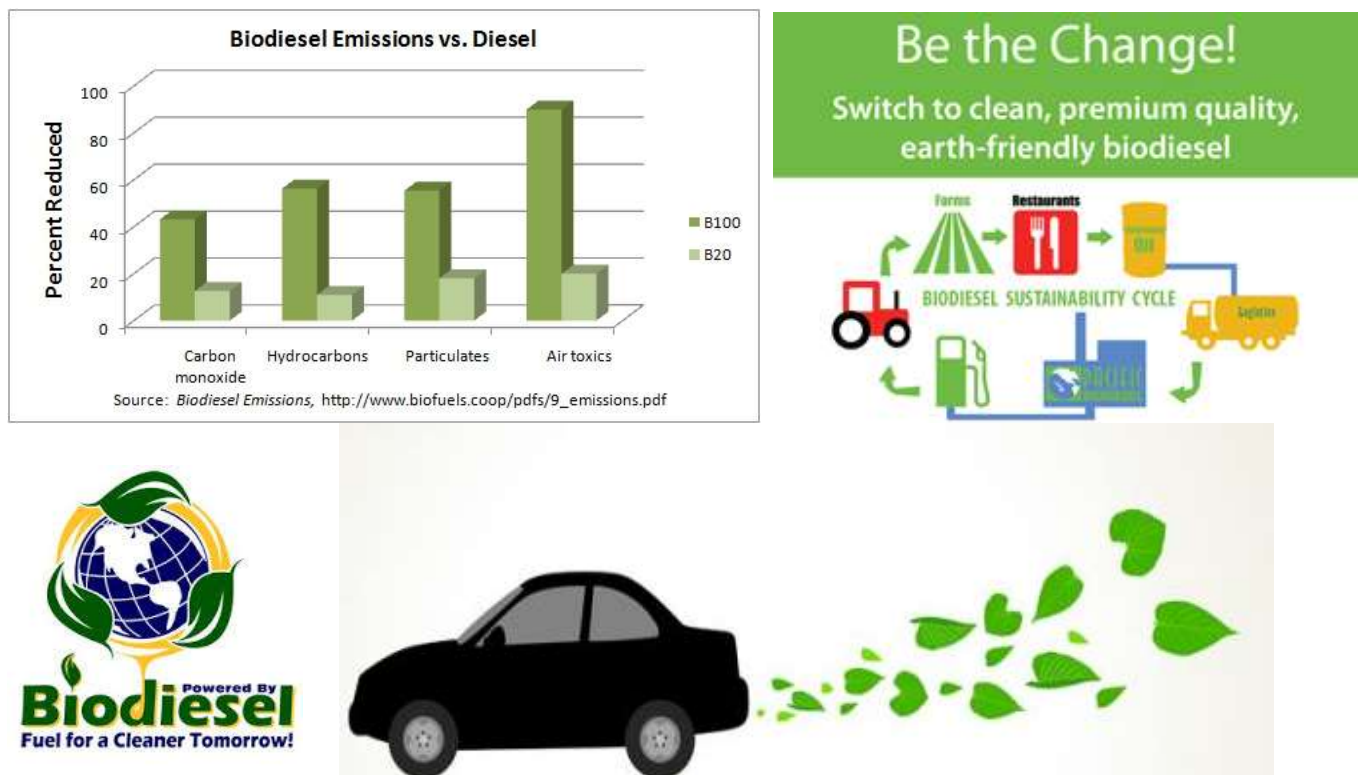


Fig: 1: The graph shows the growth of Biodiesel over diesel over many aspects, 2: The Biodiesel flowchart represents the recycling property of the biodiesel, 3: The icon represents the growth of research in this field and 4: Represents the decrease in emission of the harmful gases like CO₂, NO_x, oxides of Sulphur etc.

DEMERITS OF BIODIESEL

- **Variation in Quality of Biodiesel:**

Biodiesel is made from variety of biofuel crops. When the oil is extracted and converted to fuel using chemical process, the result can vary in ability to produce power. In short, not all biofuel crops are same as amount of vegetable oil may vary.

- **Not Suitable for use in Low Temperatures:**

Biodiesel gels in cold weather but the temperature that it will gel depends on the oil or fat that was used to make it. The best way to use biodiesel during the colder months is to blend it with winterized diesel fuel.

- **Food Shortage:**

Since biofuels are made from animal and vegetable fat, more demand for these products may raise prices for these products and create food crisis in some countries. For e.g.: the production of biodiesel from corn may raise its demand and it might become more expensive which may deprive poor people from having it.

- **Increased use of Fertilizers:**

As more crops are grown to produce biofuels, more fertilizer is used which can have devastating effect on environment. The excess use of fertilizers can result in soil erosion and can lead to land pollution.

- **Clogging in Engine:**

Biodiesel cleans dirt from the engine. This proves to be an advantage of biofuels but the problem is that this dirt gets collected in fuel filter and clogs it.

- **Regional Suitability:**

Some regions are not suitable for oil producing crops. The most productive crops can't be produced anywhere and they need to be transported to the plants which increases the cost and amount of emission associated with the production and transportation.

- **Water Shortage:**

The use of water to produce more crops can put pressure on local water resources. The areas where there is water scarcity, production of crops to be used in making of biofuels is not a wise idea.

- **Monoculture:**

Monoculture refers to the practice of producing same crop over and over again rather than producing different crops. While this results in fetching best price for the farmer but it has some serious environmental drawbacks. When the same crop is grown over large acres, the pest population may grow and it may go beyond control. Without crop rotation, the nutrients of soil are not put back which may result in soil erosion.

- **Fuel Distribution:**

Biodiesel is not distributed as widely as petroleum diesel. The infrastructure still requires more boost so that it is adopted as most preferred way to run engines.

- **Use of Petroleum Diesel to Produce Biodiesel:**

It requires much amount of energy to produce biodiesel fuel from soy crops as energy is needed for sowing, fertilizing and harvesting crops. Apart from that, raw material needs to be transported through trucks which may consume some additional fuel. Some scientists believe that producing one gallon of biofuel needs energy equivalent to several gallons of petroleum fuel.

- **Slight Increase in Nitrogen Oxide Emissions:**

Biodiesel has about 10% higher Nitrogen Oxide (NO_x) than other petroleum products. Nitrogen Oxide is

one the gas that is used in the formation of smog and Ozone. Once it gets dissolved in atmospheric moisture, can cause acid rain.

- **Deforestation:**

One of the best biofuel sources in the world is palm oil. Yes, the nasty, environmentally destructive, palm oil. When the demand for biofuels began to increase at the end of the 90's, people began to realise that palm oil was a great material to use to produce biofuels. However, they didn't consider the environmental issues and drawbacks of producing palm oil in Indonesia and shipping it to Europe. Not only were forest cleared and burnt to make way for palm oil plantations, but a huge amount of fossil fuels was burnt in doing so – defeating the entire purpose of using biodiesels.

Image depicting the evilness of Biodiesel:

COUNTERTHINK: FUEL VS. FOOD



Fig: 1: The picture depicts the need of corn ethanol in order to work properly thus in 2: Represent that the people are not getting enough food to eat and the food is used to produce fuel. 3: The land is deforested in order to make more space for the production of more biodiesel and even 4: a lot of water is wasted in the process.

SUMMARY

Biodiesel is thus an alternative fuel that can be used in place of the other natural gases. It is produced by the process called Trans-esterification, in which is the process of exchanging the organic group R'' of an ester with the organic group R' of an alcohol. These reactions are often catalyzed by the addition of an acid or base catalyst. Biodiesel can be produced from straight vegetable oil, animal oil/fats, tallow and waste cooking oil. Although the experiment is eco-friendly but it still is an expensive method which makes it a disadvantageous use. It has many advantages like Easy to Use, Produced from Renewable Resources, Can be Used in existing Diesel Engines, Less Greenhouse Gas Emissions, Grown, Produced and Distributed Locally, Cleaner Biofuel Refineries, Biodegradable and Non-Toxic, Better Fuel Economy, Positive Economic Impact etc. Since it's a renewable source of energy as it follows a cycle. Thus it has some disadvantages also like: It cannot be kept at low temperature places, it needs petroleum to produce itself, there is no uniformity in the quality of the diesel, it has lead to a slight increase in the oxide of nitrogen in atmosphere etc. Thus it has some very good merits and some worst demerits too.

CONCLUSION

Thus we conclude that despite of having so many weaknesses, the advantages are much more and are enough to over shadow the demerits. Hence the Biodiesel can be said "THE FUEL OF FUTURE" and can be used in place of other natural fossil fuels.

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**THANK
YOU!**

