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#### “A REVIEW ON BIODIESEL FUEL”

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#### ABSTRACT

*Biodiesel has become a key source as a substitution fuel and is making its place as a key future renewable energy source. As an alternative fuel for diesel engines, it is becoming increasingly important due to diminishing petroleum reserves and the environmental consequences of exhaust gases from petroleum-fuelled engines. To minimize the biofuel cost, in recent day's waste cooking oil was used as feedstock. The used cooking oils are used as raw material, adaption of continuous transesterification process and recovery of high quality glycerol from biodiesel by-product (glycerol) are primary options to be considered to lower the cost of biodiesel. There are four primary ways to make biodiesel, direct use and blending, micro-emulsions, thermal cracking (pyrolysis) and transesterification. The utilization of liquid fuels such as biodiesel produced from used cooking oil by transesterification process represents one of the most promising options for the use of conventional fossil fuels. However, as the biodiesel is produced from vegetable oils and animal fats, there are concerns that biodiesel feedstock may compete with food supply in the long-term. Currently, the higher GHG emissions from fossil fuel has persuaded the policy makers, investors and researchers to think more of the substitution of fossil fuels to save the planet. In this review, the processes of biodiesel production by transesterification and factors affecting biodiesel production are also addressed.*

**KEYWORD:** Biodiesel; Transesterification, Pyrolysis, Micro-emulsion, Direct Use and Blending

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#### I. INTRODUCTION

Fossil fuels are non-renewable energy resources. Although, these fuels are contributing largely to the world energy supply, their production and use have raised environmental concerns and political debates. It has been shown that 98% of carbon emissions are resulted from fossil fuel combustion [1]. The need of energy is increasing continuously due to rapid increase in the number of industries and vehicles owing to population explosion. The sources of this energy are petroleum, natural gas coal, hydrocarbon and nuclear. The major disadvantages of using petroleum based fuels are atmospheric pollution created by the use of petroleum diesel. The petroleum diesel combustion emits several greenhouse gases. Apart from these emissions, petroleum diesel is also major source of these air containments including NO<sub>x</sub>, SO<sub>x</sub>, CO, particulate matter and volatile organic compounds [2]. Several alternative fuels have been studied to either substitute diesel fuel partially or completely. Vegetable oils are proposed to be promising alternatives to diesel, as they are produced in rural areas. The oil produced from seeds can provide self employment opportunities [3].

## The Standard Biodiesel Cycle

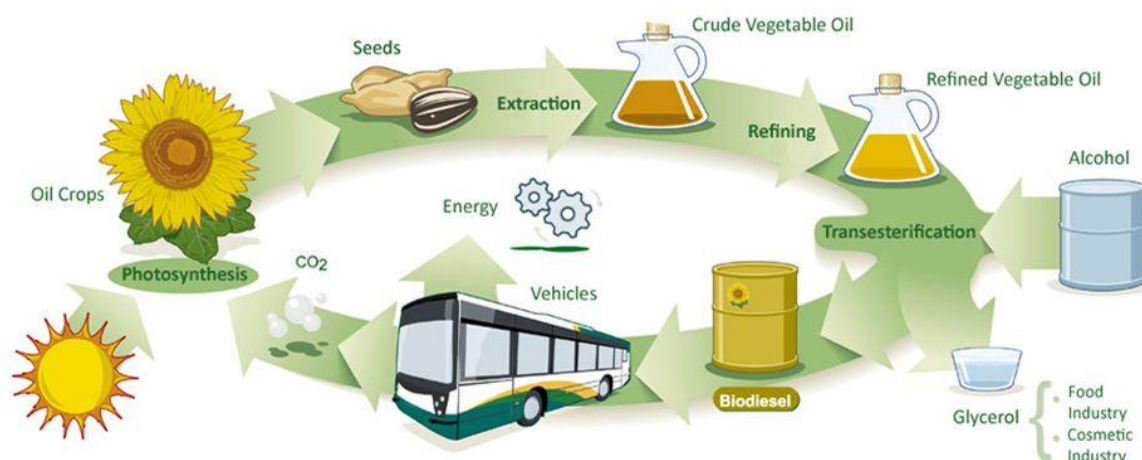


Figure.1 Biodiesel Cycle

The concept of bio-fuel is not new. Rudolph Diesel was the first to use a vegetable oil (peanut oil) in a diesel engine in 1911. The use of bio-fuels in place of conventional fuels would slow the progression of global warming by reducing sulphur and carbon oxides and hydrocarbon emissions. Because of economic benefits and more power output, biodiesel is often blended with diesel fuel in ratios of 2, 5 and 20%. The higher the ratio of biodiesel to diesel, the lower the carbon dioxide emission. Using a mixture containing 20% biodiesel reduces carbon dioxide net emissions by 15.66% while using pure biodiesel makes the net emission of carbon dioxide zero. [4].

Biodiesel is defined as monoalkyl esters of long chain fatty acids originated from natural oils and fats of plants and animals, is a kind of alternative for fossil fuels. Biodiesel has attracted wide attention in the world due to its renewability, biodegradability, nontoxicity and environmentally friendly benefits [5]. Manufacturing biodiesel from used vegetable oil is relatively easy and possesses many environmental benefits. The use of vegetable oils as frying oils produces significant amounts of used oils which may present a disposal problem. Their use for biodiesel production has the advantage of their low price. Vegetable oil from plant sources is the best starting material to produce biodiesel because the conversion of pure triglyceride to fatty acid methyl ester is high and the reaction time is relatively short [6]. The use of edible vegetable oils and animal fats for biodiesel production has recently been of great concern because they compete with food materials. As the demand for vegetable oils for food has increased tremendously in recent years, it is impossible to justify the use of these oils for fuel use purposes such as biodiesel production. Moreover, these oils could be more expensive to use as fuel [7] and [8] compares the cost of biodiesel production based on the materials used. It can be seen that amongst the four materials such as palm oil, jatropha oil, soya bean oil and waste cooking oil, waste cooking oil can be seen as the cheapest and most economical raw material for biodiesel production. Used cooking oil has sufficient potential to fuel the compression ignition engines. The kinematic viscosity of used cooking oil (UCO) is about 10 times greater, and its density is about 10% higher than that of mineral diesel. These properties play vital role in the combustion; therefore these must be modified prior to the use of UCO in the engine. Many techniques have been developed to reduce the kinematic viscosity and specific gravity of vegetable oils, which include pyrolysis, emulsification, leaning and transesterification. Among these techniques, transesterification is the hot favorite[9].

Biodiesel is an alternative diesel fuel derived from vegetable oils or animal fats. The main components of vegetable oils and animal fats are triglycerides or also known as ester of fatty acid attached to glycerol [10] and [11].

## II. BIODIESEL AND ITS RAW MATERIALS

Biodiesel is an alternative liquid fuel that can substantially replace conventional diesel and reduce exhaust pollution and engine maintenance costs. This renewable fuel can be produced from different feedstock containing fatty acids such as animal fats, non edible oils (Jatropha oil, Karanji or Pongamia oil, Neem oil, Jojoba oil, Cottonseed oil, Linseed oil, Mahua oil, Deccan hemp oil, Kusum oil, Orange oil, and Rubber seed oil), and waste cooking oils and by products of the refining vegetables oils and algae [12] and [13].

## III. PRODUCTION OF BIODIESEL

There are different processes which can be applied to synthesize biodiesel such as direct use and blending, micro emulsion process, thermal cracking process and the most conventional way is transesterification process. This is because of the fact that this method is relatively easy, carried out at normal conditions, and gives the best conversion efficiency and quality of the converted fuel [9].

## IV. DIRECT USE AND BLENDING

The direct use of vegetable oils in diesel engine is not favorable and problematic because it has many inherent failings. Even though the vegetable oils have familiar properties as biodiesel fuel, it required some chemical modification before can be used into the engine. It has only been researched extensively for the past couple of decades, but has been experimented with for almost hundred years. Although some diesel engine can run pure vegetable oils, turbocharged direct injection engine such as trucks are prone to many problems. Energy consumption with the use of pure vegetable oils was found to be similar to that of diesel fuel. For short term use, ratio of 1:10 to 2:10 oil to diesel has been found to be successful [15]

## V. CONCLUSION

Biodiesel has attracted wide attention in the world due to its renewability, biodegradability, non toxicity and environmentally friendly benefits. It is an important new alternative transportation fuel. It can be produced from different feedstock containing fatty acids such as animal fats, non edible oils, and waste cooking oils and by products of the refining vegetables oils and algae. Transesterification is a commonly employed method for its production. The purpose of this method is to reduce the viscosity of oil or fat using acid or base catalyst in the presence of methanol or ethanol. However, the biodiesel production is strongly affected by parameters such as molar ratio of alcohol, reaction temperature, reaction time and catalyst concentration. Hence, this paper concentrates on the development of economically viable as well as ecofriendly substrates for biodiesel production and briefly discusses the factors that affect the biodiesel production.

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