BIODIESEL PRODUCTION FROM WASTE COOKING OIL AND PARAMETERS INFLUENCING THE PROCESS- A REVIEW

Priyanka G[1], Dr N.D Rao[2]
[1] Mechanical Engineering Department, Guru Nanak Dev Engg College
[2] Mechanical Engineering Department, Guru Nanak Dev Engg College

Abstract
Waste/Used Cooking Oil the feedstock coming from waste vegetable oils or commonly known as waste cooking oils is one of the alternative sources among other higher grade or refine oils. Waste cooking oil is easy to collect from other industries such as domestic usage and restaurant and also cheaper than other oils (refine oils). Hence, by using these oils as the raw material, we can reduce the cost in biodiesel production. The advantages of using waste cooking oils to produce biodiesel are the low cost and prevention of environment pollution. Waste cooking oils need to be treating before dispose to the environment to prevent pollution. Due to the high cost of disposal, many individuals dispose waste cooking oils directly to the environment especially in rural area. So that, the use of waste cooking oils is an effective way to reduce the cost of biodiesel production. Used cooking oil has sufficient potential to fuel the compression ignition engine. In this review paper, various parameters influencing the process of biofuel production such as reaction rate, catalyst concentration, temperature, catalyst type, alcohol used, alcohol to oil ratio, free fatty acid content, and water content have been summarized

I. INTRODUCTION

Today it is very essential to use alternative fuel because of energy security, environmental concerns and socioeconomic reasons. Escalating oil prices and depletion of oil reserves necessitate better alternatives of energy from fossil fuels. With the rise in concern for pollution caused by fossil fuels such as petroleum,coal and natural gas, alternative fuels and renewable sources of energy such as biodiesel are coming in vogue. Besides, the side effect of petroleum based fuels is that over the years there has been a steady increase in the amount of pollution produced by these fuels. The use of these energy sources over many years have resulted to the rise in global temperature levels also known as global warming. Over the last few years biodiesel has gained importance as an alternative fuel for diesel engines. 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. Used vegetable oil is described as a 'renewable fuel' as it does not add any extra carbon dioxide gas to the atmosphere, as opposed to fossil fuels, which cause changes in the atmosphere.. 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.

Waste cooking oil can be seen as the cheapest and most economical raw material for biodiesel production. However, production of biodiesel from edible oils competes with the use of those oils as food resource for human being. Thus, finding cheaper and non edible oils for biodiesel production is an important target. Biodiesel can

be defined as the alkyl monoesters of fatty As an alternative fuel, it has many advantages as it is derived from a renewable, domestic resource, thereby relieving dependence on petroleum fuel trade in. It is biodegradable and nontoxic when compared to petroleum based diesel, biodiesel has a more favorable combustion emission profile, such as low emissions of carbon monoxide, particulate matter and unburned hydrocarbons. Carbon dioxide produced by combustion of biodiesel can be recycled by photosynthesis, thus minimizing the impact of biodiesel combustion on the greenhouse effect.

II . Factors Affecting the Production of Biodiesel from Waste Cooking Oil

Catalyst Type - In addition to this when the concentration of catalyst is increases with oil samples, the conversion of triglycerides into biodiesel is also increases. On the other hand insufficient amount of catalyst leads to the incomplete conversion of triglycerides into fatty acid esters. However, optimal product yield (biodiesel) was achieved when the concentration of NaOH reaches 1.5 wt.% at the same time further increase of catalyst concentration proved to have negative impact on end product yield. Because addition of excess amount of alkali catalyst react with triglycerides to form more soap.

Catalyst Concentration. A catalyst functions to accelerate the reaction rates. For transesterification reaction, an increasing amount of heterogeneous catalyst caused the slurry , too viscous giving rise to a problem of mixing and a demand of higher power consumption for adequate stirring

Type of Alcohol. In most cases, methanol is used for the production of biodiesel, because recovery of methanol from the final product is much easier . Yield of biodiesel obtained from waste cooking oil using methanol is higher than other alcohols (ethanol, butanol) and viscosity of biodiesel obtained using methanol is lesser than that of biofuel obtained from other alcohols . The cost of methanol is lesser than that of other alcohols, but ethanol is less toxic than methanol . Ethanol can be obtained from renewable source .When ethanol or isopropanol is used it will form azeotrope with water, which intur makes difficulty in separation of water from alcohol during distillation process . In some cases, i-butanol or t-butanol is added as solvent to the reaction mixture to avoid the inhibition of lipase by methanol or glycerol. But in most of enzymatic reactions, ethanol is being used instead of methanol.

Alcohol to Oil Ratio. To produce three moles of alkylesters, three moles of alcohol and one mole of triglyceride are required.Alcohol to oil ratio always haspositive, effecton biofuel conversion,the rate of formation of product increases as reactant concentration is increased .Therefore, if the concentration of alcohol is increased automatically, the rate of product formation will be accelerated. Further increase in the molar ratio of alcohol to oil will increase the product formation. The recovery of glycerol and unreacted methanol becomes tedious and also increases the cost of product biodiesel by increasing its post treatment cost, methanol for transesterification of waste sunflower oil and studied using various molar ratio of alcohol to oil with NaOH catalyst and found that 6 : 1molar ratios of alcohol to oil gave the highest yield of 99.5% methyl ester. But when they studied the transesterification of waste canola oil using 1 : 1 molar ratio of methanol to oil, the yield was reported to be 49.5% .

Free Fatty Acid. Waste cooking oil contains high free fatty acid content than the fresh cooking oils . Hence, it is know that higher free fatty acid contents will lead to formation of soap and water. Similarly, if free fatty acid content exceeds 3%, transesterification reaction will not proceed even with homogenous base catalyst . problem could be solved by using heterogeneous catalyst and also on pretreatment with acid homogenous catalyst or heterogeneous catalyst to esterify the free fatty acid to form free fatty acid ester. Usually, the acid-catalyzed reaction rate is low and high reaction conditions are required . Soaps formed while neutralizing free fatty acid using homogenous base catalyst can be converted back to free fatty acid by adding phosphoric acid to decanted glycerol and soap mixture obtained from final product.

Temperature. Reaction temperature is the important factor that will affect the yield of biodiesel. Higher reaction temperature increases the reaction rate and shortened the reaction time due to the reduction in viscosity of oils. Increase

in reaction temperature beyond the optimal level leads to decrease of biodiesel yield

III ADVANTAGES OF BIOFUEL

Bio fuel is manufactured from plant oils, animal fast etc. Bio fuel advantages are as follows:

* It is renewable.
* It is energy efficient.
* It displaces petroleum-derived fuel.
* It can be used as a 20% blend in most diesel equipment with no or only minor modifications.
* It reduces global warming gas emission.
* It reduces tail pipe emissions, including air toxics.
* It is nontoxic, biodegradable, and suitable for sensitive environments.
* Bio fuel is environmentally friendly substitute for petroleum-based diesel fuel.
* It is produced from vegetations like trees and plants, animal fats, and can be used in existing diesel engine without any expensive modification and increases engine life with its superior lubricity.
*Bio fuel can also be added to petroleum diesel to create a bio-diesel blend with favorable performance attributes and environmental benefits roughly proportional to the bio-diesel fraction
*Bio fuel is safe, nontoxic, biodegradable, and reduces the emissions of many harmful compounds associated with the combustion of petroleum-based diesel.
*Because bio fuel is produced from domestically produced plant oils or waste fats, switching from petroleum-based diesel to bio fuel decreases dependence on foreign Petroleum, reduces net greenhouse gas emissions, and provides benefits for the domestic economy It also reduces the risk of cancer by 90% as it emits less HC and CO.

IV. CONCLUSION

Water produced during the esterification process can inhibit acid catalyst, and this can be eliminated by stepwise reaction mechanism. Methanol is the most suitable alcohol because of its low cost and easy separation from biofuel.

.

REFERENCES

[1] M. Canakci, "The potential of restaurant waste lipids as biodiesel feedstocks," *Bioresource Technology*, vol. 98, no. 1, pp. 183–190, 2007.

[2] B. Supple, R. Howard-Hildige, E. Gonzalez-Gomez, and J. J. Leahy, "The effect of steam treating waste cooking oil on the yield of methyl ester," *Journal of the American Oil Chemists'Society*, vol. 79, no. 2, pp. 175–178, 2002.

[3] D. Y. C. Leung, X. Wu, and M. K. H. Leung, "*A review on biodiesel production using catalyzed transesterification*," *Applied Energy*, vol. 87, no. 4, pp. 1083–1095, 2010

[4] Karmee, S and Chadha, "*A Preparation of bio-diesel from crude oil of Pongamiapinnata. Bio resource Technology*", 96, 2005; 1425-1429.

[5] SinemCaynak, Metin Guru, AhmetBicer, Ali Keskin, YakupIcingur, "*Bio-diesel production from pomace oil and improvement of its properties with synthetic manganese additive*" Fuel, 88, 2009; 534-538.

[6] P. L. Naik, D. C. Katpatal " *Reduction of high viscosity of Pongamiapinnata (Karanja) oil using esterification followed by transesterification and to assess the performance and emission characteristics of diesel engine*" ISSN: 2319-7064.