

Preliminary Studies on Biodiesel Efficacy – A Case Study

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ABSTRACT

During past decades use of fossil fuels has been increasing due to increase in human population and industrialization, which has caused depleting fossil fuel reserves and increase in price of petroleum products. To overcome this problem renewable energy can be used as an alternative to fossil energies. One of the best alternatives is Biofuels. Among biofuels, Biodiesel is a one of the possible solution. In this paper, experiment had been conducted to produce Biodiesel from waste cooking oil by transesterification reaction.

Keywords – Biodiesel, Waste cooking oil, Petroleum diesel.

I.INTRODUCTION

Biodiesel is a form of fuel derived from plants or animals and consisting of long chain fatty acid esters. It is typically made up of chemically reacting lipids such as animal fat, soya bean oil, or some other vegetable oil with an alcohol, producing methyl, and ethyl or propyl ester. Biodiesel has significantly lower emissions than petroleum based products when burned, whether it is in its pure form or in blended with petroleum diesel. It does not contribute in net rise in the level of carbon dioxide in atmosphere and leads to minimize the intensity of green house effect. In addition to this, biodiesel is better than petroleum diesel in terms of its sulphur content, flash point, aromatic content and biodegradability.

Biodiesel is a non-toxic, biodegradable, renewable fuel that can be produced from a range of organic and renewable raw material including fresh or waste vegetable oils, animal fats, and oilseed plants. There are many different raw materials for the production of biodiesel. Currently edible oils are the main source of biodiesel production. In this paper waste cooking oil was used for the experimentation. Waste cooking oil is harmful to environment when disposed directly, so we can use waste cooking oil as raw material to produce biodiesel. When waste cooking oil is disposed it not only clogs the municipal sewers but also reduces the efficiency of waste water treatment plants. Moreover, when waste cooking oil reaches the natural water reserves, it affects the aquatic life and it also pollutes the water bodies due to rise in BOD (Bio-chemical Oxygen Demand), and it also has an impact on human health.

Biodiesel can be processed from different mechanisms. Transesterification is the most common process, in which an ester compound is exchanged by an alcohol in the alkyl group. The alcohol used in the process is usually methanol or ethanol. These reactions are catalyzed by the addition of an acid or a base.

II. LITERATURE REVIEW

A.C. Ahmia , F. Danane , R. Bessah , I. Boumesbah (2014) studied "Raw material for biodiesel production. Valorization of used edible oil" In this study they studied different renewable resources which can be used as raw material for biodiesel production to emphasize the possibility of the use of edible used oils by transesterification reaction, and concluded that the use of WCO (Waste Cooking Oil) as raw material in biodiesel production is a potential solutions to environmental pollution by fuel combustion emission and increase of the world energy demand problem.

Benard A Udeh (2017) studied "Biodiesel Production from vegetable oil (Sunflower) obtained from fried chicken and plantain" In this study, biodiesel was produced using waste sunflower vegetable oil which yielded 88.6% and studied its efficiency, and compared it with conventional fossil fuel diesel product.

Christine Cleetus, Shijo Thomas, Soney Varghese(2013) studied "Synthesis of Petroleum-Based Fuel from Waste Plastics and Performance Analysis in a CI Engine" In this study they synthesized petroleum based fuel from waste plastics and analyzed performance of CI engine.

Enggar Hero Istoto, Widayat, and Singgih Saptadi(2019) studied "Production of fuels from HDPE and LDPE plastic waste via Pyrolysis methods" In this study, they calculated composition of fuels obtained from HDPE and LDPE plastic waste, produced fuel using pyrolysis process.

M.Z.H.Khan, M.Sultana, M. R. Al-Mamun and M.R.Hasan(2016) studied "Pyrolytic waste plastic oil and its diesel blend: fuel characterization", in this study they produced biodiesel from plastic waste using thermal pyrolysis process and characterized the fuel.

Rummi Devi Saini (2017) studied "Conversion of Waste Cooking Oil to Biodiesel", in this study, she produced biodiesel from waste cooking oil using transesterification process and studied the factors affecting biodiesel production.

Sanjib Kumar Karmee and Carol Sze Ki Lin(2014) studied "Valorization of food waste to biofuel: current trends and technological challenges" In this study ,they converted food waste into biodiesel and bioethanol using biocatalyst and concluded that conversion of food waste into biofuel will provide an innovative food valorization strategy; which could contribute substantially to bio-based economy.

T. Sathish(2017) studied "Performance Measurement on Extracted Bio-Diesel from Waste Plastic" In this study, he extracted biodiesel from plastic waste and analyzed different factors influencing the biodiesel and also analyzed the performance of biodiesel on IC engines and its efficiency.

III.EXPERIMENTAL

Petroleum diesel and waste cooking oil biodiesel were analyzed based on their properties. Waste cooking oil was collected from the local hotels and households. Biodiesel was produced from transesterification process using NaCl as a catalyst. Transesterification is the process in which a glyceride reacts with an alcohol to produce alkyl esters in presence of a catalyst. Quality of the fuels were determined by measuring properties of fuels.

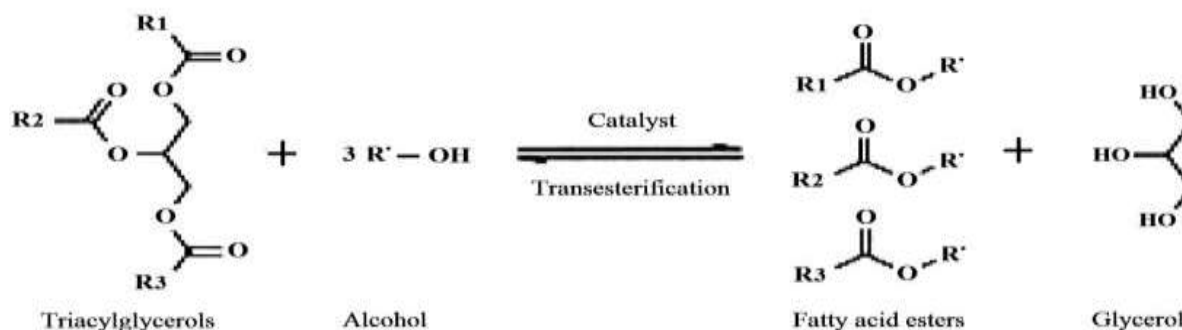


Fig.1: Transesterification process of triglycerides

IV.RESULTS AND DISCUSSIONS

4.1 Fuel Properties

After production of Biodiesel, fuel properties of biodiesel and petroleum diesel were determined such as density, kinematic viscosity, Flash point, Calorific value, Cetane Number to qualify the biodiesel. From the below table we can observe that density of Biodiesel is nearly same as the petroleum diesel. The kinematic viscosity of biodiesel is

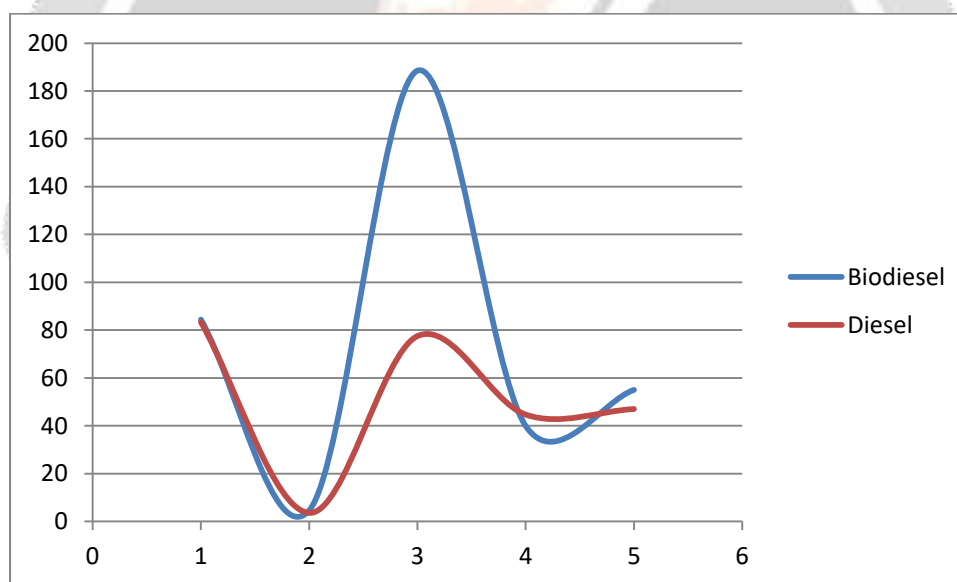
more than the petroleum diesel, it shows that biodiesel need to be blended with petroleum diesel as high viscosity causes poor atomization, engine deposits and increases fuel pump energy consumption. And biodiesel also have higher flash point compared to the petroleum diesel, higher flash point makes fuel safer for handling and storage and prevent unexpected fire during fuel combustion. Biodiesel has lower calorific value and higher Cetane Number.

Table 1: Fuel properties of Biodiesel and Diesel.

Properties	Biodiesel	Diesel
Density	84.4	83.3
Kinematic Viscosity	4.6175	3.556
Flash point	188.5	77.5
Calorific Value	39.907	44.664
Cetane Number	55	47

Fig 2 shows the variation of fuel properties, As shown in the Fig2 almost all the fuel properties of biodiesel and diesel have nearly same value except flash point which indicates that biodiesel match the standards, so it can be used. As kinematic viscosity of biodiesel is little more than diesel we have to blend the biodiesel with diesel.

Fig 2 : Variation in fuel properties



V. CONCLUSION

In this study our main objective was production of biodiesel from waste cooking oil by transesterification process, And to check the quality of biodiesel. After determination of fuel properties, conclusion drawn is biodiesel match the properties of diesel. Biodiesel can be used for the vehicles as it is fit for vehicles and biodiesel properties can be improvised by blending biodiesel with diesel. Biodiesel have high flash point which is safe during handling fuel and transportation.

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