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A STUDY OF PERFORMANCE AND EMISSION CHARACTERISTICS ANALYSIS OF DIESEL ENGINE BY USING EUCALYPTUS BIODIESEL

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Abstract:
Fossil fuels have always been the most important source of energy for the world. But in view of the energy crisis faced by the world today due to fossil fuel depletion, it is time for us to shift our attention to other renewable sources which could be used as fuel alternatives. My project examines the suitability of Eucalyptus oil **(above 50 feet)** as a source of biodiesel, for use in Diesel Engines. In previous projects they use mallees groups that trees are 50 feet below growth trees. But in our India specially south India having 50 feet above trees. So my project was done by using 50 feet above trees. Biodiesel was produced from pure Eucalyptus oil by the process of Transesterification and the fuel properties were studied. In the next phase, a single cylinder diesel engine **Kirloshkar AV1** was used to test the blends of eucalyptus biodiesel with neat diesel fuel in 40:60 ratio. The various performance and emission characteristics of the engine for each of the fuel blends were analyzed for all operating conditions of the engine. Results showed that the use of biodiesel blends resulted in a significant reduction in the CO2 and CO emissions with a performance almost equivalent to diesel fuel at almost all loads. However, an increase in the HC emissions was noticed while raising the biodiesel content in the fuel blend. The result shows the same NOx for std diesel and DF60EUB40 blend.

Key words - fossil fuel depletion, Transesterification, Kirloshkar**.**

1. INTRODUCTION

As a result alternative fuels have received much attention due to its ability to replace fossil fuels. Moreover, the environmental issues concerned with the exhaust gas emission by the usage of fossil fuels also encourage the usage of alternative fuels such as biodiesel. In this context, there has been growing interest on alternative fuels like vegetable oils to provide a suitable diesel oil substitute for internal combustion engines. The main drawback of vegetable oils is associated with their high viscosity, 15–20 times greater than the standard diesel fuel. Researchers have suggested different techniques for reducing the viscosity of the vegetable oils. The different techniques are blending with diesel fuel, micro-emulsification with methanol or ethanol, thermal cracking, and conversion into biodiesels through the transesterification process. Among these transesterification process is most widely used. The advantages of biodiesels are that they are renewable, can be produced locally, cheap, higher lubricity, higher cetane number, and minimal sculpture content and less pollutant for environment compared to diesel fuel. On the other hand, their disadvantages include the higher viscosity and pour point, and lower calorific value and volatility. Moreover, their oxidation stability is lower, they are hygroscopic, and as solvents may cause corrosion in various engine components. For all the above reasons, it is generally accepted that blends of diesel fuel, with up to 20% bio-diesels, can be used in existing diesel engines. The mixing quality of biodiesel spray with air can be generally improved by selecting the best injection parameters and better design of the combustion chamber. SaswatRath et al. [2012] investigated that many vegetable oils has been analyzed in compression ignition engine. The vegetable oils are very high viscosity and density. The methyl ester of the oil to overcome these many problems.

2. LITERATURE SURVEY

Their use in the form of methyl esters in non modified engines has given encouraging results. Karanja oil is an experimental investigation to evaluate the performance, emission and combustion characteristics of a diesel engine using different blends of methyl ester of Karanja with mineral diesel. Karanja methyl ester was blended with diesel in proportions of 5%, 10%, 15%, 20%, 30%, 40%, 50% and 100% by mass and studied under various load conditions in diesel engines. The performance parameters are very close to that of mineral diesel. The brake thermal efficiency and mechanical efficiency were better than mineral diesel for specific blending ratios under certain loads. The emission characteristics investigated to carbon dioxide, carbon monoxide, nitric oxide and hydrocarbons were found to be higher than pure diesel. Gaurav Dwivedi et al. [2012] evaluated to focus on the work done in the area of production of biodiesel from Pongamia biodiesel. The characterization of properties of various blends of Pongamia biodiesel. The higher viscosity is problem with biodiesel comparing than diesel. The higher content of viscosity leads to formation of gums in the biodiesel, which will affect its performance and also includes the impact analysis of Pongamia oil and its biodiesel on engine performance and exhaust emission. The results obtained are compared with the Jatrophacurcas biodiesel. The research has indicated that up to B20, there is no need of any modification. The test result of using biodiesel reduction in particulate emission, CO emissions accompanying with power loss, the increase in fuel consumption and the increase in NOx emission on conventional diesel engine with no or fewer modification. The result, it can be observed when biodiesel will replace diesel as a source of fuel in near future. Stalin et al.[2012] investigated from Karanja oil was produced by an alkali catalyzed transesterification process. The Performance of IC engine using pongamia biodiesel blending with diesel and various blending ratios has been evaluated. The engine performance studies were conducted with a prong brake-diesel engine set up. The experimentally investigate Parameters like parameters speed of engine, fuel consumption and torque also measured in different loads of pure diesel and various combinations of dual fuel. Brake power, brake specific fuel consumption and brake thermal efficiency were calculated by using testing of engines. The test results also indicate that the dual fuel combination of B40 can be used in the diesel engines without making any engine modifications. Hossain Mohammad Imran et al. [2010] investigated about the process involved transesterification of Karanja oil with methanol in the presence of a catalyst (NaOH), to yield biodiesel as the main product and glycerin as by-product. In review this paper off, free fatty acid (FFA) of Karanja oil was determined and it was found less than 5%. As the result of one step transesterification was carried out. Pongamia Oil to methanol molar ratio (6:1 to 12:1) and the variation (0.5% to 1.6% with of oil) of Catalyst (NaOH) concentration was found. Base-catalyzed transesterification converted Karanja oil into biodiesel and glycerol using 1.5% NaOH as alkaline catalyst at 60-650C. This paper study revealed the maximum yield of biodiesel up to 85% with methanol to oil ratio 1:9 and for 1.5 her reaction at 650C.The Co-ignition of biodiesel with commercial diesel was also evaluated and it was found that diesel engine runs smoothly in the ratio of commercial diesel to biodiesel was 7:3. Nagarhalli et al. [2009] investigated to study about this paper to analyze the emission and performance characteristics of a single cylinder 3.67 kW, compression ignition engine fuelled with mineral diesel and diesel-biodiesel blends at an injection pressure of 200 bar. To evaluate, performance parameters were break thermal efficiency, break specific energy consumption (BSEC) brake specific fuel consumption and the emissions also measured. The carbon monoxide (CO), carbon dioxide (CO_2), hydrocarbon (HC), and oxides of nitrogen (NO_x) also measured. The test results indicate that the CO emissions were slightly higher, HC emissions decreased from 12.8 % for B20 and 2.85 % for B40, NO_x emissions decreased up to

39 % for B20 and 28 % for B40. The efficiency decreased slightly for blends in comparison with diesel. The BSEC was slightly more for B20 and B40. Till now the investigation can be concluded that biodiesel and it can be used as an alternative to diesel in a compression ignition engine without making any engine modifications. Hence a blend of 40% biodiesel and 60% diesel (B40) is recommended.

3. ANALYSIS OF BIODIESEL

The results are in line with that reported in literature by different researchers using various biodiesel fuels and their blends. Rathod et al. [2010] analyzed vegetable oils, due to their agricultural origin, are able to reduce net CO2 emissions to the atmosphere. The review studying in this paper to conclude that directed towards improving the performance of C.I. The engine uses oil (Methyl ester Kusum oil) as a fuel. The engine performance was studied at constant speed, with the engine operated at various loading conditions to perform of parameters considering about comparing with brake specific fuel consumption, thermal efficiency, brake power, exhaust gas temperature, smoke density part load and peak load performance of the engine. The increase in thermal efficiency, when it is powered by Kusum oil, and its blends at various loads by engine performance. The result of power developed, and exhaust gas temperature, increases with the increase and specific fuel consumption is higher than diesel fuel. ShirishSonawane et al. [2000] discussed about the process for the production of the ethyl ester from Karanja oil to use as a biodiesel fuel. The studying this paper, first the transesterification of Karanja oil using methanol. NaOH is used as catalyst to yield methyl ester of Karanja oil as a product biodiesel and glycerol as a by-product. Experiments have been performed to determine the optimum conditions for the preparation of Easter. The temperature, catalyst, methanol used to select the parameters. The engine performance of biodiesel was checked with petroleum diesel and increase in the catalyst concentration there is an increase in the biodiesel output. The optimum value at the concentration of 0.6 g and increase in the catalyst concentration the biodiesel output was found to decrease. Venkateswara Rao et al. [2008] investigated the methyl esters of vegetable oils, known as biodiesel are increasingly low environmental impact and potential as a green alternative fuel for diesel engine. The methyl ester of Pongamia (PME), Jatropha (JME) and Neem (NME) are derived through transesterification process. Experimental investigations have been investigated to examine the properties, performance and emissions of different blends (B10, B20, and B40) of PME, JME and NME in compared to diesel. Results also indicated to B20 have closer performance to diesel and B100 had lower brake thermal efficiency mainly due to its high viscosity compared to diesel. The diesel blends showed reasonable efficiencies, lower smoke, CO and HC. Pongamia methyl esters have better performance compared to Jatropha and Neem methyl esters. Anand Kumar Pandey et al. [2008] discussed about global warming due to engine emission and rapid depletion of petroleum reserves, to find using vegetable oil. The Karanja oil methyl ester biodiesel used in a CIDI engine.

4. RESULT ANALYSIS

Diesel-biodiesel blends at an injection pressure of 200 bar. The performance parameters evaluated were break thermal efficiency, break specific energy consumption (BSEC) and the emissions measured were carbon monoxide (CO), carbon dioxide (CO_2), hydrocarbon (HC), and oxides of nitrogen (NO_x). The Experiment of experimental investigation with biodiesel blends were compared with that of baseline diesel. The Experiment indicates that the CO emissions were slightly higher, HC emissions decreased from 12.8 % for B20 and 2.85 % for B40, NO_x emissions decreased up to 39 % for B20 and 28 % for B40. The efficiency decreased slightly for blends in comparison with diesel.

The BSEC was slightly more for B20 and B40. From the investigation, it can be concluded that biodiesel can be used as an alternative to diesel in a compression ignition engine without any engine modifications. Prasad B.V.V.S.U et al. [2011] - Detailed three-dimensional CFD simulations involving flow and combustion chemistry are used to study the effect of swirl induced by re-entrant piston bowl geometries on pollutant emissions from a single-cylinder diesel engine. The baseline engine configuration consists of a hemispherical piston bowl and an injector with finite sac volume. The first iteration involved using a torridly, slightly re-entrant bowl geometry, and a sac-less injector. Pollutant emission measurements indicated a reduction in emissions with this modification. Simulations on both configurations were then conducted to understand the effect of the changes. The simulation Experiment indicates that the selected piston bowl geometry could actually be reducing the in-cylinder swirl and turbulence and the emission reduction may be entirely due to the introduction of the sac-less injector. In-cylinder, air motion was then studied in a number of combustion chamber geometries, and a geometry which produced the highest in-cylinder swirl and Turbulence Kinetic Energy (TKE) around the compression top dead center (TDC) was identified.

CONCLUSION

BSFC and TFC values are lower when biodiesel blends are used. Also, brake thermal efficiency and indicated thermal efficiency increases when diesel is replaced by B20 biodiesel blends. Moreover, there is a slight reduction in CO and CO2 emissions. NOx emissions are reduced by more than 25% and HC emissions are lowered by 20% using biodiesel blends. Using ethanol as additive further improves the engine performance. There is a reduction of 16% to 20% in BSFC is using additives and almost 10% reduction in TFC when BE-2 is used. Also, BT efficiency and IT efficiency are found to improve using additives. At full load condition, BE-2 has a 30% higher BT efficiency when compared to pure diesel. Ethanol reduced the emission of CO2 by 12% when compared to diesel. There is not much change in CO emissions when biodiesel blends are used instead of diesel. But using ethanol as additive shows a slight reduction in CO emissions at full load condition. Ethanol increases the NOx and HC emissions, but it is still less than pure diesel.

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