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Effect on the Ignition Delay and the Characteristics of Engine by using Biodiesel Fuel

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***Abstract* - Depletion of fossil fuels, will lead the renewable energy sources to fulfill the energy demands. There are many alternate fuels available for IC engine. One of the such alternate fuel is biodiesel, which is easily available. Biodiesel research is gaining importance due to its less polluting and renewable nature as opposed to conventional diesel. Gasoline and diesel engines power the majority of ground transportation today. Although similar in the fact that both are reciprocating piston engines, differences between the two exist in the form of power efficiency, fuel economy and emissions**

In terms of emissions, diesel engines typically produce lower carbon monoxide (CO) and unburned or partially burned hydrocarbons (HC) compared to gasoline engine. However, NOx which comprises of nitric oxides and nitrogen dioxides as well as particulate matter (PM) or soot are significant pollutants from diesel engines which require proper control strategies as they pose adverse health and environmental impacts. In the presence of sunlight, NOx reacts with volatile organic compounds (VOCs) to produce ground-level ozone or smog which is harmful to lung tissues and causes damages to vegetation and reduced crop yields. PM, alone or in combination with other air pollutants, causes respiratory and cardiovascular problems.

Keywords - Fossil fuels, Ignition delay, Non-renewable sources, Emission, Power and performance, Bio diesel fuel.

I. INTRODUCTION

In the context of fast depletion of petroleum resources there is a great requirements to find the alternative source of energy which will fulfil the require demand. Gasoline and diesel engines power the majority of ground transportation today. Although similar in the fact that both are reciprocating piston engines, differences between the two exist in the form of power efficiency, fuel economy and emissions In terms of emissions, diesel engines typically produce lower carbon monoxide (CO) and unburned or partially burned hydrocarbons (HC) compared to gasoline engine. However, NOx which comprises of nitric oxides and nitrogen dioxides as well as particulate matter (PM) or soot are significant pollutants from diesel engines which require proper control strategies as they pose adverse health and environmental impacts. In the presence of sunlight, NOx reacts with volatile organic compounds (VOCs) to produce ground-level ozone or smog which is harmful to lung tissues and causes damages to vegetation and reduced crop yields. PM, alone or in combination with other air pollutants, causes respiratory and cardiovascular problems.

II. LITERATURE SURVEY

Biodiesel has a higher cetane number, which gives shorter ignition delay when compared with diesel fuel. The shorter ignition delay affects the combustion performance of an engine. Ignition delay of the CI engine fuel is inversely proportional to its cetane number. Hence, optimization of ignition delay will improve the performance of the engine.

In this study the diesel engine is frequently used in transportation, power generation and many miscellaneous applications including industrial and agricultural. The major pollutants from diesel engine are smoke, particulate matter, carbon monoxide. In this study the diesel engine is frequently used in transportation, power generation and many miscellaneous applications including industrial and agricultural. The major pollutants from diesel engine are smoke, particulate matter , carbon monoxide. [**1**].The use of non-edible vegetable oils is significant because edible oil is necessary as food. The demand for both food and biofuel has increased rapidly because of population growth. The use of non-edible oils for biodiesel production solves the food-versus-fuel concern and other issues. Moreover, unproductive lands, degraded forests, cultivators fallow lands, irrigation canals, and boundaries of roads and fields can be used for the plantation of non-edible oil crops. Density, viscosity, flash point, cetane number, cloud and pour point, and calorific value, among others are the most important fuel properties considered in the application of non-edible biodiesels in diesel engines. [2,6,7]

The injection rate pattern, the mass ratios between pulses and the pulse number have been proved to be very important parameters in injection mode. For early injection pulses, the modulation should emphasize the effectiveness of elimination of wall wetting, by setting small and gradually increased pulses. For later injection pulses, the modulation should completely take the advantage of last pulse in mixture formation, injecting as much fuel as possible in last pulse.[**3**]

Non edible oil can be directly mixed with diesel fuel and may be used for running an engine. The blending of Non edible oil with diesel fuel were experimented successfully by various researchers [5,6]. A diesel fleet was powered with a blend of 95% filtered used cooking oil and 5% diesel in 1982. In 1980, Caterpillar, a Brazilian Company

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used pre-combustion chamber engines with a mixture of 10% Non-edible oil to maintain total power without any modification to the engine. A blend of 20% oil and 80% diesel was found to be most successful. It has been proved that the use of 100% Non edible oil was also possible with some minor modifications in the fuel system. [4]

III. EXPERIMENTATION& CALCULATIONS

Engine used in this work was a single cylinder, four stroke, constant speed and water-cooled, direct injection compression ignition engine coupled with an eddy current dynamometer. A digital rpm indicator was used to measure the speed of the engine. Burette and stop watch arrangement was used to measure the flow rate of the fuel. Kirloskar make single cylinder of AV1 model four stoke constant speed water cooled diesel engine was used for testing the fuel for its performance and emission characteristics.

The ignition delay was evaluated from the dynamic pressure traces of the combustion process. The ignition delay times of each diesel fuel only and DF combustion experiments at different pre-ignition conditions were determined. At first, the diesel fuel ignition delay data were analyses in terms of the relationship between the delay time, pressure, and temperature. Regression analysis was used to develop a diesel fuel ignition delay correlation. Below in the figure shows the relation between Ignition Delay with the different Cetane numbers. In this work, the ignition delay is regarded as the pressure rise delay. This was evaluated by recording both needle lift and the dynamic pressure trace of the entire combustion process. The delay section was then enlarged, such that the pressure rise delay period became distinct from the following combustion process. The pressure that arises from the ignition of the mixture during the delay period is significantly different from the pressure disturbance caused by the pilot diesel injection.

Figure 1 shows the increasing cetane number of the fuel, the ignition delay is decreased. Speed at 1500rpm. The ignition quality governed by its Cetane number. The cetane number of the diesel fuel (48-51) is less than the biodiesel, hence the delay is high for diesel fuel. Cetane number of jetropha (41-45),Cetane number of pongamia is(40-44).Decreasing Cetane number below about 38 may result in a more rapid incresed in Ignition delay .

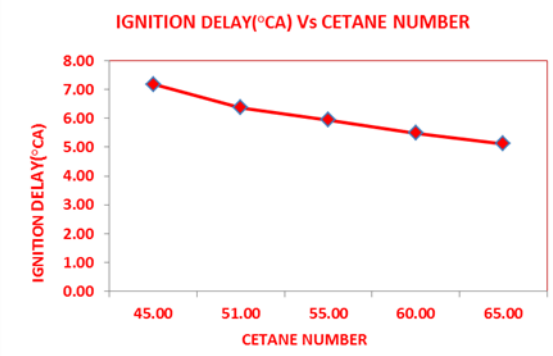

Figure 1 Ignition Delay with the different Cetane numbers

The Experimental ignition delay with various brake power. The brake power increases as ignition delay decreases, no load condition the delay has maximum, because of the in cylinder temperature lower, when the load increases engine temperature increases so the delay period reduces. Also the part load and full load condition more fuel has been injected to the combustion chamber. Bio-diesel fuel has more ignition delay as compared diesel fuel. So change the injection of the fuel, the ignition delay period is reduced. Here retard the injection timing of biodiesel fuel 5°CA with various blends B40,B60,B80. This detail is shown in the figure 2

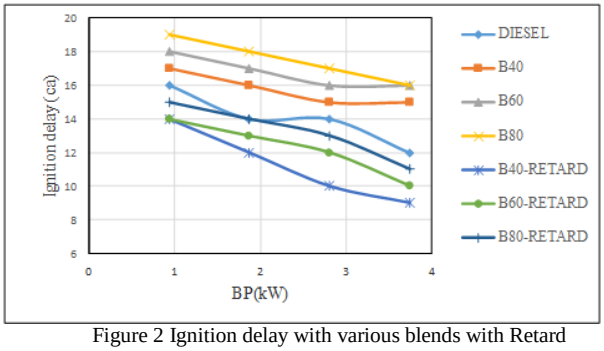

Figure 2 Ignition delay with various blends with Retard injection timing and BP.

IV. CONCLUSION

1. The retard injection timing leads the longer diffusion combustion phase.the better combustion and emission characteristics using B40,B60,B80 biodiesel blends.
2. Ignition delay going to decreases with the increase in injection pressure and atmospereic air pressure for all tested fuel mixture at different composition.
3. Biodiesel fuel has high value of cetane number.

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