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A Review on Preheating of Bio-Diesel for the Improvement of the Performance Characteristics

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Abstract: **- Unlike conventional diesel fuel, bio-diesel is a 100% renewable fuel. It significantly reduces levels of harmful pollutants and global warming gases. Some technical problem arises during the use of this fuel in CI Engines due to the high surface tension and high viscosity. The diesel blended with bio-diesel in varying proportions up-to 20% of bio-diesel can be easily used in CI Engines, but above those blending proportions, it creates a decrease in overall engine performance. Therefore preheating of bio-diesel is necessary which reduces the surface tension and viscosity and thereby can be easily used in CI Engines with increased performance characteristics.**

Keywords:- **CI engines, Jortha, bio diesel, hydrocarbons.**

I. INTRODUCTION

For industrial development and sound economy of any country, the availability of energy resources is the main criteria. Petroleum energy being the major energy resource plays an important role in the development of country. But this petroleum resource are depleting rapidly so alternate fuels are very much in need. Bio-diesel is one of them. Bio-diesel has many advantages include the following: its renewable, safe for use in all conventional diesel engines, offers the same performance and engine durability as petroleum diesel fuel, non-flammable and nontoxic, reduces tailpipe emissions, visible smoke and noxious fumes and odours. The use of Bio-diesel has grown dramatically during the last few years. Because of this, many countries in the world have committed to increasingly search for alternative fuels using renewable energy sources. Bio-diesel is 100% biodegradable – leaving behind a cleaner environment – a cleaner future. Bio-diesel is environmental friendly and economical. Processed Bio-diesel meets the international standards of quality for use in diesel driven automobiles and trucks. Bio-diesel can be used with little or no modifications required for most diesel engines. Bio-diesel can even be mixed together with fossil diesel, in any blend, from 1% to 100%. Bio-diesel even provides enhanced lubrication compared to fossil diesel. The use of Bio-diesel reduces greenhouse gas emissions compared to fossil diesel and is therefore a better choice when working in pollution sensitive environments. Bio-fuel is a non-polluting, locally available, accessible, sustainable, and reliable fuel obtained from renewable sources. The fractions of biomass that have been used and are still enjoying renewed attention as feed stock for production of liquid bio-fuels are from agricultural sources, like: lipids, simple sugars and polysaccharides sources. Bio-diesel refers to vegetable oil or animal fat-based diesel fuel consisting of alkyl (methyl, propyl, or ethyl) esters obtained by chemical reaction of the lipids (vegetable oil, animal fat) with an alcohol. Bio-diesel is a clean burning alternative fuel to fossil diesel. It is produced from domestically grown renewable resources. Chemically, most Bio-diesel consists of alkyl esters instead of the alkanes and aromatic hydrocarbons of

petroleum derived diesel. There are many problems associated with direct use of Bio-diesel in engines. With changes of outside temperature, fats can precipitate out of bio-fuel. These fats block fuel filters. The heating re-melts any fats and ensures that fuel filters stay clear. Poorer cold-flow properties and shorter shelf life compared with petroleum diesel. Due to their high viscosity (about 11–17 times higher than diesel fuel) and low volatility, they do not burn completely and form deposits in the fuel injector of diesel engines. (Demirbas A, 2003). The fuel injection system of new technology engines is sensitive to fuel viscosity changes. High viscosity of the vegetable oil leads to poor fuel atomization which in turn may lead to poor combustion, ring sticking, injector cocking, injector deposits, injector pump failure and lubricating oil dilution by crank-case polymerization. Increased exhaust gas temperature and increased oxides of nitrogen and other emissions, with increased blending of Bio-diesel with diesel and 100 % Bio-diesel.

II. LITERATURE REVIEW

Lots of research work was conducted to examine the engine performance and exhaust emissions using preheated vegetable oils. It is essential to preheat the vegetable oil to 70–90C to resolve the fuel filter clogging problem. It is specified to have a fuel inlet temperature requirement of 140^0C for acceptable viscosity for using vegetable as fuel for both direct injection and indirect injection engines. It was reported that heating the vegetable oils to 140^0C would (i) reduce the viscosity to near that of diesel at 40^0C, (ii) increase the cetane rating, (iii) improve the spray characteristics by increasing the penetration rate accompanied by a decrease in cone angle. Preheating of crude palm to 60^0C is essential to lower its viscosity, ensure smooth flow and to avoid fuel filter clogging. It was also indicated that the injection system was not affected even by heating to 100^0C. However, the use of higher Bio-diesel blending more than 20 % will increase the viscosity problems and increased exhaust temperatures. If they are heated so that it will perform in a similar fashion to diesel fuel. Heated Bio-fuel is thinner than cold bio-fuel. Heated bio-fuel will atomize better in the engine leading to cleaner, more complete and therefore more economical combustion. There is short time available for the mixing, vaporization and distribution. The vaporization is controlled by the temperature. The vaporized fuel makes a homogeneous mixture of fuel and air, and improves the combustion and to reduce noxious content of the engine exhaust. The rate of chemical reaction depends to a great extent on temperature; small at low temperatures but increases rapidly with increase in temperature. The ignition lag therefore decreases with increases in the temperature. The lower and upper ignition limits of the mixture depend upon mixture ratio and temperature. The ignition limits are wider at increased temperatures because of higher rates of reaction and higher diffusivity co-efficient of the mixtures. Increases in intake temperature increases the flame speed. It reduces the specific fuel consumption by providing better combustion and reduces the pollutants.

III. HEATING MECHANISM

Preheating process involves heating of Bio-diesel fuel before injecting it into the combustion chamber of the engine cylinder. Bio-diesel can be preheated at different temperature ranges like 60°C, 90°C, 120°C, and 150°C. But the case study on preheating temperature have found that preheating temperature for Bio-diesel should be 90°C to meet the required characteristic. For this purpose Heat exchangers are used. Figure shows a heat exchanger set up in which hot exhaust gases from engine are circulated around the tubes in which the fuel is

flowing. .It increases the temperature of Bio-diesel flowing through tubes or heating coils can be used to preheat.

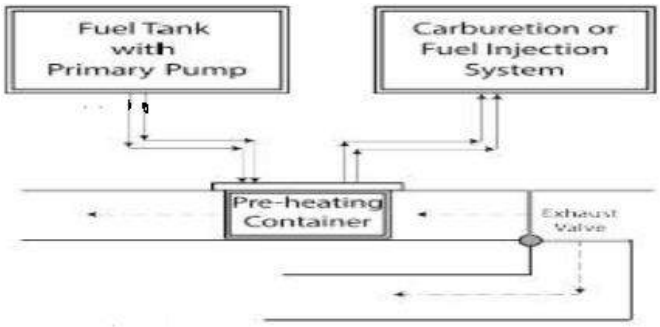

Figure 1 preheating setup

IV. CONCLUSION

Various bio-diesels blends like B20, B40, B60 and B80 can be used in CI engines without making any changes in engine. The major technical problem of higher viscosity, density and surface tension will be solved effectively by heating Bio-diesel prior to injecting it into combustion chamber. Bio-diesel thus with decreased viscosity can be successfully used with following improved ignition and emission characteristics:-

- Preheating results in decreasing the kinematic viscosity, density and surface tension properties which dominantly improves injection of Bio-diesel by contributing to better fuel atomization at the elevated temperature. It reduces the ignition problem by decreasing the ignition delay time.
- Due to preheating reduction in CO, CO2 emissions of Bio-diesel occur.

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