COMPREHENSIVE EXPERIMENTAL EXAMINATION ON DIESEL ENGINE SUPPLIED WITH KANUGA METHYL ESTER/DIESEL BLENDS

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Abstract: Petroleum based fuels are producing high emissions in depletion of environment. Due to the usage with modern globalization these emissions causing hazardous for the environment.
Due to the local topography and climatology, Bio-fuels can be produced from various sources. Likewise every nation will have its own source. Kanuga oil is abundantly available in india but it's not been used and if used it's a great resource of energy. This study explores the potential alternate for diesel as fuel for automobiles and other industrial purposes. This study is focused on kanuga methyl esters performance and emission characteristics and comparing it with the traditional petroleum diesel. The fuels are used pure methyl ester and different blends of the methyl ester with diesel.
The tests were conducted on a 3.7 KW, single cylinder, direct injection, water-cooled diesel engine.
The experimental result shows that every blend performs good with decreased amount of pollution. This analysis shows that kanuga methyl ester and its blends are a potential alternate for diesel.

Key Words: Experimental Examination; Diesel Engine; Kanuga Methyl Ester/Diesel Blends.

1. INTRODUCTION:

Bio-diesel is a domestic, renewable fuel for diesel engines derived from natural oils like vegetable oils. Bio-diesels can be used in any concentration with petroleum based diesel fuel in existing diesel engines with little or no modification. Bio-diesel is not the same thing as raw vegetable oil. It is produced by a chemical process, which removes glycerol from the oil.

Chemically, it is a fuel comprised of a mix of mono-alkyl esters of long chain fatty acids. A lipid transesterification production process is used to convert the base oil to the desired esters and remove free fatty acids. After this processing, unlike straight vegetable oil, bio-diesel has very similar combustion properties to petroleum diesel, and can replace it in most current uses. However, it is most often used as an additive to petroleum diesel, improving the otherwise low lubricity of pure ultra low sulphur petro-diesel fuel. It is one of the possible candidates to replace fossil fuels as the world's primary transports energy source, because it is a renewable fuel that can replace petro-diesel in current engines and can be transported and sold using today's infrastructure.
Bio-diesel is typically produced by a reaction of vegetable oil animal fat with an alcohol such as methanol or ethanol in the presence of catalyst (acidic or basic) to yield mono-alkyl esters and glycerol, which is removed.
Unlike soybeans, pongamia, canola and many other agricultural sources of biodiesel, Kanuga can be cultivated on arid and semi arid non-agricultural land. This means growing Kanuga never has to compete with growing food. Also, on a per acre basis, Kanuga can yield up to 10 times the amount of oil as other sources of biodiesel. Finally, Kanuga is a perennial, lasting up to 50 years without replanting. In fact the "cake" (portion of the seed left over after extraction of the seed's oil) is full of nitrogen compounds making it an excellent organic fertilizer. After 4 or 5 years of treatment with this "cake" the soil of this originally non-agricultural land will be suitable for planting food crops or trees for reforestation.
Kanuga grows almost anywhere, even on gravelly, sandy and saline soils. It can thrive on the poorest stony soil. It can grow even in the crevices of rocks. The leaves shed during the winter months form mulch around the base of the plant. The organic matter from shed leaves enhance earth-worm activity in the soil around the root-zone of the plants, which improves the fertility of the soil. Regarding climate, Kanuga is found in the tropics and subtropics and likes heat, although it does well even in lower temperatures and can withstand a light frost. Its water requirement is extremely low and it can stand long periods of drought by shedding most of its leaves to reduce transpiration loss. Kanuga is also suitable for preventing soil erosion and shifting of sand dunes.

1.1 Significance of Kanuga

Features of Kanuga

- Low cost seeds
- High oil content
- Small gestation period
- Growth on good and degraded soil
- Growth in low and high rainfall areas
- Seeds can be harvested in non rainy season
- Plant size is making collection of seeds more convenient

1.2 EFFECTIVE YEILD

The Kanuga plant bears fruit from the second year after its plantation and the economic yield stabilizes from the fourth or fifth year onwards. The plant may live for more than 50 years with an average effective yielding time of 50 years. The economic yield can be considered as 0.75-2.0 kg/plant and 4.0-6.0 tones per hectare per year depending on the agro-climatic zone and agricultural practices. The cost of plantation has been estimated at Rs.20,000 a hectare inclusive of plant material, maintenance for one year, training, overheads and the like. A selling price of Kanuga seeds at Rs.12 a kg would be an economically attractive proposition for farmers. 12 million jobs: India has vast stretches of degraded land, mostly in areas with adverse agro climatic conditions, where species of Kanuga can be grown easily. Use of 11 million hectare of wasteland for Kanuga cultivation can lead to generation of a minimum of 12 million jobs. India with its huge waste/non fertile lands, has taken a well-noted lead in Kanuga cultivation and commercial production is what the industries have to focus on for sustainable development.

2. PERFORMANCE ANALYSIS:

Performance properties are slightly lesser for biodiesel compared to diesel. Accordingly they improve injection process and ensure better atomization of the fuel in the combustion chamber. Biodiesel can be blended in any ratio for better performance and the increased lubricity makes for a better running of vehicle.

We analyzed the performance properties of kanuga methyl esters.

Results of the experiments in the form of brake power, brake thermal efficiency, specific fuel consumption for different load conditions for various blends of kanuga methyl esters compare with the petroleum diesel in the form of graphs.

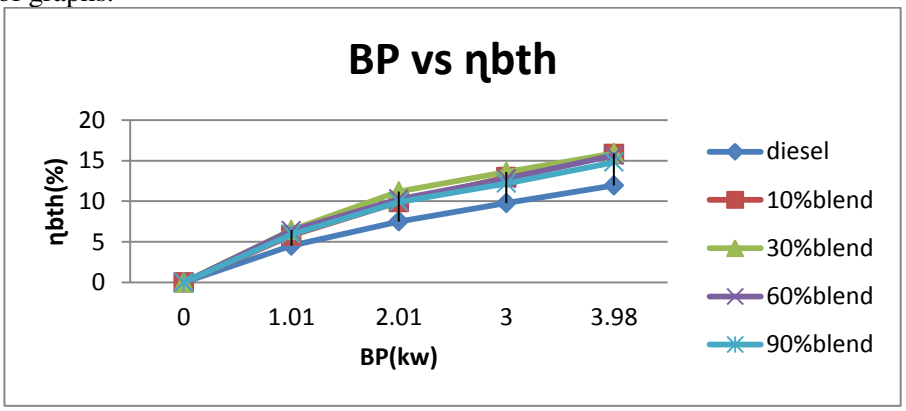

Figure.1

The BTE variations with BP for various blends of methyl esters were shown in fig.1.

From the fig. 1, it is observed that the BTE is slightly lower than the diesel for kanuga methyl ester and its blends. The BTE is nearly same for kanuga methyl ester because of nearer calorific value.

The brake thermal efficiency is based on bp of the engine .This efficiency gives an idea of the out put generated by the engine with respect to heat supplied in the form of fuel. For CI engine brake thermal efficiency gradually increases with increase in bp.

From the fig. 1, it is observed that brake thermal efficiency is low at low values of bp and is increasing with increase of bp for all blends of fuel. For all blend of the brake thermal efficiency is high at low bp values when compared with diesel fuel and is very close to diesel at high values of bp. Hence for the blends of kanuga methyl ester the performance of the engine is good .

3. EMISSION ANALYSIS:

Emission characteristics are improved for biodiesel compared to conventional diesel . Biodiesel runs in any conventional unmodified diesel engine and yields approximately equal performance as petroleum diesel. So

basically engine just runs like normal except odour. Trasesterified vegetable oils have lower viscosities than the parent oils. Accordingly they improve injection process and ensure better atomization of the fuel in the combustion chamber. Bio-diesel can be blended in any ratio for reduced emissions and the increased lubricity makes for a better running of vehicle.

We analyzed the emission properties of kanuga methyl esters. Results of the experiments in the form of carbon monoxide (CO), Nitrogen oxides (NOx), Hydrocarbons (HC) for different load conditions for various blends of kanuga methyl esters compare with the petroleum diesel in the form of graphs.

3.1 CO EMISSION

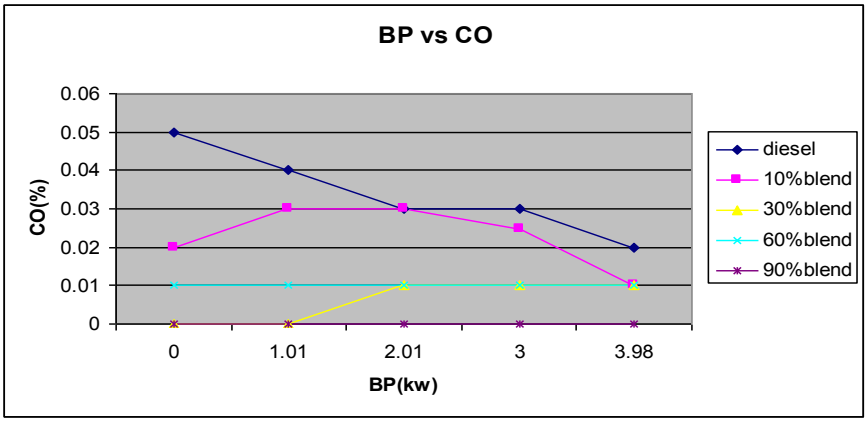

Figure.2

3.2 HC EMISSION (in PPM)

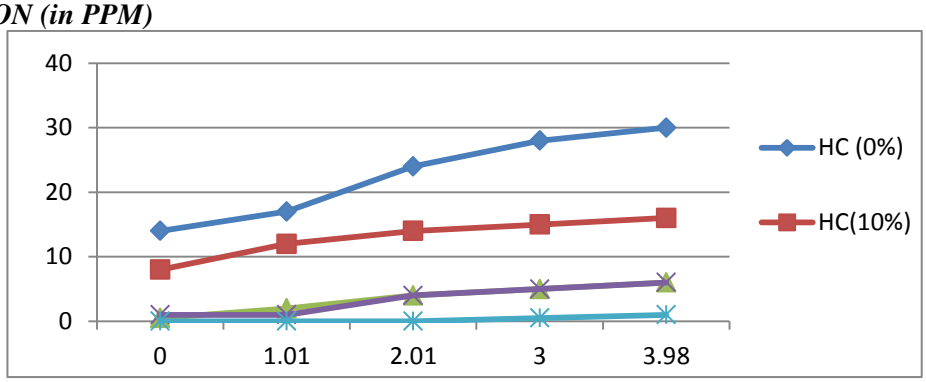

Figure.3

The comparison of hydrocarbons (HC) emissions for diesel, neat ME and blends of them are presented in Fig. 3

From fig.3 it is observed that hydro carbon (HC) increases with increasing load for all the blends of Kanuga methyl esters. If percentage of blends of Kanuga methyl esters increases, HC reduces. The hydrocarbon emissions are inversely proportional to the percentage of KME in the fuel blend. A significant difference between KME and diesel operation can be inferred. The diesel oil operation showed the highest concentrations of HC in the exhaust at all loads. Since KME is an oxygenated fuel, it improves the combustion efficiency and hence reduces the concentration of hydrocarbon emissions (HC) in the engine exhaust.

3.3 NOx EMISSION (in PPM)

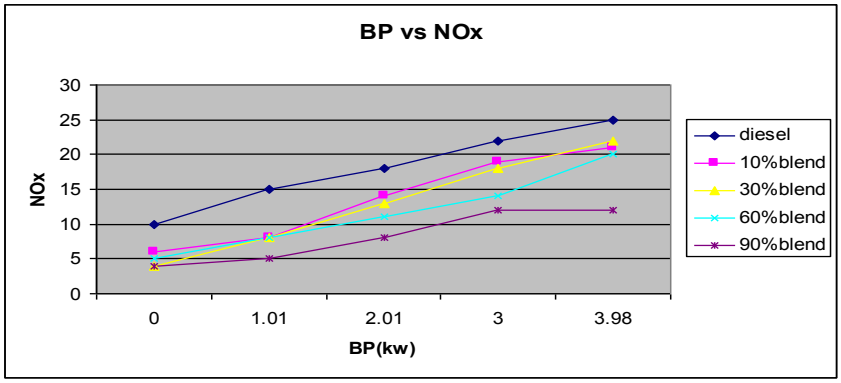

Figure.4

4. CONCLUSION:

Experiment has been done by blending biodiesel (kanuga) in different volumes with diesel. The engine performance indicating parameters like brake power, indicated power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, etc., have been observed for various blends at different loads.

It is clear that, at all blending of biodiesel the engine performance is found to be very appreciable. At 20% blending trial particularly at full load and half load conditions the specific fuel consumption and indicated thermal efficiency are very closer to the values obtained without blending. So at some considerable conditions KME blends can be the good substitute of petroleum diesel.

From the experiments conducted, it is concluded that biodiesel and its blends as a fuel for diesel engine have better emission characteristics compared with diesel. More over its impact on environment is very poor when compared with diesel.

The NOx, HC and CO emissions are less compared with diesel. Thus KME biodiesel may be the promising fuel for the future.

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