Exprimental Investigations of Cotton Seed Oil And Neem Methyl Ester As Biodiesel In Single Cylinder Four Stroke Di Diesel Engine

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Abstract- *With the rapid depletion of fossil fuel, petroleum products have been a matter of concern for the many countries which imports more crude oil. Therefore it is necessary for the developments of alternate fuels for the better control over pollution. Now-a-days various vegetable oil have become more attractive recently with their environmental credentials. Biodiesel commands crucial advantages such as technical feasibility of blending in ratio with petroleum fuel, use of existing storage facility and infrastructure, superiority from the environment and emission reduction angle, its capacity to provide energy security to remote and rural areas and employment generation. Among many biodiesels, cotton seed oil and neem oil is consider to be best with its proper ties. The cotton seed biodiesel production can be reduced by improving the conversion technology and organized cultivation of biodiesel feed stroke. The cotton seed oil and neem oils have its own merits and demerits. But the properties of fuels can be improved further with the blending of cotton seed oil and neem oil in various proportions whose properties will be nearer to the diesel and can be used in the existing diesel engine without any modifications. Hence the present work is planned accordingly. In the present investigation we focused on the efficiency and emission characteristics of blends of cotton seed oil and neem oil and its blends like B5, B10, B15, B20 and B25 and is presented.*

Keywords- Biodiesel, Properties, Transesterification, Cotton Seed Methyl Ester and Neem methyl ester

I. INTRODUCTION

Conventional energy resources such as oil, coal and natural gas have limited reserves that are expected for the less amount of time. Among various fuels, biofuels show to be the best alternative to fossil fuels because these are produced from farmers which will not run out. They are become cost wise comparable with fossil fuel, they appear to be more green friendly and they are rather accessible for transportation and existing technologies. Cotton plant is a tropical plant. The cotton crop is the fast growing plant with long productive life span of 3-4 months. It has the ability to survive on drought and poor soils at an average and high temperatures up to 40 C. Cotton was the third biggest crop grown worldwide. India is the fifth largest cotton production country in the world today, the first-four being the US, Caina, Russia, and Brazil. Our country produces about 8% of the cotton production worldwide. Its vegetable oil is extracted from the seeds of cotton, after the cotton lint has been removed and freed from the linters. Then the seeds are shelled, crushed, pressed and are treated with chemicals to obtain crude cotton seed oil. Cotton seed also readily available oil and most widely used oil and is relatively in expensive and also readily available. Cotton seed is less price, easily available in any super market in any season. Neem fruits, seeds, oil, leaves, bark and roots have much uses in the preparation of general antiseptics, antimicrobials and treatment of inflammatory diseases. This is mainly due to the chemical all parts of the tree have been used medicinally for centuries. The present work is to investigate the performance of cotton seed oil and neem oil with diesel. Experiments are carried out at different loads and different blends of cotton seed and neem oil.

II. BIODIESEL PRODUCTION

The transesterification process of vegetable oil was performed using 1l vegetable oil, 400ml methanol, 6.4 g sodium hydroxide. The vegetable oil was heated to about 70 in a reactor then, the catalyst that is sodium hydroxide was mixed with methyl alcohol to dissolve and added to the heated cotton seed oil in the reactor After the mixture was stirred for the 1 h at a fixed temperature 65 C, it was transferred another container and the separation of the glycerol layer was allowed. Once the glycerol layer was settled down, the methyl ester layer at the upper of the container was transferred to another vessel. After that, a washing process was carried out to remove some unreacted remainder of methanol and catalyst using distilled water and blown air. Then distillation process at about 100 C was applied for removing water contained in the esterifies neem seed oil.

Figure 1. Biodiesel Production

Table 1. Properties of Cotton Seed Methyl Ester Neem Methyl Ester, blending oil and Diesel

S.No	Properties	Diesel	Csome	Nme	Csome & Nme
1	Gross Calorific value, Cal/g	10234	9387	8548	8865
2	Kinematic viscosity, at 40◦C,cst	3.2	4.2	7.4	5.16
3	Density , g/ml at 15 ◦c	0.815	0.880	0.885	0.890
4	Flash point,◦C(open cup)	38	180	176	153
5	Fire point, ◦C	40	184	186	162
6	Specific gravity	0.824	0.845	0.854	0.848

III. EXPRIMENTAL SET UP

A single cylinder four stroke water cooed diesel engine having 5HP as rated power at 1500 rpm was used for the present work. The engine was coupled electrical dynamometer for loading it. A photo sensor along with a digital rpm indicator was used to measure the speed of the engine. The fuel flow rate was measured on the volumetric basis using burette and a stop watch. Thermo couples in conjunction with digital temperature indicator were used for measuring the engine and exhaust gas temprature. Their experiment set up shown the figure.

Table 2. Specification of Diesel Engine

Manufacture	KIRIOSKAR ENGINE
Engine type	Single cylinder four stroke CI engine
Rated power	3.7KW(5HP)
Bore	80mm
Stroke	110 mm
Swept volume	555cc
Compression ration	16.5:1
Mode of injection	Direct injection
Cooling system	Water cooling
Dynamometer	Eddy current dynamometer

Figure 2. Four Stroke Diesel Engine

Figure 4. Bleedings of (CME+ NME) and Diesel In different proportions

IV. RESULTS AND DISCUSSIONS

The experimental data generated were calculated and present through appropriate graphs. Performance test were conducted on various biodiesel blends in order to optimize the blend concentration for small term usage in diesel engine. To achieve this, samples of used cotton seed biodiesel diesel lends that is C5,C10,C15,C20 and C25 were prepared to be fuelled into variable compression diesel engine.

BRAKE SPECIFIC FUEL CONSUMPTION

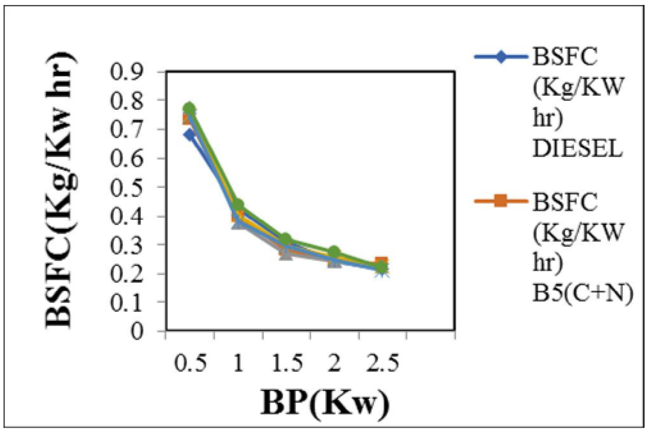

Figure 5. Variation in Brake Power with Brake Specific Fuel Consumption

Graph 1 illustrates the variation in brake specific fuel consumption with brake power. For all blends and diesel tested, BSFC decreased with increasing brake power. It is observed that the biodiesel mixtures, the BSFC values were determined to be higher than that of neat diesel fuel. The BSFC of the fuel depends on the calorific value of the fuel and combustion in the combustion chamber. Among the five different blends of biodiesel, B20 has the lowest value of brake specific fuel consumption.

BRAKE THERMAL EFFICIENCY

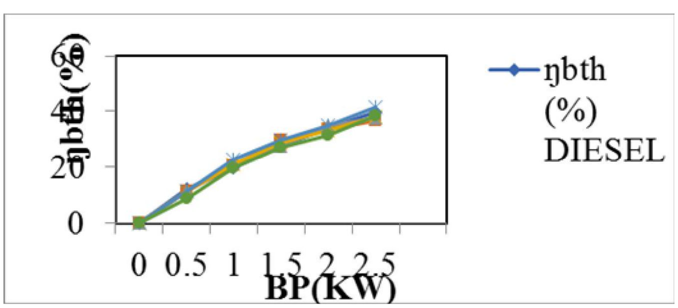

Figure 6. Variation in Brake Power with Brake thermal efficiency

Graph 2 illustrates the variation in brake thermal efficiency with brake power. For all blends and diesel tested, brake thermal efficiency increase with increasing brake power. In case of biodiesel mixtures, the brake thermal efficiency values were determined to be higher than that of neat diesel fuel. As the amount of biodiesel is increasing, the calorific value increases and on the other hand the combustion is also increasing. This is evident with the increasing of brake thermal efficiency. Among five different blends of biodiesel, B20 has the highest brake thermal efficiency when compared with all other blends.

MECHANICAL EFFICIENCY

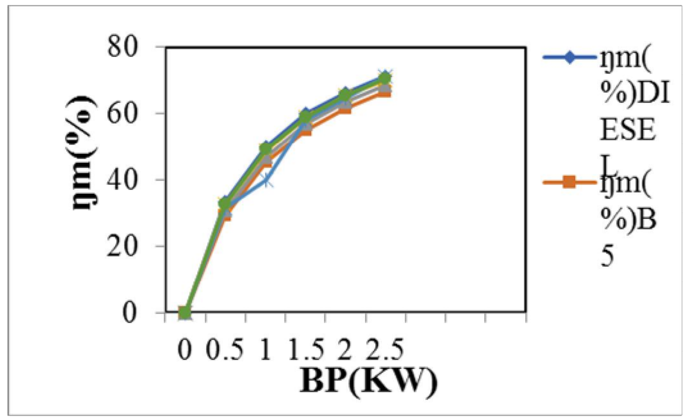

Figure 7. Variation in Brake Power with Mechanical Efficiency

The variation of mechanical efficiency with brake power is evident with graph 3. The mechanical efficiency of the engine depends on the power developed inside the combustion chamber. With the higher calorific value the combustion is complete. Hence it is evident with increasing of mechanical efficiency. For all blends and diesel tested mechanical efficiency increase with increasing brake power. Among five different blends of biodiesel, B20 has the highest value of mechanical efficiency than B15 and B25 blends.

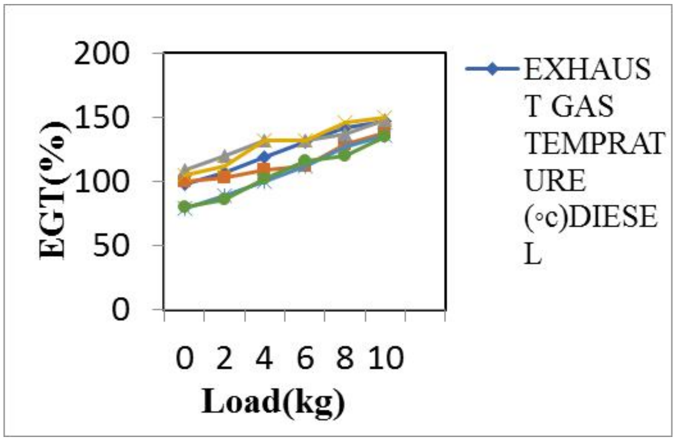

Figure 8. Variation in Brake Power with Exhaust Gas Temperature

In general the exhaust gas temperature varies with the amount of combustion in the chamber. If the combustion is complete it will be evident from exhaust gas temperature. Graph 4 shows the variation in exhaust gas temperature with brake power. For all blends and diesel tested, exhaust gas temperature increase with increasing load. In case of biodiesel mixtures, the exhaust temperatures gas values were determined to be lower than that of neat diesel fuel. Among five different blends of biodiesel, B20 has the lowest value of exhaust gas temperature and B15 and B25 satisfaction exhaust gas temperature.

V. EMISSIONS CO

The CO emissions are basically due to the incomplete combustion of the fuel in the combustion chamber. Caron monoxide with load can be observed for all the cotton seed oil and neem oil blends diesel fuel blend. The result show that CO emission of cotton seed oil and neem oil blend is lower than diesel fuel. With increase in power output, the CO emission gradually reduced for biodiesels blend diesel fuel blends and the difference in the values for CO emission with diesel fuel reduced significantly. This is due to the fact that the Cotton seed and neem oils inherently consists of oxygen content which promotes the combustion in the combustion chamber.

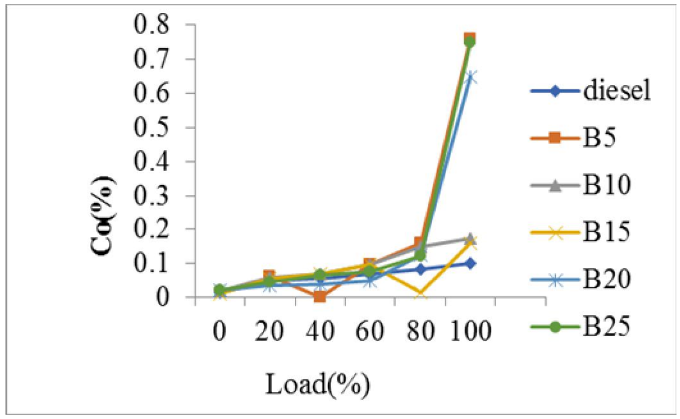

Figure 9. Load Vs carbon monoxide HC EMISSIONS

The variation of HC with load for tested fuels is depicted in the above graph. Generally the HC emissions are due to the incomplete combustion, sudden quenching and burning of lubricating oil. From the results, it can e noticed that the concentration of HC of cotton seed oil and neem oil blends diesel fuel blends is less than diesel fuel. Among all the blends B20 blend gives less emissions

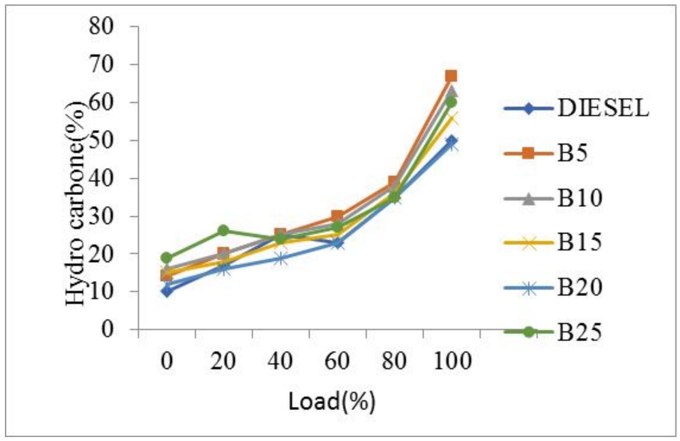

Figure 10. Load Vs hydro carbon

VI. CONCLUSION

- A single cylinder four stroke DI diesel engine is operated successfully with cotton seed oil methyl ester and neem methyl ester blending.
- Compared CSME and NME after blending biodiesel has low flash points and fire point.
- Performance of pure diesel shows high brake thermal efficiency and low brake specific fuel consumption with the highest level of emission was observed.
- Performance of pure biodiesels shows less brake thermal efficiency and high brake fuel consumption and low level emission was observed with low emissions.

VII. ACKNOWLEDGEMENT

I wish to express my sincere gratitude to my project guide Dr.S.Sunil Kumar Reddy, Ph D, Professor and Head of the Department of Mechanical Engineering, SIETK, and Chittoor district, Puttur. His valuable guidance and supervision during the course of this work. Apart from the technical knowledge, I gained a lot of information from him, which will be useful in my career.

I wish to express my sincere gratitude to Dr.RAMU, Ph D, Principal, MJRCET and Chittoor distic, Piler. For providing necessary facilities to carry out this paper work.

I am also indebted to the entire faculty who has imparted considerable knowledge to me during my study at this institution.

Finally, I take this opportunity to express my profound sense of gratitude to my family and friends for their valuable suggestions and other help provided.

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