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Engine performance and exhaust emission study on blends of biodiesel and petrodiesel

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ABSTRACT

Presently diesel generation against consumption is seen as the problem for future. Therefore the alternative is required to be found out. Biodiesel is found the potential resource as an alternative to diesel. The present automobile industry which uses 100% diesel is to be replaced by the blend of diesel & biodiesel. The various biodiesel blends study is carried out & particularly for Palm-based biodiesel blends with petro diesel is considered for the study. The present work is to study the engine performance & exhaust emission for optimum blend ratio of above mentioned biodiesel petro diesel blends. The experiments will be carried out & the result will be shown. The pure petro diesel (100%) and blend ratio of 5%, 10%, 15%, 20%, 25%, 30%and 35% will be taken for experiment. The literature says that the optimum blend ratio for biodiesel and petro diesel is around 20%. The exhaust emission will also be studied. Care is taken during work, the existing engine should work with the suggested blend ratio and should give good engine performance and the exhaust emission should be minimum or within a tolerable limit.

Keywords: *Palm biodiesel, Biodiesel blends, Diesel engine, Performance, Emission.*

1. INTRODUCTION

Biodiesel is a biodegradable and nontoxic fuel produced from vegetable oil and animal fats which is renewable. It is used in C.I (Compression Ignition) engine without modification. The biodiesel combustion by-products is better not only for inhabitants but also for earth's environment. The emissions of unburned hydrocarbon, carbon monoxide, particulate matter of biodiesel combustion are much lesser than conventional diesel fuel. As biodiesel is produced from natural sources it contains very few amounts of sulfur which leads to fewer emissions of sulfur dioxide when it burns in an engine. Generally, the blend of biodiesel-diesel mix is denoted by alphabet "B" followed by the percentage of biodiesel in a mixture, so if 20% biodiesel and 80% diesel is in a mixture on a volume basis then it is denoted as B20. Biodiesel tends to freeze or crystallize in cold weather conditions and may be unsuitable to use in an engine. In order to criticize biodiesel as an alternative fuel, people used this point. But there are many techniques by which one can use biodiesel even in cold weather conditions. Biodiesel is safer in handling and in stores as a fuel because its flash point is more than petroleum-based fuel. The cost of the various feedstock of biodiesel is different as per availability and as per production technology. As the demand will increase the cost of biodiesel will also decrease. One of the major reasons to have favorable conditions to use biodiesel as an alternative fuel is the cost of crude oil which is very high and varying on daily basis. This leads to a growing awareness in the field of biodiesel in developed and in developing countries.

2. EXPERIMENTAL SETUP

Figure 1: Experimental setup

(1) Single cylinder four stroke diesel engine (2) Exhaust gas calorimeter (3) Rotameters (4) Air flow measuring device (5) Fuel tank with fuel measuring unit (6) Calibrated burette (7) Control valve (8) Eddy current Dynamometer (9) Sensor (10) Computer system (11) AVL exhaust gas analyzer (12) Probe

2.1Description of Experimental Setup

The present set of experiments were conducted on a four-stroke single cylinder VCR water cooled diesel engine equipped with eddy current dynamometer. The engine was operated with a full load and constant speed and the performance parameters like brake power, torque, specific fuel consumption were measured for diesel and all the test fuels. The CO, HC, O_2, CO_2, NOx emissions were also measured for diesel and all the test fuels by using the exhaust gas analyzer.

3. RESULTS AND DISCUSSION

I. Engine Performance Analysis

A. Engine Brake power: Brake power is increased with increase in load because with increasing load in the engine more fuel is injected in the engine. So brake power is increased. The power developed by the engine at varying load is higher for Diesel and slightly less for the blends of palm biodiesel.

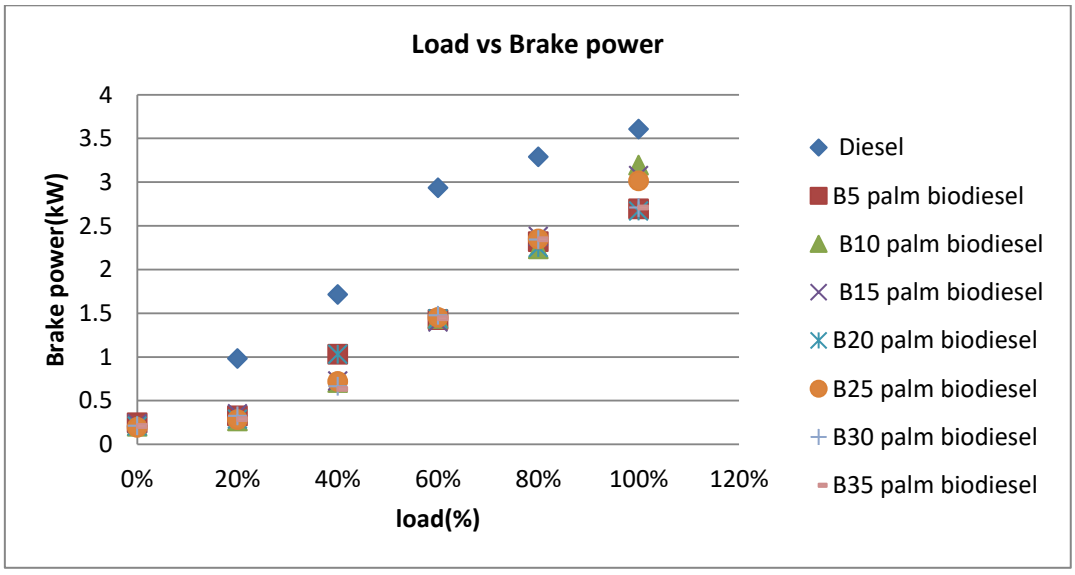

Figure 2: Variation of Brake Power with Engine Load

B. Specific fuel consumption

The brake specific fuel consumption (BSFC) was found to be lowest for diesel and tend to increase a little with the RBOME blends. The BSFC is more with higher blends of biodiesel.

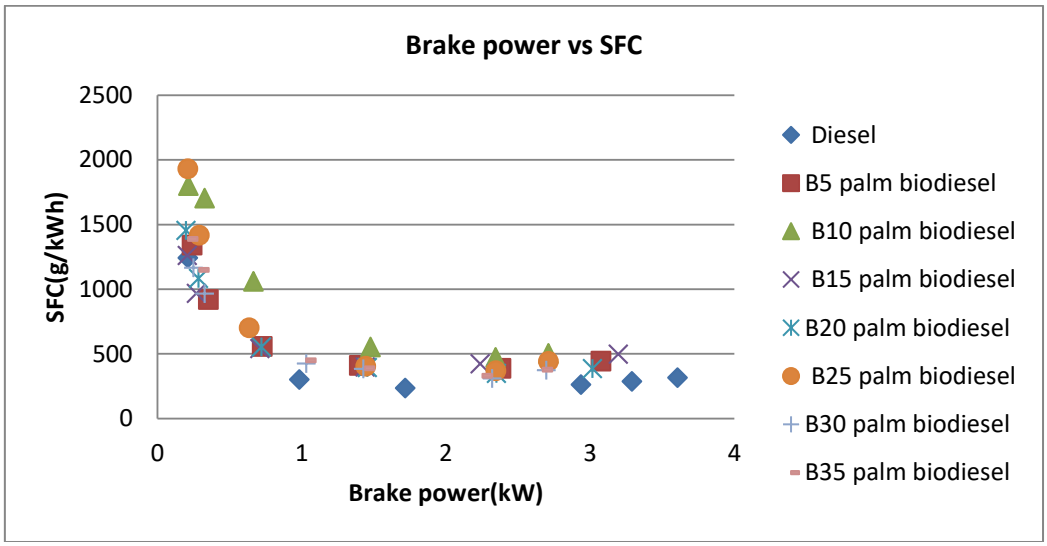

Figure 3: Variation of Brake Power with Engine Load

II. Engine Exhaust Emission Analysis

A. Carbon monoxide & oxygen emission: The Exhaust emissions CO & O_2 are decreased to increase with load because for developing high load more fuel is injected in the diesel engine thereby reducing excess air, which results in higher combustion & exhaust temperature this, is why CO & O_2 decreased with the load.

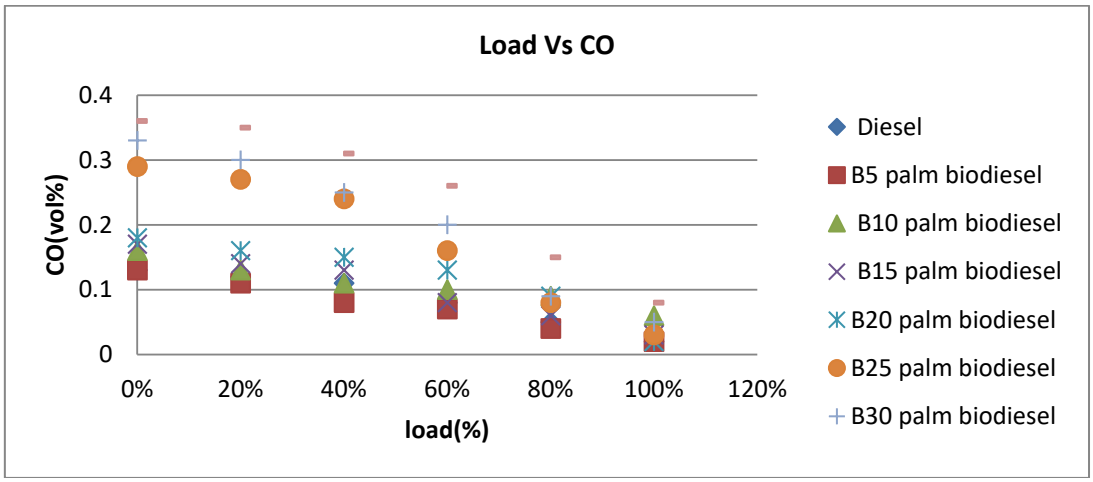

Figure 4: Variation in Co emissions with engine load

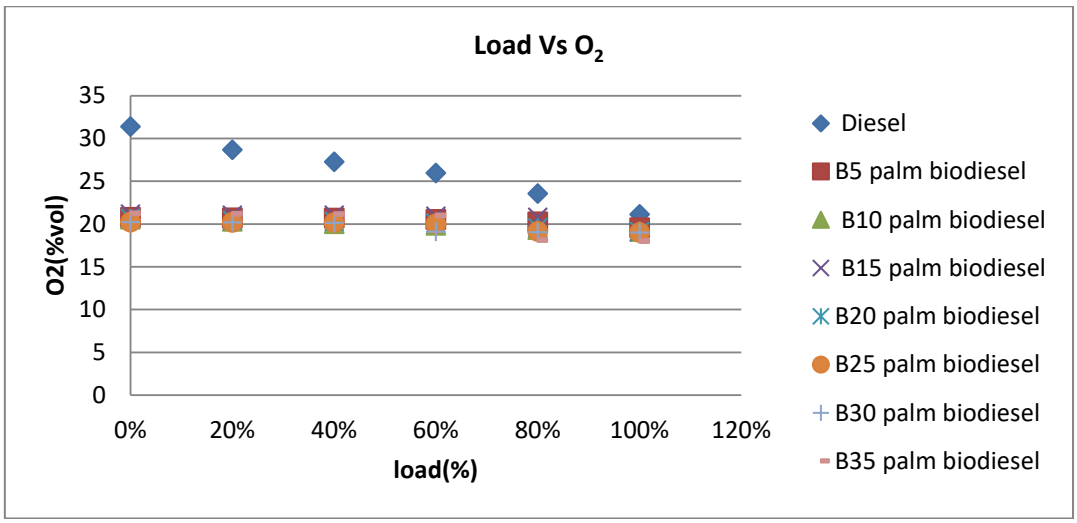

Figure 5: Variation in O2 emissions with engine load

B. Carbon dioxide, Hydrocarbon, nitrogen oxide emissions

The Exhaust emissions CO2, HC, NO are increased with increase in load because for developing high load more fuel is injected in the diesel engine thereby reducing excess air, which results in higher combustion & exhaust temperature this is why CO2, HC, NO increased with load.

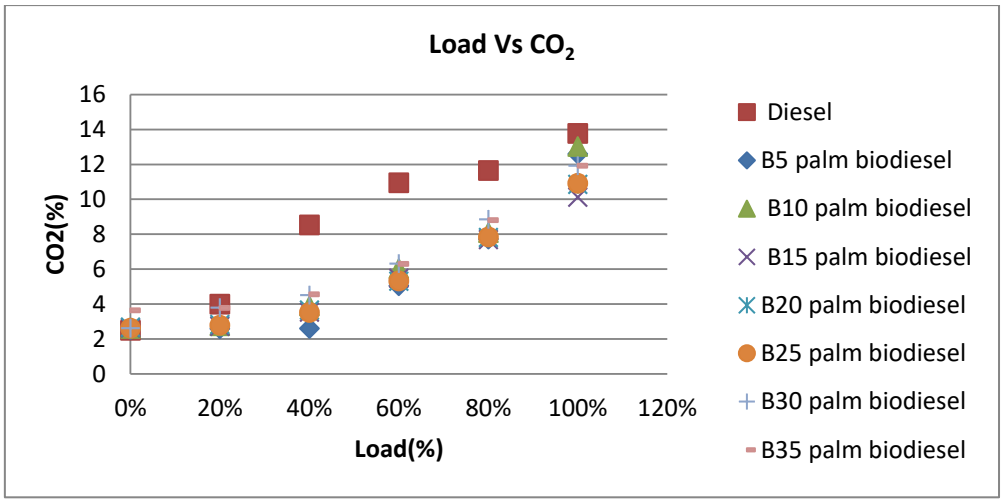

Figure 6: Variation in CO_2 emissions with engine load

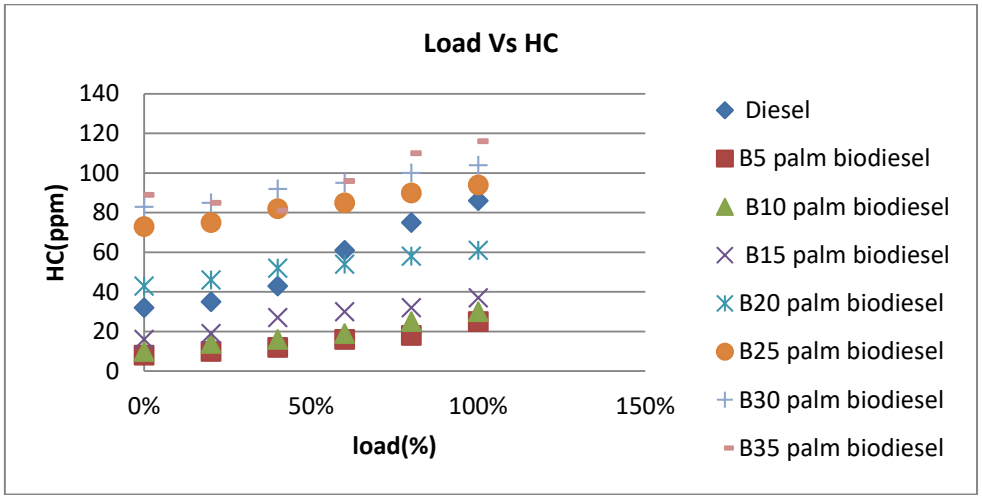

Figure 7: Variation in HC emissions with engine load

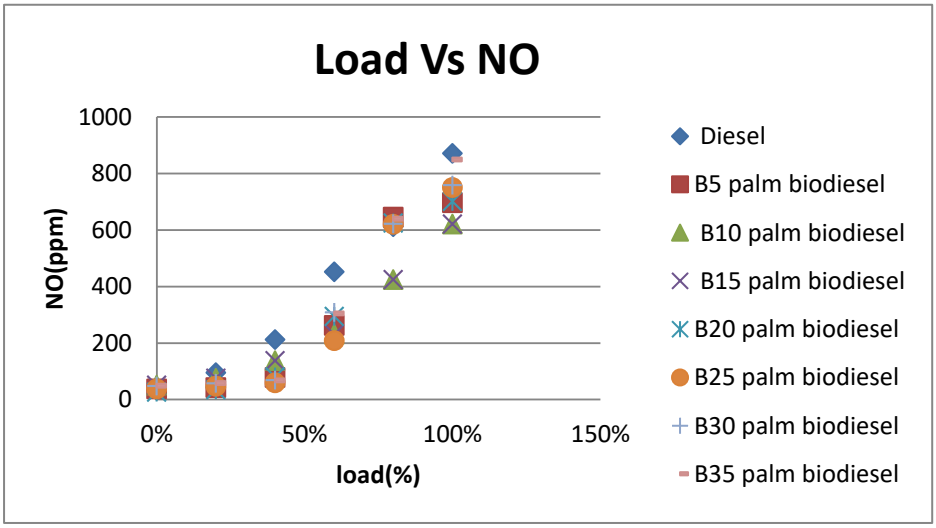

Figure 8: Variation in NO emissions with engine load

4. CONCLUSIONS

The objective of this study was making blends of palm biodiesel and petrodiesel and preparation of B5, B10, B15, B20, B25, B30, and B35 blends for use in a single cylinder VCR diesel engine. Based on the experimental results found the following conclusions are drawn:

- The brake power of the engine using all the blends of RBOME is very close to the value obtained with diesel.
- The SFC of the blends is little higher than that of Diesel. The higher fuel consumption with the blends reflects the lower heating value and higher viscosity of the biodiesel. The SFC increases linearly with the increase in biodiesel percentage in the blend.
- As per the exhaust emissions with the blends, it was found that the CO, CO_2, HC, NOx , O_2 emissions were reduced significantly when compared to those of diesel. Form the above conclusions drawn, it is found that the performance of the test engine when operating with palm biodiesel blends were very satisfactory and close to that of Diesel oil and significant improvement was noticed in the exhaust emissions of CO, CO_2 , HC, NOx , O_2 when the engine was operating with the blends.

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5. REFERENCES

[1] S.Madiwalea , V.Bhojwanib "An Overview of Production, Properties, Performance and Emission Analysis of blends of Biodiesel" Procedia Technology 25 (2016) 963 – 973

[2] Nada E.M. ElSolh "The Manufacture of Biodiesel from the used vegetable oil" A thesis submitted to the Faculty of Engineering at Kassel and Cairo Universities for the degree of Master of Science Kassel, 28 Feb. 2011

[3] Soni S.Wirawan, Armansyah H. Tambunan, Martin Djamin, Hiroshi Nabetani " The Effect of Palm Biodiesel Fuel on the Performance and Emission of the Automotive Diesel Engine", Agricultural Engineering Sciences

[4] Kazi Mostafijur Rahman, Mohammad Mashud, Md. Roknuzzaman and Asadullah Al Galib "Biodiesel from Jatropha Oil as an Alternative Fuel for Diesel Engine", International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS Vol:10 No:03

[5] Venkata Ramesh Mamilla, M. V. Mallikarjun2 and G. Lakshmi Narayana Rao Performance analysis of IC engines with bio-diesel jatropha methyl ester (JME) blends Journal of Petroleum Technology and Alternatives Fuel Vol. 4(5), pp. 90-93, May 2013

[6] Sehmus Altun, Hu samettin Bulut, Cengiz O¨ ner "The comparison of engine performance and exhaust emission characteristics of sesame oil–diesel fuel mixture with diesel fuel in a direct injection diesel engine", Renewable Energy 33 (2008) 1791–1795.

