

EFFECT OF 2-MEA AND JATROPHA BIODIESEL BLEND ON VCR CI ENGINE PERFORMANCE AND EMISSION CHARACTERISTICS

¹M.RajaSankar, ²K.ShyamSundar, ³C.H. Akshay, ⁴K.Avinash, ⁵P.Muthiah

¹Associate Professor, ^{2,3,4,5}Student, Department of Mechanical Engineering,
Karpagam College of Engineering, Coimbatore

Abstract: A 3.5 HP VCR CI engine is used to analyze the characteristics of performance and emission parameters with respect to various load conditions by varying the compression ratio as well as percentage of 2-methoxy ethyl acetate. The B20 blend is used along with 10 ml and 20ml of 2-methoxy ethyl acetate throughout the analysis to identify the best blend for better performance and lesser emission. The observed brake thermal efficiency is slightly better for the B20 blend with 20 ml of 2-methoxy ethyl acetate for the compression ratio 18. The emissions such as carbon monoxide, unburnt hydrocarbon and carbon dioxide emissions are lesser compared with diesel fuel. The Nitrogen oxide emission is lesser and also comparable with diesel fuel for all load conditions. Finally B20 blend is identified as better fuel to obtain favorable performance and emissions without modifying any hardware change in the existing engine.

Keywords: performance, emission, Jatropha methyl ester, 2-Methoxy ethyl acetate.

1. Introduction

The idea of the work is to identify the better blend and to replace the diesel fuel partially without doing any modifications in engine. The other hand, the identified biodiesel blend is utilized to analyze the characteristics of performance and emissions for various load conditions. In this region, the quanta of works are very limited that is one of the reasons to expand the research with diesel, biodiesel and 2-methoxy ethyl acetate blends.

Srinivas Kommana et.al (2016) have concluded that blended fuels exhibit properties similar to diesel. The better results were obtained at higher compression ratio for the blends than diesel. B15 was found out to be better performing with effective emission and combustion characteristics fuel blend among the other fuel blends. The better atomization was obtained when compared to diesel that may be due to lower viscosity of fuel blends. The results revealed that 41.09% reduction in carbon monoxide, 42.99% reduction in Hydrocarbon for B15 blend at full load.

N. Jayashri et.al (2017) have done the experimental analysis on performance and emission characteristics of diesel engine with neem biodiesel blends. This paper revealed that the Neem biodiesel blends are observed with higher brake thermal efficiency than diesel. CO, HC and CO₂ emissions are decreasing for the blends than diesel at full load. The B10 blend shows higher performance and lower emissions than other fuel blends and diesel.

R.Senthil et.al (2016) have carried out the performance and emission characteristics of 2-methoxy ethyl acetate in various proportion such as 5ml, 7.5ml, 10ml, 15ml, 20ml, 25ml are mixed with B20 Jatropha biodiesel blend. The hydrocarbon, carbon monoxide and carbon dioxide emissions are reduced significantly for the B20 fuel blend with 2-methoxy ethyl acetate compared to diesel fuel. The brake thermal efficiency is increased upto 2% when compared to conventional diesel.

The elaborated real time investigations were performed by CI engine with various compression ratios (17:1 and 18:1) for the Biodiesel-Diesel-2-Methoxy ethyl acetate as fuel. The test results were compared with base diesel fuel to determine the better fuel blend.

2. Test Set Up and Testing Procedure

Table 1. Technical Specification

Make	: Kirloskar
Type	: VCR, Single cylinder, water cooled
Maximum power	: 3.5 kW at 1500 rpm
Bore × Stroke	: 87.5 × 110 mm
Compression ratio	: 12:1 to 18:1
Range	
Injection pressure	: 200 bar
Injection point	: 0 to 25° b TDC
variation	
Loading device	: Eddy current dynamometer

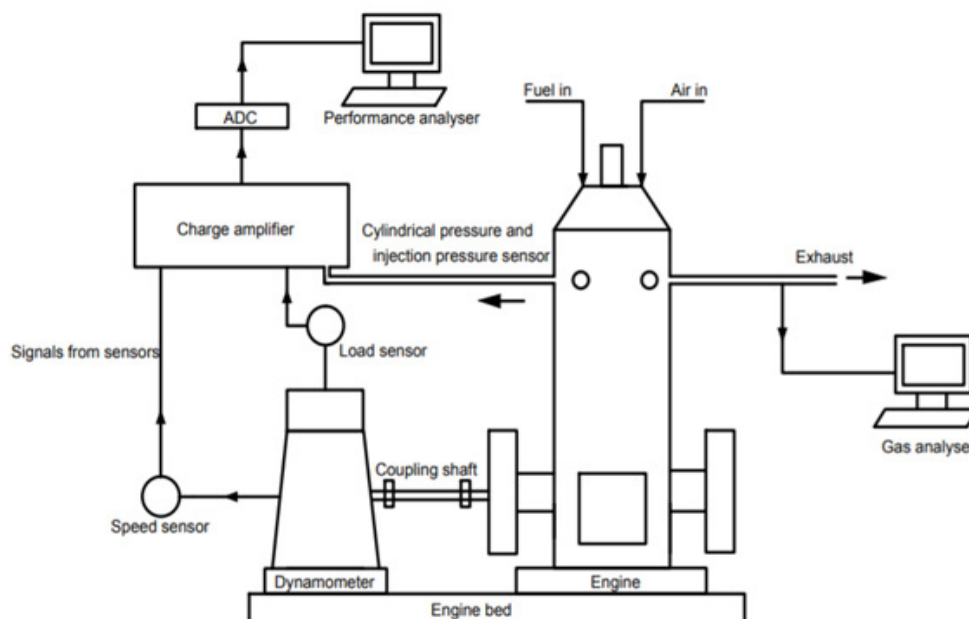


Figure 1. Layout of Test Rig

A VCR, single cylinder, four stroke diesel engine coupled with an eddy current dynamometer was used for the detailed experimental analysis. The technical specification of the engine is given in table 1. The layout of the experimental setup was shown in figure 1. The test runs were carried out using Biodiesel-Diesel blend with an additive for various load conditions. The performance and emission data's (CO, HC and NO_x) were recorded after the engine attained steady state condition with the help of analyzer setup (AVL make) to do further analysis.

3. Result and Discussion

The variations of brake thermal efficiency, Carbon monoxide, Hydrocarbon emission and Oxides of

Nitrogen are discussed for the various load conditions and compression ratio and also the results are compared with base diesel fuel.

3.1 Brake Thermal Efficiency

The variations of brake thermal efficiency with various load conditions for the base diesel and other fuel blends were shown in figure.2. There is an increasing trend is observed for the fuel and fuel blends with respect to load. The B20 blend with 2% of 2-Methoxy ethyl acetate of compression ratio 18 is observed with 14.69% higher brake thermal efficiency than base diesel fuel. It may be due to higher oxygen content availability in biodiesel as well as 2-Methoxy ethyl acetate that leads to better combustion.

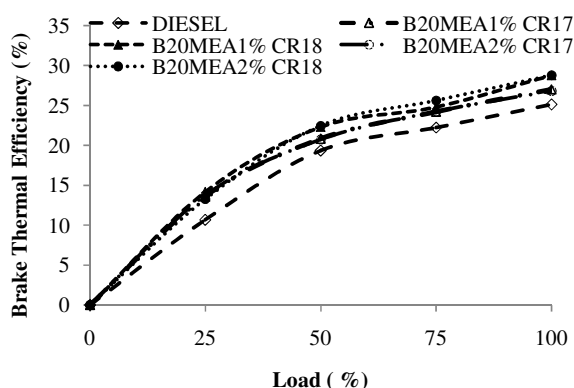


Figure 2. Load Vs Brake Thermal Efficiency

3.2 Carbon Monoxide

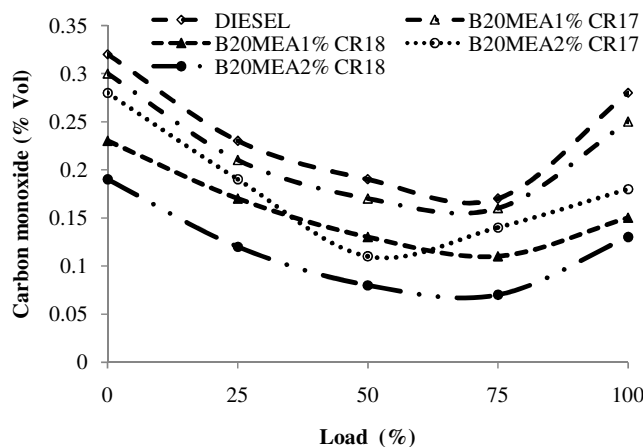


Figure 3. Load Vs Carbon monoxide

The variations of carbon monoxide were shown in figure.3 for the base diesel and other fuel blends for various load conditions. There is a reduction of carbon monoxide emission for fuel and fuel blends by increasing the load as well as compression ratio. The B20 blend is observed with 53.57% lesser emissions than diesel along with the 2% of 2-Methoxy ethyl acetate of compression ratio 18. This may be due to amount of oxygen molecules availability in biodiesel and 2-Methoxy ethyl acetate which increase the rate of fuel atomization that leads to better combustion.

various load conditions. It is decreased by increasing the load and compression ratio for all the blends with respect to base diesel fuel. The B20 blend shows lesser emissions along with the percentage of 2-Methoxy ethyl acetate. Finally, it was concluded that B20 with 2% of 2-Methoxy ethyl acetate for compression ratio 18 results reduction (16.8%) in HC emissions compared to base diesel fuel and other fuel blends. It may be due combined effect of the excess oxygen content in biodiesel as well as 2-Methoxy ethyl acetate and the temperature generated by increasing the compression ratio which aids the unburnt fuel to evaporate at faster rate.

3.3 Unburned Hydrocarbon

The variations of hydrocarbon emission were shown in figure.4 for the base diesel and other fuel blends for

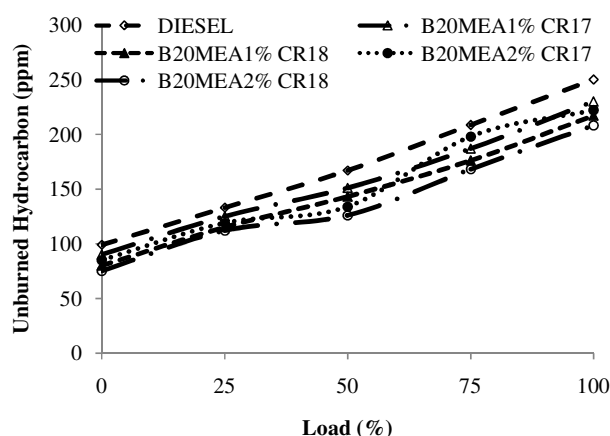


Figure 4. Load Vs Unburned Hydrocarbon

3.4 Oxides of Nitrogen

The variations of Oxides of Nitrogen were shown in figure.5 for the base diesel and other fuel blends for various load conditions along with different compression ratio. There is an increasing trend is observed by increasing the load and compression ratio

for various fuels blends used for this analysis. The Oxides of Nitrogen is 4. 25% higher for the B20 blend along with 2% of 2-Methoxy ethyl acetate of compression ratio 18 at full load. This may be due to temperature increase by increasing the compression ratio that leads to better combustion. It was observed lesser for other fuel blends than base diesel fuel.

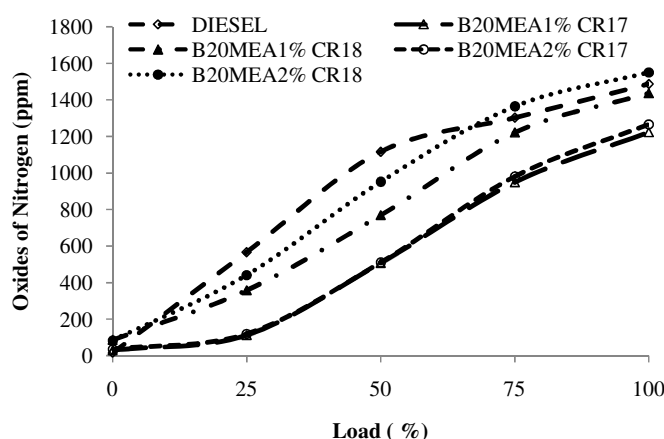


Figure 5. Load Vs Oxides of Nitrogen

4. Conclusion

The results were given as follows for the B20 blend with two different percentage of 2-methoxy ethyl acetate for various compression ratios.

- The B20 blend is observed with slightly higher brake thermal efficiency along with 2% Methoxy ethyl acetate of compression ratio 18 compare to diesel and other fuel blends.
- Carbon monoxide, carbon dioxide and Unburned hydrocarbon emissions are lesser than base diesel for same fuel blend.
- An oxide of Nitrogen is increased by increasing the compression ratio especially almost equal amount of oxide of Nitrogen observed at compression ratio 18.
- This work reveals that B20 Jatropha methyl ester with 2% of 2-Methoxy ethyl acetate is the best blend to enhance the characteristics of performance as well as emissions.

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