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Research Paper

Engineering

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Study of Cottonseed Oil and Maize Oil Biodiesel as a Fuel for C I Engine

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ABSTRACT

Experimental study of performance and emission characteristics has been done with methyl ester of cotton seed oil and its blends (5%B,10%B,15%B, 20%B,25%B, 30%B,100%B and %, 50%, 60%, 80% and 100%B) with diesel. and study of performance and emission characteristics has been done with methyl ester of maize oil and its blends (5%B,10%B,15%B, 20%B,25%B, 30%B,100%B with diesel on single cylinder, four stroke, Variable Compression Ratio (VCR) Diesel engine study is conducted at different compression ratio. Performance characteristics include brake thermal efficiency, brake specific fuel consumption, specific energy consumption aAfter experimentation we conclude that, volumetric efficiency, brake thermal efficiency of cottonseed and maize oil as compared to diesel is same at higher compression ratio but vary when compression ratio decreases, also at lower compression ratio maize oil blend create more sound pollution than diesel. Fuel consumption of diesel is less as compared to cottonseed oil and maize oil methyl ester blend.

A) INTRODUCTION:

The rapid depletion in world petroleum reserves and uncertainty in petroleum supply due to political and economical reasons as well as the sharp escalation in petroleum prices, have stimulated the search for alternatives to petroleum based fuels specifically diesel and gasoline. Moreover, bulks of petroleum fuels are being consumed by agriculture and transport sector for which diesel engine happens to be the prime mover. Vegetable oils -due to their properties being close to diesel fuel may be a promising alternative for its use in diesel engine, But, their high viscosity prevents them from using it directly in an engine. Investigation focuses on the use of biodiesel as fuel in diesel engine by blending it with diesel for dilution of viscosity and preheating it for reduction of viscosity can be a good option for crude oil.

B) ENGINE SETUP :

The setup consists of single cylinder, four stroke, Variable Compression Ratio (VCR) Diesel engine connected to eddy current type dynamometer for loading. The compression ratio can be changed without stopping the engine and without altering the combustion chamber geometry by specially designed tilting cylinder block arrangement. Setup is provided with necessary instruments for combustion pressure and crank-angle measurements. These signals are interfaced to computer through engine indicator for Pθ–PV diagrams. Provision is also made for interfacing airflow, fuel flow, temperatures and load measurement.

The setup has stand-alone panel box consisting of air box, two fuel tanks for duel fuel test, manometer, fuel measuring unit, transmitters for air and fuel flow measurements, process indicator and engine indicator. Rota meters are provided for cooling water and calorimeter water flow measurement. The setup enables study of Variable Compression Ratio (VCR) engine performance for brake power, indicated power, frictional power, Brake Mean Effective Pressure (BMEP), Indicated Mean Effective Pressure (IMEP), brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency, volumetric efficiency, specific fuel consumption, A/F ratio and heat balance. Lab view based Engine Performance Analysis software package is provided for on line performance evaluation.

Eddy current dynamometer:

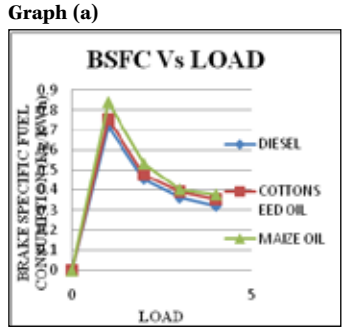
It consists of a stator on which are fitted a number of electromagnets and a rotor disc and coupled to the output shaft of the engine. When rotor rotates eddy currents are produced in the stator due to magnetic flux set up by the passage of field current in the electromagnets. These eddy currents oppose the rotor motion, thus loading the engine. These eddy currents are dissipated in producing heat so that this type of dynamometer needs cooling arrangement. A moment arm measures the torque. Regulating the current in electromagnets controls the load.

C) RESULTS &DISCUSSION:

COMPARISON GRAPHS OF DIESEL, COTTONSEED OIL AND MAIZE OIL

1. Brake specific fuel consumption (Kg/kWh) :

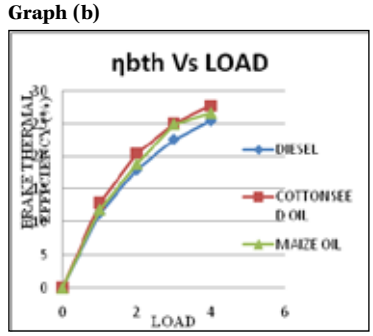
Graph (a)



Brake specific fuel consumption of diesel varies from 0 to 0.321Kg/kWh for the load 0 to 12 whereas brake specific fuel consumption of cottonseed and maize oil varies from 0 to 0.353 Kg/kWh and 0 to 0.378 Kg/kWh for the load 0 to 12 respectively. This graph shows that brake specific fuel consumption of diesel is less as compared to cottonseed and maize oil i.e. fuel consumption of cottonseed and maize oil for producing 1 KW power is more.

2. Brake thermal efficiency :

Graph (b)



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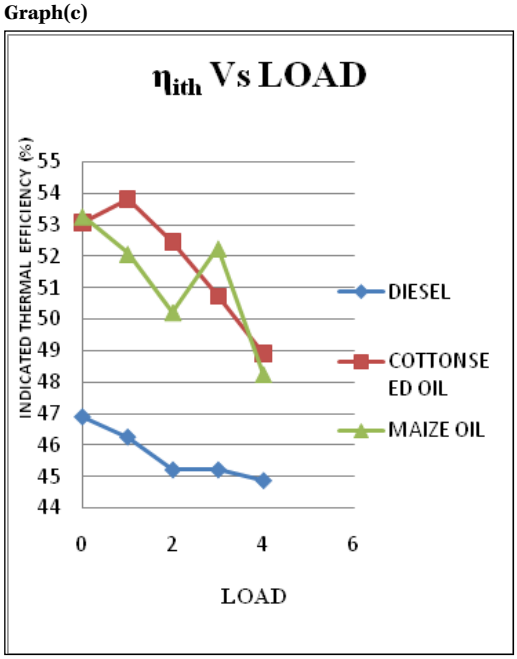
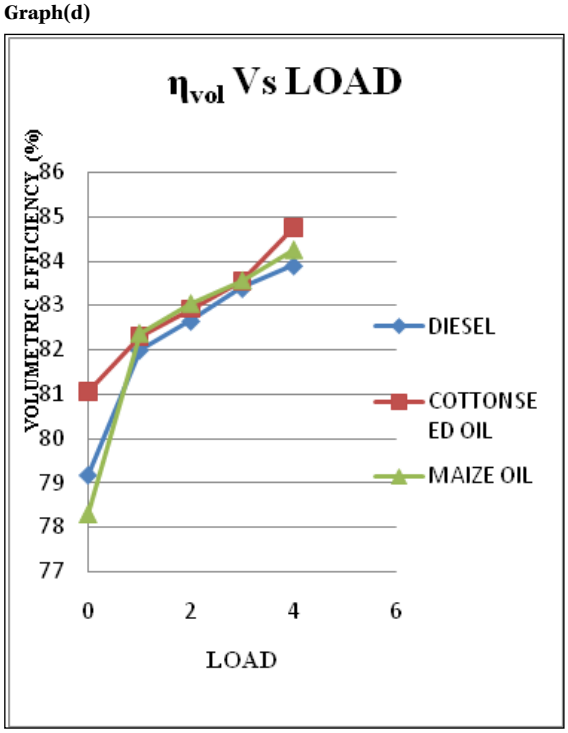
Brake thermal efficiency of diesel varies from 0 to 25.5% for the load 0 to 12 whereas Brake thermal efficiency of cottonseed and maize oil varies from 0 to 27.77% and 0 to 26.66% for the load 0 to 12 respectively. This graph shows that Brake thermal efficiency of diesel is less as compared to cottonseed and maize oil.

3. Indicated thermal efficiency :
Graph(c)



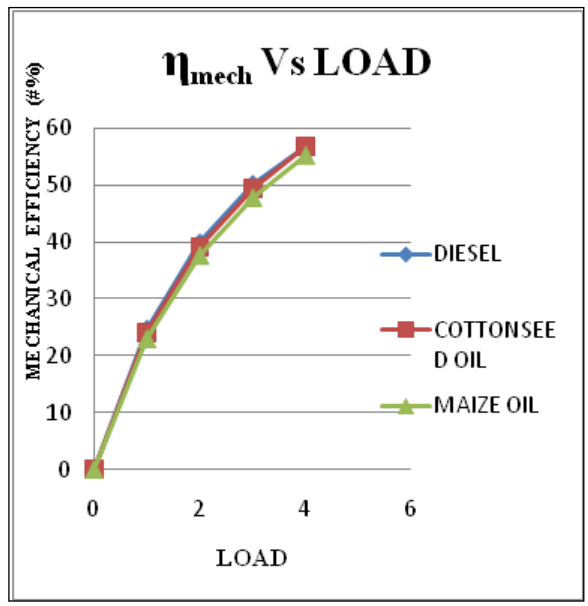
Indicated thermal efficiency of diesel varies from 46.9 to 44.88% for the load 0 to 12 whereas indicated thermal efficiency of cottonseed and maize oil varies from 53.07 to 48.89% and 53.27 to 48.25% for the load 0 to 12 respectively. This graph shows that indicated thermal efficiency of diesel is less as compared to cottonseed and maize oil.

4. Volumetric efficiency :
Graph(d)



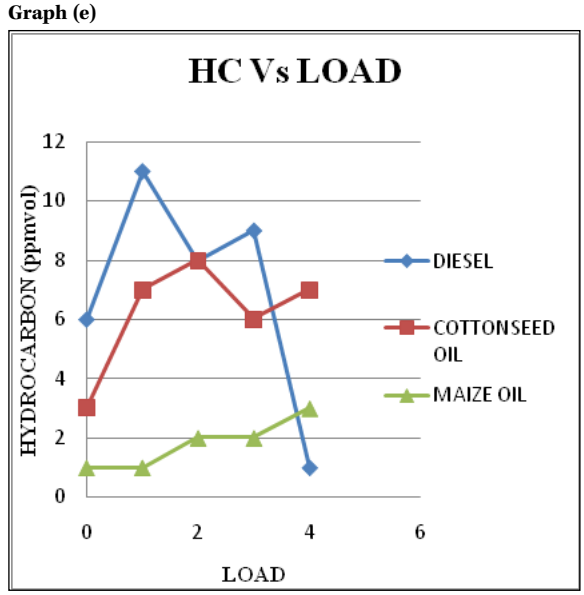
Volumetric efficiency of diesel varies from 79.16 to 83.89% for the load 0 to 12 whereas volumetric efficiency of cottonseed and maize oil varies from 81.05 to 84.76% and 78.29 to 84.24% for the load 0 to 12 respectively. This graph shows that volumetric efficiency of cottonseed oil is more as compared to maize oil and diesel.

5. Mechanical efficiency :
Graph (d)



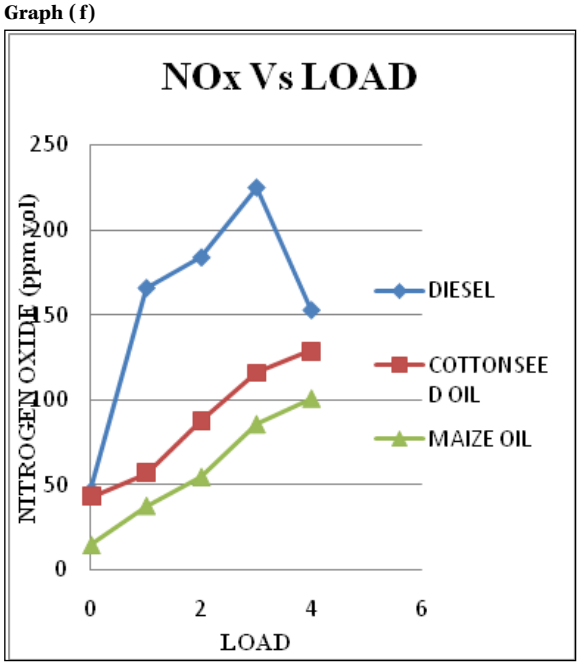
Mechanical efficiency of diesel varies from 0 to 56.81% for the load 0 to 12 kg whereas mechanical efficiency of cottonseed and maize oil varies from 0 to 56.81% and 0 to 55.29% for the load 0 to 12 kg respectively. This graph shows that mechanical efficiency of diesel, cottonseed oil and maize oil is almost same and varies with load.

6. Hydrocarbon :
Table (VII)
Graph (e)



Hydrocarbon emission of diesel is more than cottonseed oil and maize oil.

7. Nitrogen oxide :
Graph (f)



Nitrogen oxide emission of diesel, cottonseed oil, maize oil increases with increase in load.

D) CONCLUSION

The study aims to evaluate the suitability of using biodiesel as an alternative fuel in Variable Compression Ratio (VCR) engine. Experimental investigations were carried out on the operating characteristics of the engine. The tests are carried out on blends of esterified Cottonseed oil and Maize oil with diesel on various compression ratios which yields following conclusions:

1. Brake thermal efficiency of engine increases at higher loads and at higher compression ratios. Brake thermal efficiency of cottonseed oil and maize oil is higher than diesel.
2. At lower compression ratio fuel consumption of engine is more and it increases with increase in load. Fuel consumption of cottonseed oil and maize oil is slightly higher than diesel.
3. Volumetric efficiency of engine increases with increase in load. At lower compression ratio volumetric efficiency is high and it decreases with increase in compression ratio. Volumetric efficiency of cottonseed oil is more than diesel and maize oil.
4. Brake specific fuel consumption of engine increases with increases in load. Brake specific fuel consumption of maize oil is more than diesel and cottonseed oil.
5. Exhaust gas temperature is same for compression ratios and increases with increase in load.

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