Journal of Chemical and Pharmaceutical Sciences ISSN: 0974-2115

PERFORMANCE AND EMISSION CHARACTERISTICS OF JATROPHA-ETHANOL BLEND FUELLED WITH COMPRESSION IGNITION ENGINE

R.Silambarasan*, R. Senthil, G. Pranesh, P. Mebin Samuel, M. Manimaran
*Department of Mechanical Engineering, University College of Engineering Villupuram, Anna University, Chennai.
***Corresponding author: simbu2explore@gmail.com**

ABSTRACT

Experimental tests were carried out to study the performance and emissions of the engine fuelled with Ethanol-Biodiesel blends and compared with those fuelled by diesel. The test results show that it is feasible and applicable for the ethanol-biodiesel blends to replace pure diesel as the fuel for diesel engine. In this study jatropa is used as the biodiesel. The thermal efficiencies of the engine fuelled by the blends were comparable with that fuelled by diesel, with some increase of fuel consumptions, which is due to the lower heating value of ethanol. The emission characteristics were also studied for engines fuelled by the blends, it is found that the smoke emissions from the engine fuelled by the blends were all lower than that fuelled by diesel. The carbon monoxide (CO) were reduced along with the hydrocarbon (HC) emissions. The nitrogen oxides (NO_x) emissions were different for different speeds, loads and blends.

Keywords: Jatropha Methyl Ester, ethanol, performance, emission, Diesel Engine

INTRODUCTION

The vegetable oil, animal fats, used frying oil, waste cooking oil and edible oils such as soybean, sunflower, canola, palm and non-edible oils such as jatropha curcas, pongamia pinnata, madhucaindica, ficuselastica, nicotinatabacum, and calophylluinophyllumm can be used as an alternate fuel for diesel (Y.C. Sharma 2008). The performance, emission and combustion of DI diesel engine using rapeseed oil and its blends of 5%, 20%, 70% and standard fuel. He has reported that the biodiesel produces lower smoke emission and higher brake, specific fuel consumption compare to the diesel fuel (Erkem, 2010). The effects of biodiesel types, biodiesel fraction and physical properties on combustion and performance characteristics of a CI engine. They have conducted an experiments on 4 cylinder 4 stroke DI and turbo charged diesel engine using biodiesel blends of waste oil and rapeseed oil and corn oil with normal diesel (B.Tefsa, 2013). The performance and emission study of a DI diesel engine using blends of diesel fuel with vegetable oils. They have conducted the experimental study on 4 stroke DI , Ricardo/cussons using various bio diesels such as cotton seed oil, soyabean oil, sunflower oil, rapeseed oil, palm oil ,corn oil and olive kernel oil and their corresponding methyl ester at the blends ratio of 10/90 and 20/80(C.D Rakopoulos, 2013).The vegetable oils and their methyl esters (raw sun flower, raw cotton seed oil, raw soybean oil and their methyl esters, refined corn oil, distilled opium poppy oil and refined rapeseed) performance and emission of a four stroke, direct injection diesel engine (Recep, 2001). They have conducted the experiments using Soybean oil, peanut oil, corn oil, sunflower oil, rapeseed oil, palm oil, palm kernel oil, and waste fried oil (vegetable oil basis). They have found that diesel engine fueled with vegetable oil methyl ester could potentially produce the same engine power as one fueled with diesel fuel, but with a reduction in the exhaust gas temperature (EGT), smoke and total hydrocarbon (THC) emissions, with a slight increase in nitrogen oxides (NOx) emissions (Bai, 2009).

Test Engine and fuel properties: A single cylinder, water cooled, four stroke direct injection compression ignition engine was used for the present study. Specification is given in table-1.

Table-1: Engine Specification.

Type	Vertical, Water cooled, Four stroke
Number of cylinder	1
Bore	87.5 mm
Stroke	110 mm
Compression ratio	17.5:1
Maximum power	5.2 kW
Speed	1500 rev/min
Dynamometer	Eddy current

Testing Procedure: Initially the engine was allowed to run with diesel at a constant speed of 1500rpm for nearly 30 minutes to attain the steady state conditions at the lowest possible load. Experiments were carried out at steady state for different engine loads at constant speed of 1500. The engine was allowed to run for few minutes until the exhaust gas temperature, the cooling water temperature, the lubricating oil temperature, as well as the emission have attained steady-state values and data's were recorded subsequently.

RESULTS AND DISCUSSION

Brake Specific Fuel Consumption (BSFC):

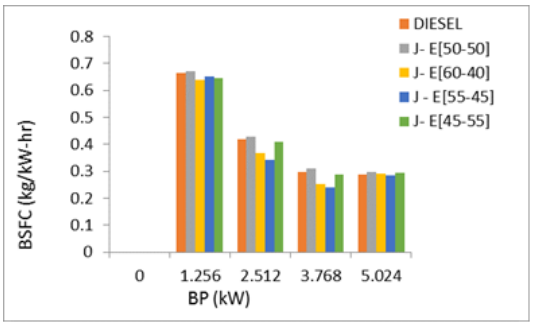

Fig-1: BP vs BSFC

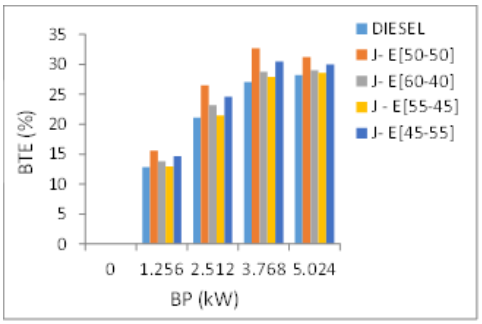

Fig-2: BP vs BTE

Fig-1 shows that for all the Jatropa-Ethanol fuel blends, the SFC is a little higher than the corresponding diesel fuel case for higher loads. At lower loads JE60 shows lower BSFC than diesel. This is the expected behaviour due to the lower calorific value of the ethanol compared to that for the neat diesel fuel.

Brake Thermal Efficiency (BTE):

Fig-2 shows that the brake thermal efficiency is simply the inverse of the product of the specific fuel consumption and the lower calorific value of the fuel. It is observed that for all the ethanol–Jatropa fuel blends, the brake thermal efficiency is slightly higher than that for the corresponding neat diesel fuel case. Comparatively JE50 shows higher BTE.

Nitrogen Oxides (NOx):

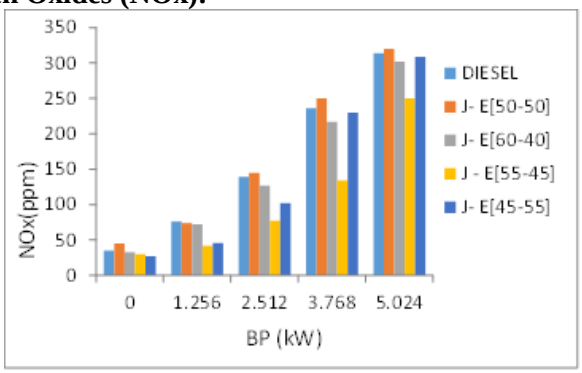

Fig-3: BP vs NOx

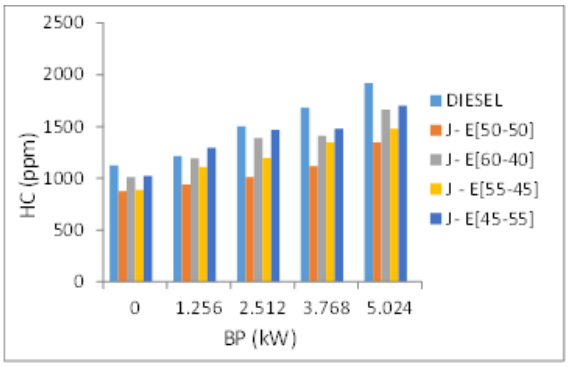

Fig-4: BP vs HC

Fig-3 shows that the NOx emitted by the ethanol-Jatropa blends are slightly lower than those of the neat diesel fuel. This may be attributed to the engine running overall 'leaner' and the temperature lowering effect of the ethanol (lower calorific value and higher heat of evaporation) having the dominant influence.

Hydro Carbon (HC): Fig-4 shows that the HC emitted by the ethanol–jatropa fuel blends are lower than those for the corresponding neat diesel fuel. JE50 shows very low HC emission overall.

Smoke: Fig-5 shows that the SMOKE emission for various Jatropa- Ethanol blends are lower than that of neat diesel fuel.

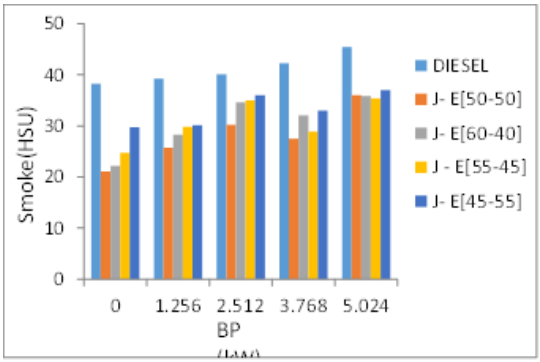

Fig-5: BP vs Smoke

CONCLUSION

From the above all experimental the following conclusions are made.

- BTE is higher for JE50 than all other blends and diesel fuel.
- NOx emission in JE55 lower compared to all other blends and also with diesel.
- Smoke emission is lower in all JE blends compared with diesel fuel.
- JE50 seems to be the best blend ratio.

REFERENCES

B. Tesfa, R. Mishra, C.Zhang, F.Gu, A.D. Ball. Combustion and performance characteristics of CI (Compression ignition) engine running with bio-diesel. Energy, 51, 2013, 101-115

Bai-Fu Lin, Jyun-Han Huang*, Dao-Yi Huang. Experimental study of the effects of vegetable oil methyl ester on DI diesel engine performance characteristics and pollutant emissions. Fuel, 88, 2009, 1779-1785

C.D .Rakopoulos, K.A. Antonopoulos, D.C.Rakopoulos, Comparative performance and emission study of a direct injection diesel engine using blends of diesel fuel with vegetable oil or bio-diesel of various origins. Energy conservation and management, 47, 2006, 3272-3287.

Ekrem Buyukkaya, Effects of bio-diesel on a DI diesel engine performance, emission and combustion characteristics. Fuel, 89, 2010, 3099-3105

RecepAltin, SelimCetinkaya, HuseyinSerdarYucesu, The potential of using vegetable oil fuel as fuel for diesel engines, Energy conservation and management, 42, 2001, 529-538

Y.C.Sharma, B.Singh, S.N.Upadhyay, Advancements in development and characterization of bio-diesel: A review. Fuel, 87, 2008, 2355-2373.