Computing and Engineering
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A study of performance and emission of diesel engine using a variation of biofuels

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INTRODUCTION

Motor vehicles are complex engineering products which globally reached their highest level ever in the present time. The annual Production Figures are exceeding 70 million units. At the start of the twentieth century there were not more than 25,000 cars worldwide. By 1985 the worldwide figure had increased to 375 million. In 2007 there were 806 million cars & light trucks worldwide which indicates the importance of these products in our life. Over the years, vehicular traffic has increased multifold causing an associated increase in the total emissions from transportation sources. These vehicular emissions affect two human occupied environments most significantly: human occupied regions near and around the roads including residences, offices, schools, hospitals etc. In compression ignition engines, mixture of fuel and air is introduced in to the cylinder and then ignited by compression. The products of combustion from these engines contain several constituents that are considered hazardous to human health. These products include CO2, CO, THC and NOx. The variations of these emissions are investigated, in this study, at different engine speed, using different types of biofuels.

Aims and Objectives

Aims

The aims of this study are:

- investigation of the biofuels effects on the engine performance and exhaust gas emissions of internal combustion engines.
- To compare the different types of emissions of internal combustion engines.
- To discuss the variation of these emissions with different engine operating parameters.

Objectives

During this study, the following objectives are fulfilled:

- Identifying and explaining the concept of operation of internal combustion engines.
- Distinguishing the various emissions resulting from combustion in internal combustion engines.
- Investigating experimentally the ways with which the engine emission varies.
- Explain and discuss the experimental results.

Experimental Apparatus and Description

Test Rig Description

The test rig used to conduct the experiments is shown in figures below. It comprises test engine, eddy current dynamometer, exhaust gas analyser, controls and data logging system.

Test Fuels

Blends of biodiesel and conventional hydrocarbon-based diesel are products most commonly distributed for use in the retail diesel fuel marketplace. Much of the world uses a system known as the "B" factor to state the amount of biodiesel in any fuel mix: fuel containing 20% biodiesel is labelled B20, while pure biodiesel is referred to as B100.The experiments are carried out using the following fuels;

	B100	B80	B75	B50	B20	E15/P5
Type of Fuels	Diesel					Diesel
	Vegetable Oil	Vegetable Oil	Vegetable Oil	Vegetable Oil	Vegetable Oil	Vegetable Oil
	Sunflower Oil	Sunflower Oil	Sunflower Oil	Sunflower Oil	Sunflower Oil	Sunflower Oil
	Corn Oil	Corn Oil	Corn Oil	Corn Oil	Corn Oil	Corn Oil

Specification of Engine	
Type	Compression engine
Model	Vauxhall
Number of cylinder	4
Bore (m)	82.5
Stroke (m)	79.50
Stroke volume	1699 CC
Compression ratio	22 : 1
Power (KW@rpm)	44@4500
Torque (Nm@rpm)	132@2400
Cooling system	Water cooled
Charging	Low boost Turbocharged
Fuelling system	Indirect injection

Table 1 Test engine specifications

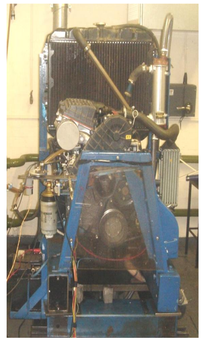

Figure 2 Photograph of Steady State Engine Test Rig.

Figure 3 Photograph of the emissions collection and storage units.

Engine Performance Results

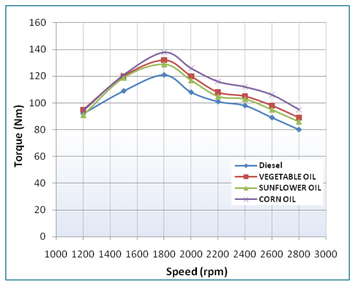

Figure 4 Variation of the brake torque with the engine speed, at 50% full throttle

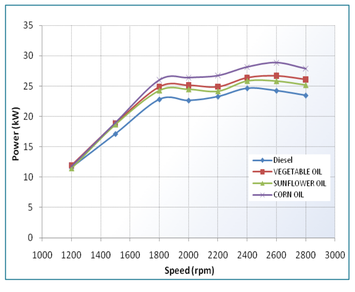

Figure 5 Variation of the power with the engine speed, at 50% full throttle

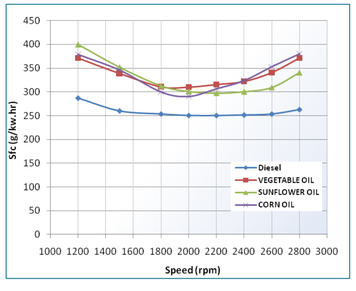

Figure 6 Variation of SFC with the engine speed, at 50% full throttle

Exhaust Emission Results

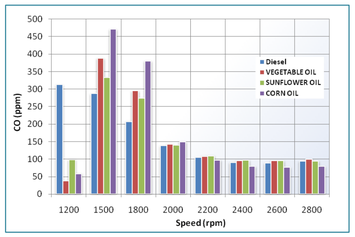

Figure 7 Variation of CO concentration with the engine speed, at 50% full throttle

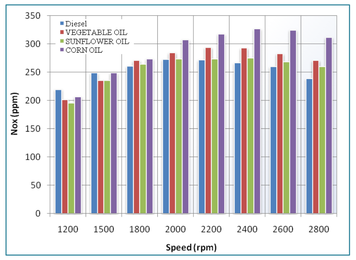

Figure 8 Variation of NOx concentration with the engine speed, at 50% full throttle

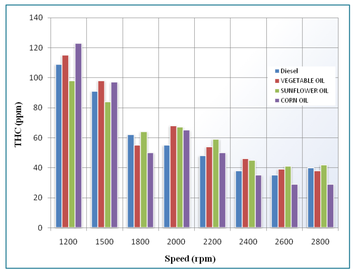

Figure 9 Variation of THC concentration with the engine speed, at 50% full throttle.

CONCLUSIONS

- For torque, corn oil is the best option when used pure or with diesel. But sunflower oil is better when used with ethanol and paraffin. This is also true for power. For Specific fuels consumption, diesel is the best option. Other than diesel, vegetable oil when mixed with diesel or ethanol and paraffin
- For emissions, corn oil and vegetable oil are good when mixed with diesel for the emissions of CO. For THC emissions corn oil and sunflower oil are the best. For NOx emissions vegetable oil and corn oil are better. Hence, vegetable oil and corn oil are better for emissions.

Future work

- Study should be carried out to understand the density and other physical properties of the mixture of diesel with different oils such as algae , jatropha and honge.

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