An Experimental Investigation of Mahua oil blended with Ethanol as substitute fuel in Diesel Engine

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Abstract

In view of increasing pressure on crude oil reserves and environmental degradation as an outcome, fuels like Biofuel may present a sustainable solution as it can be produced from a wide range of carbon based feedstock. The present investigation evaluates Mahua oil blended with ethanol as a fuel in C I engine.

A four stroke Twin cylinder C I engine was adapted to study the brake thermal efficiency, brake specific energy consumption, and emissions with the fuel of Mahua oil blended with ethanol. In this study, the diesel engine was tested usingMahua oil blended with ethanol. Twin cylinder C I engine is able to run with Bio fuel but the engine needs to run by using diesel fuel first, then followed by Bio fuel and finished with diesel fuel as the last fuel usage before the engine turned off. The performance of the engine using Mahua oil blended with ethanolcompared to the performance of engine with diesel fuel. Experimental results of Mahua oil blended with ethanoland Diesel fuel are also compared.

KeyWords: *Diesel, Performance, Emissions, Biofuel, Mahua oil blended with ethanol.*

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1. INTRODUCTION

Rising petroleum prices, increasing threat to the environment from vehicle exhaust emissions and fastly depleting stock of fossil fuels have generated an intense international interest in developing alternative renewable fuels for IC engines. Bio fuel is an oxygenated fuel which increases the combustion and makes reduce exhaust emission. It can be produced from crops with high sugar or starch content. Some of these crops include sugarcane, sorghum, corn, barley, cassava, linseedplants, sugar beets etc. Besides being a biomass based renewable fuel, Biofuel has cleaner burning and higher octane rating than the various vegetable oils [1-5]. Jason and Marc (2002) presented the exegetic environmental assessment of lifecycle emissions from M-85, E-85 (used for the gasoline engine) and other alternative fuels [6]. Diesel exhaust is a major contributor to various types of air pollution, including particulate matter (PM), oxides of nitrogen (NOx), and carbon monoxide (CO) [7]. It has been demonstrated that the formation of these air pollutants can be significantly reduced by incorporating or blending oxygenates into the fossil fuels matrix [8]. Diesel engines are an important part of the public and private transportation sector and their use will continue and grow into the future. But their smoke has become biggest threat to health and environment [9]. Keeping in mind the higher octane number of the ethanol, variable compression ratio engine is a good option in this direction using the ethanol diesel blend as fuel; Shaik et al. (2007) demonstrated VCR engine has great potential for improving part-load thermal efficiency and reducing greenhouse gas emissions [10].There were many attempts made to use Biofuel in compression ignition (CI) engine. Huang et al. (2008) carried out tests to study the performance and emissions of the engine fuelled with the ethanol diesel blends [11]. They found it feasible and applicable for the blends with n-butanol to replace pure diesel as the fuel for diesel engine. Bhattacharya and Mishra (2002) evaluated the feasibility of preparing diesel-ethanol blends using 200° (anhydrous ethanol) and ethanol lower proof [12]. They found that ethanol blends indicated power producing capability of the engine similar to that of diesel. Hansen et al. (2001) found that the properties of ethanol-diesel blends have a significant effect on safety, engine performance, durability and emissions [13]. Wang et al. (2003) analyzed that the most noteworthy benefits of E-diesel use lie with petroleum fuel reductions and reductions in urban PM_{10} and CO emissions by heavy vehicle operations [11]. Ajav and Akingbehin (2002) experimentally determined some fuel properties of local ethanol blended with diesel to establish their suitability for use in compression ignition engines [14]. Eckland et al. (1984) presented, State-of-the-Art Report on the Use of Alcohols in Diesel Engines [15]. Techniques that have been evaluated for concurrent use of diesel and alcohols in a compression-ignition engine include (1) alcohol fumigation, (2) dual injection (3) alcohol/diesel fuel emulsions, and (4) alcohol/diesel fuel solutions. Heisey and Lestz (1981) reported significant reductions in particulate generation; however, NOx generation increases [16]. Likos et al. (1982) reported increased NOx and hydrocarbon emissions for diesel-ethanol emulsions [17]. Khan and Gollahalli (1981) reported decreased NOx and hydrocarbon emissions with increased particulate emissions for diesel-ethanol emulsions [18]. Lawson et al. (1981) reported increased NOx and decreased particulate emissions with diesel methanol emulsions [19]. Performance and Emission Characteristics of Twin Cylinder CI Engine Using Cottonseed Oil Blended With Methanol [20]. Ahmed (2001) found Diesel engines are major contributors of various types of air polluting exhaust gasses such as particulate matter (PM), carbon monoxide (CO), oxides of

nitrogen (NOx), sulfur, and other harmful compounds [21]. Experimental Investigation of Twin Cylinder Diesel Engine Using Linseed oil blend with Ethanol [22].Raoet al. (2008) carried out experiment in order to found out optimum compression ratio, experiments were carried out on a single cylinder four stroke variable compression ratio diesel engine [23]. Experimental Investigation of Twin Cylinder Diesel Engine Using Diesel & Methanol [24] Investigation of Methanol in Twin cylinder in line 4 Stroke liquid cooled Diesel Engine [25] Investigation of Alternative fuels in Diesel Engine [26-37]

2. EXPERIMENTAL SETUP

Fig 1: Test engine (Twin cylinder Diesel Engine)

3. OBJECTIVE

Objective of the present study is to:

- It is proposed to use Mahua oil blended with ethanolin the diesel engine.
- The emissions like HC, CO_2, NOx, and Smoke in the exhaust gases are proposed to reduce during the combustion itself.
- To study the performance evaluation of the using Bio fuel blended with Ethanol in the diesel engine.
- To analyse the exhaust emissions and measurement, reduction in the exhaust gas.

3.1 Properties of Bio Fuel Blended With Alcohol

Table-1

Sl.No	Fuel	CV KJ/Kg
1.	Diesel	44,800
2.	Mahua oil blended with Ethanol	35,095

3.2 Engine Specification

Table-2

Test Engine specification	
Injection Pressure	1800 bar
Engine type	Four stroke Twin cylinder diesel engine
No. of cylinders	02
Stroke	100 mm
Bore Diameter	87 mm
Engine Power	15KVA
Compression ratio	17.5:1
RPM	1500

4. RESULTS

4.1 Performance Graphs

4.1.1 Brake Specific Energy Consumption

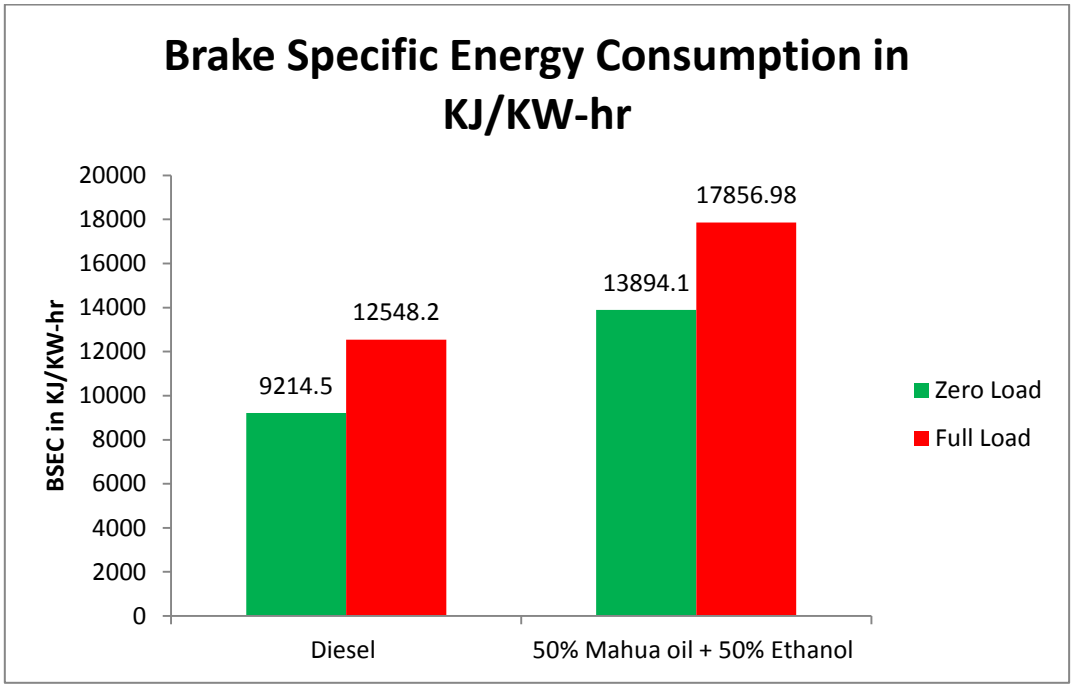

Fig-2 shows the variations of Brake Specific Energy Consumption for Diesel and Mahua oil blended with Ethanol at Zero Load and Full Load

4.1.2 Brake Thermal Efficiency

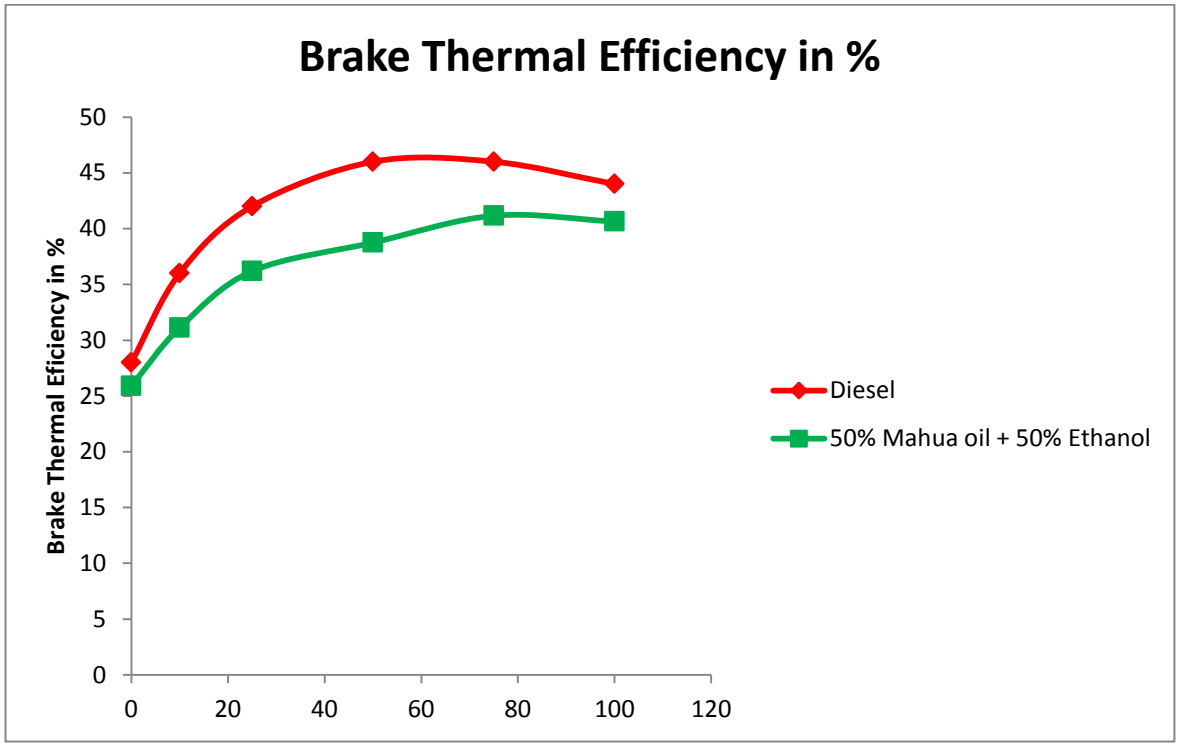

Fig-3 shows the variations of Brake Thermal Efficiency for for Diesel and Mahua oil blended with Ethanol at different loads

4.2 Emission Graphs

4.2.1 Unburnt Hydro Carbon

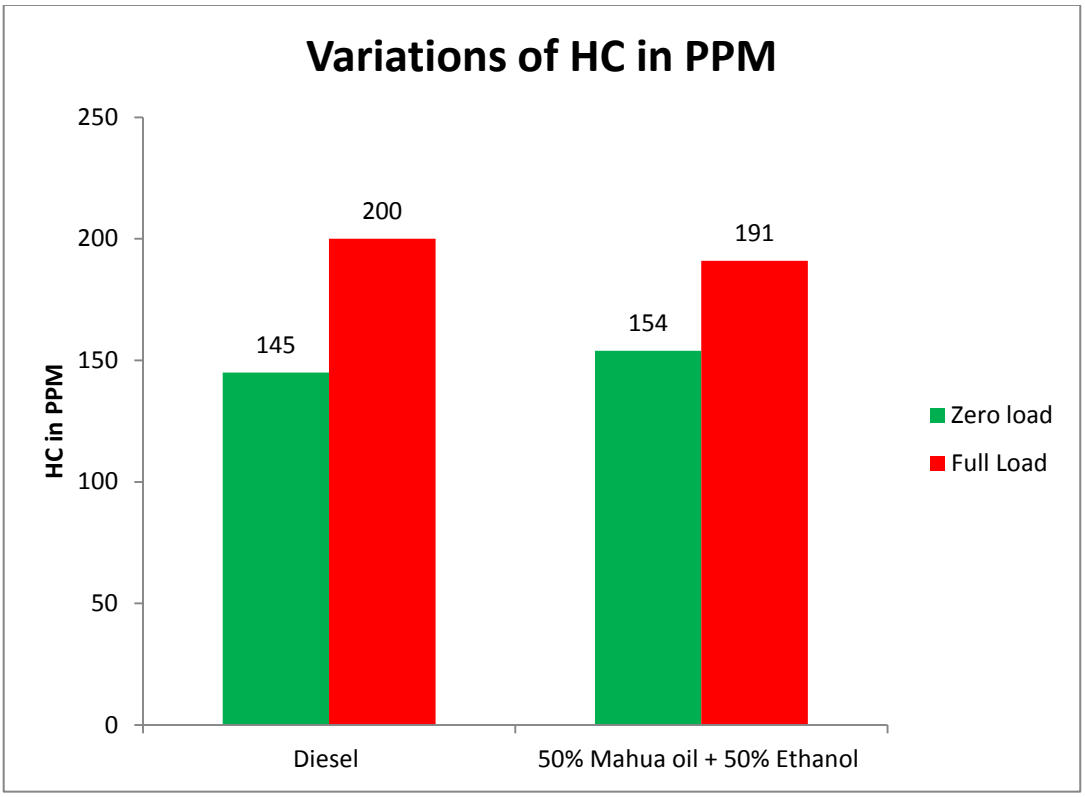

Fig-4 shows the variations of Unburnt Hydro Carbonfor Diesel and Mahua oil blended with Ethanol at Zero Load and Full Load

4.2.2 Carbon Dioxide

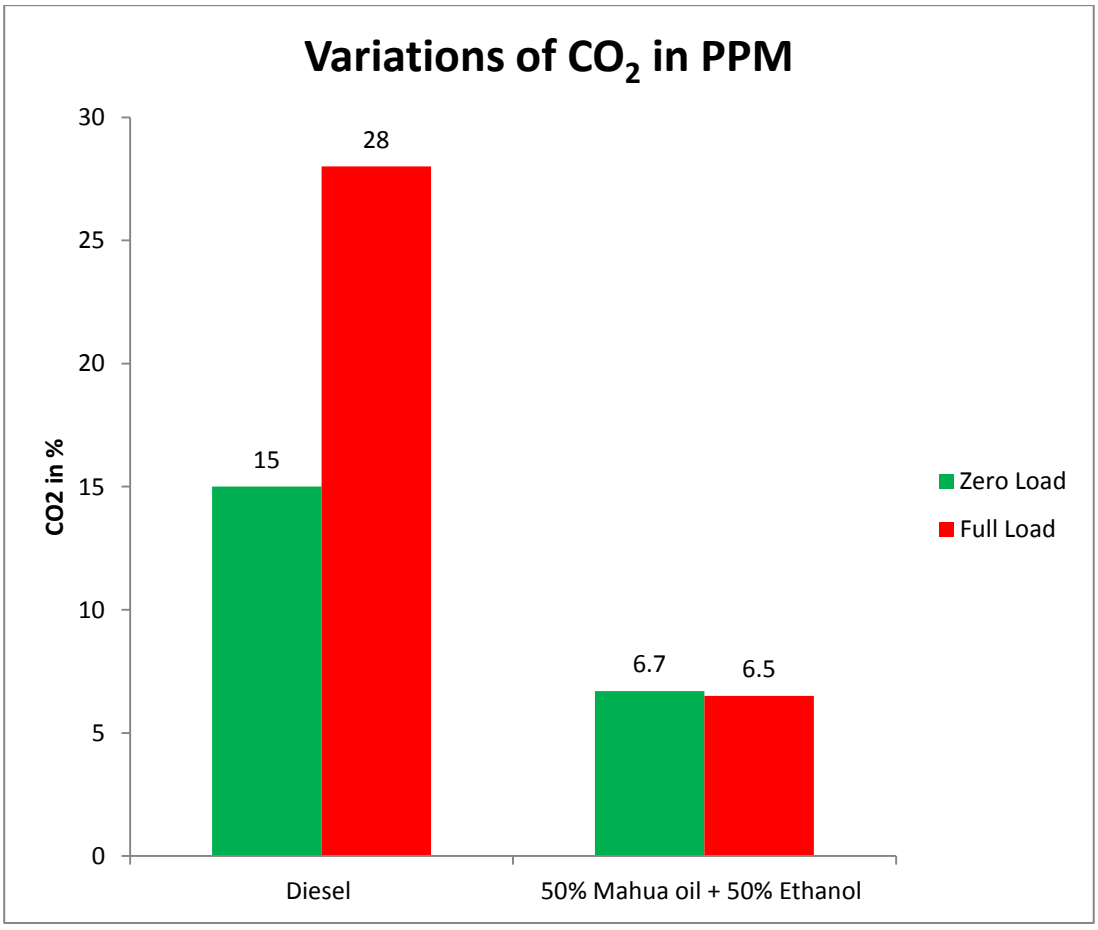

Fig-5 shows the variations of Carbon dioxidefor Diesel and Mahua oil blended with Ethanol at Zero Load and Full Load

4.2.3 Nitrogen Dioxide

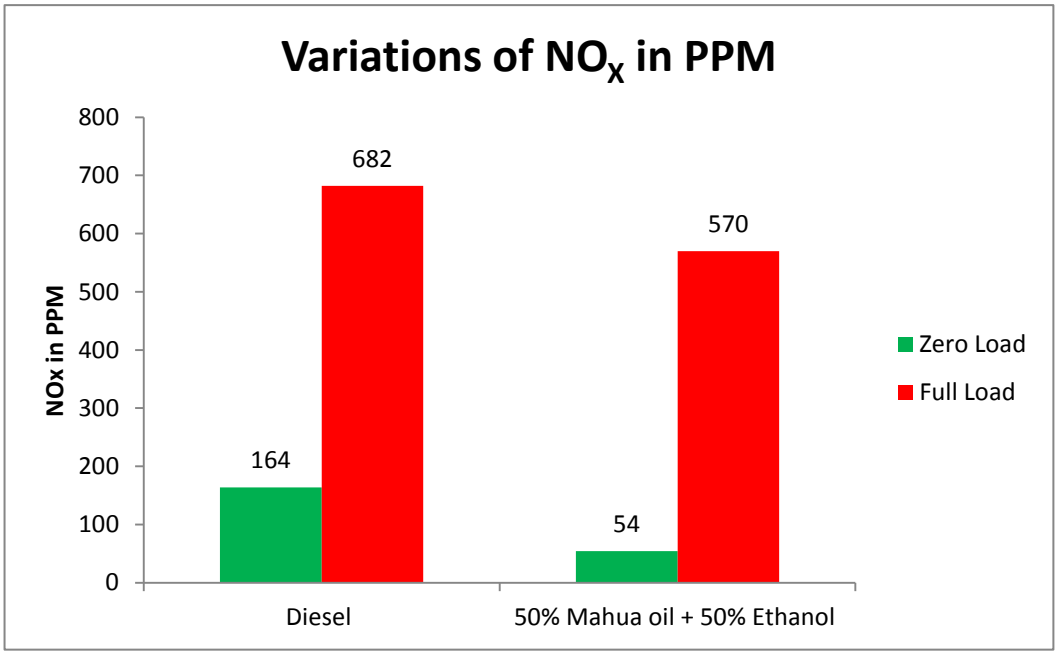

Fig-6 shows the variations of Nitrogen dioxidefor Diesel and Mahua oil blended with Ethanol at Zero Load and Full Load

4.2.3 Smoke

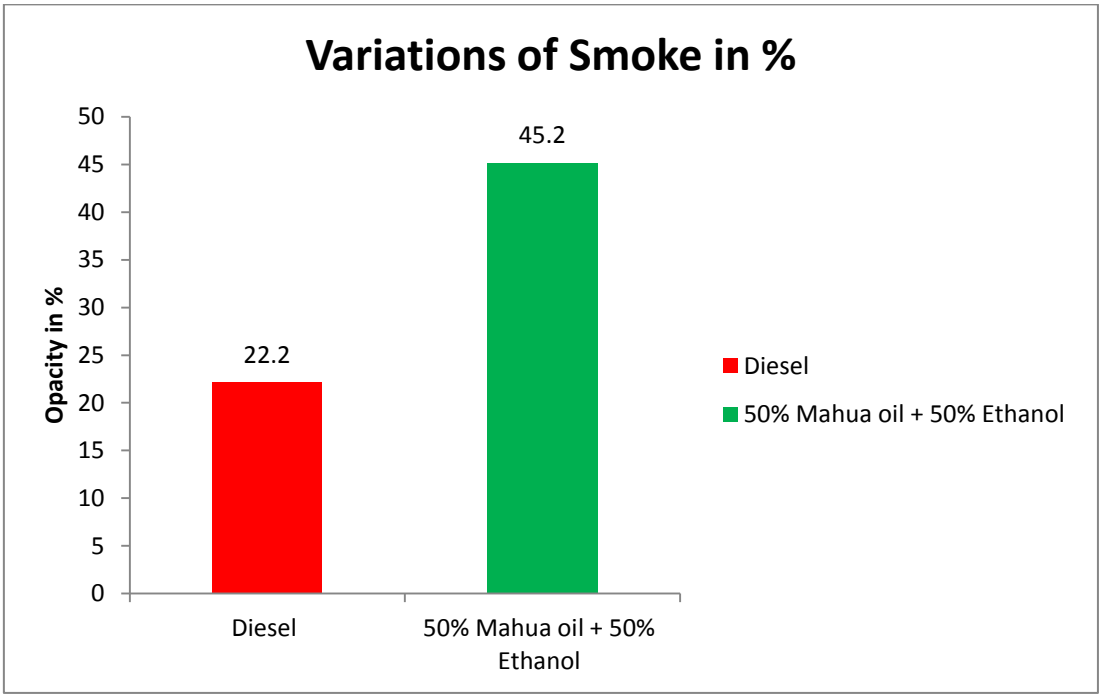

Fig-7 shows the variations of Smokefor Diesel and Mahua oil blended with Ethanol at Full Load

5. CONCLUSION

Based on the experimental results the performance and emissions of Mango seed oil blended with Ethanol, it is Concluded that the

- Mango seed oil blended with Ethanol represents a good alternative fuel with closer performance and better emission characteristics in Diesel Engine.
- From the above experimental results the Mango seed oil blended with Ethanol shows better performance Diesel Engine
- From the above experimental results the Mango seed oil blended with Ethanol shows performance characteristics like Brake thermal efficiency, Brake specific Energy consumption and decrease in the emission parameters like HC, CO_2, NOx, Smoke are lower Biofuel blended with Ethanol compared with Diesel.

- Hence the Mango seed oil blended with Ethanol can be used as a substitute for diesel effectively in diesel engines.

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