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RESEARCH ARTICLE

IMPACTS OF MAHUA OIL BLENDED WITH METHANOL COMBUSTION ON HC, CO, NOX, SMOKE EMISSIONS AND THEIR REDUCTION IN DIESEL ENGINE

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ABSTRACT

Sarcoidosis In view of increasing pressure on crude oil reserves and environmental degradation as an outcome, fuels like Methanol blended with Mahua oil may present a sustainable solution as it can be produced from a wide range of carbon based feedstock. The present investigation evaluates Methanol blended with Mahua oil as a diesel engine fuel. The objectives of this paper is to analyze the fuel consumption and the emission characteristic of a twin cylinder diesel engine that are using Methanol blended with Mahua oil & compared to usage of ordinary diesel that are available in the market. A four stroke Twin cylinder diesel engine was adopted to study the brake thermal efficiency, brake specific energy consumption, and emissions at zero load & full load with the fuel of methanol. In this study, the diesel engine was tested using Methanol blended with Mahua oil. By the end of the experiment, the successful of the experiment have been started which is Diesel engine is able to run with Methanol blended with Mahua oil but the engine needs to run by using diesel fuel first, then followed by Methanol blended with Mahua oil and finished with diesel fuel as the last fuel usage before the engine turned off. The performance of the engine using Methanol blended with Mahua oil fuel compared to the performance of engine with diesel fuel. Experimental results of Methanol blended with Mahua oil and Diesel fuel are also compared.

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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 (Alan C. Hansen *et al*., 2005; Dr.Hiregoudar Yerrennagoudar *et al*., 2014; Neven Voca *et al*., 2009; Avinash Kumar Agarwal, 2006; Hakan, Bayraktar, 2005; Jason *et al*., 2002). 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 (Jason *et al*., 2002). Diesel exhaust is a major contributor to various types of air pollution, including particulate matter (PM), oxides of nitrogen (NOx), and carbon monoxide (CO) (Hwanam Kima and Byungchul Choi, 2008). 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 (De-gang Li *et al*., 2005). 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 (Sehmus Altuna *et al*., 2008). 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 (Amjad Shaik *et al*., 2007). 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 (Jincheng Huang *et al*., 2008). 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 (Bhattacharya and Mishra, 2002). They found that

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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 (Alan C. Hansen *et al*., 2001). 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 (Jincheng Huang *et al*., 2008). 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 (Kamo and Bryzik). Eckland *et al*. (1984) presented, State-of-the-Art Report on the Use of Alcohols in Diesel Engines (Ram Mohan *et al*., 1995). 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 (Van Sudhakar). Likos *et al*. (1982) reported increased NOx and hydrocarbon emissions for diesel-ethanol emulsions (Varaprasad and Ram Mohan , 1988). Khan and Gollahalli (1981) reported decreased NOx and hydrocarbon emissions with increased particulate emissions for diesel-ethanol emulsions (Rangaiaii *et al*., 1985). Lawson *et al*. (1981) reported increased NOx and decreased particulate emissions with diesel methanol emulsions (Ram Mohan). Performance and Emission Characteristics of Twin Cylinder CI Engine Using Cottonseed Oil Blended With Methanol (Hiregoudar Yerrennagoudar *et al*., 2015). 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 (Mather and Sharma, 1996). Experimental Investigation of Twin Cylinder Diesel Engine Using Linseed oil blend with Ethanol (Hiregoudar Yerrennagoudar *et al*., 2015). Rao *et 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 (Eckland). Experimental Investigation of Twin Cylinder Diesel Engine Using Diesel & Methanol (Hiregoudar Yerrennagoudar *et al*., 2015) Investigation of Methanol in Twin cylinder in line 4 Stroke liquid cooled Diesel Engine (Hiregoudar Yerrennagoudar *et al*., 2013) Investigation of Alternative fuels in Diesel Engine (Hiregoudar Yerrennagoudar *et al*., 2013; Hiregoudar Yerrennagoudar *et al*., 2015; Hiregoudar Yerrennagoudar *et al*., 2014; Hiregoudar Yerrennagoudar *et al*., 2015)

Objective

Objective of the present study is to:

- It is proposed to use Mahua oil blended with Methanol in 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 Mahua blended with Methanol in the diesel engine.
- To analyse the exhaust emissions and measurement, reduction in the exhaust gas.

Experimental Setup

Fig. 1. Test engine (Twin cylinder Diesel Engine)

Table 1. Properties of Bio Fuel Blended With Alcohol

Sl.No	Biofuel	CV KJ/Kg
1.	Diesel	44,800
2.	Mahua oil blended with Methanol	31,745

Table 2. Engine Specification

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

RESULTS

Performance Graphs

Brake Specific Energy Consumption

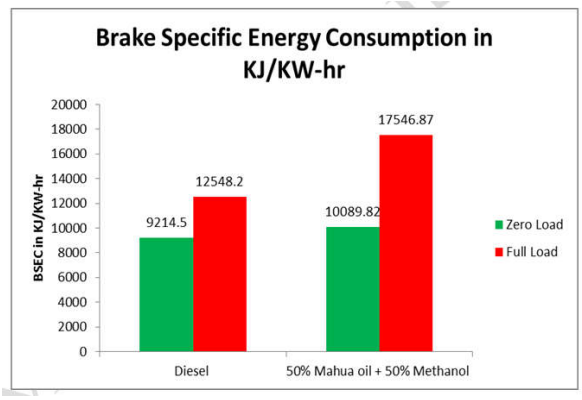

Fig. 2. The variations of Brake Specific Energy Consumption for Diesel and Mahua oil blended with Methanol at Zero Load and Full Load

Brake Thermal Efficiency

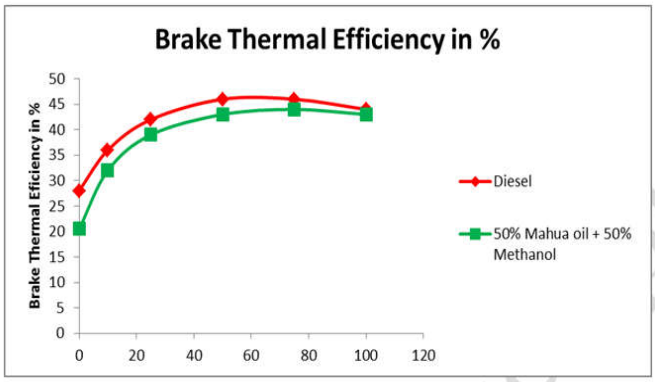

Fig. 3. The variations of Brake Thermal Efficiency for Diesel and Mahua oil blended with Methanol at different Loads

Emission Graphs

Unburnt Hydro Carbon

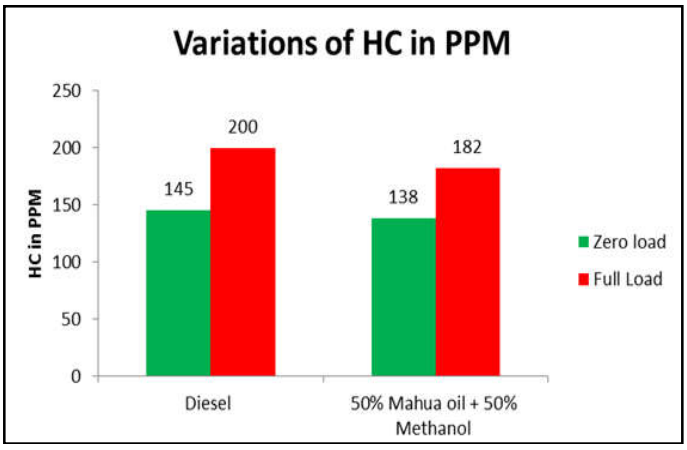

Fig. 4. The variations of Unburnt Hydro Carbon for Diesel and Mahua oil blended with Methanol at Zero Load and Full Load

Nitrogen Dioxide

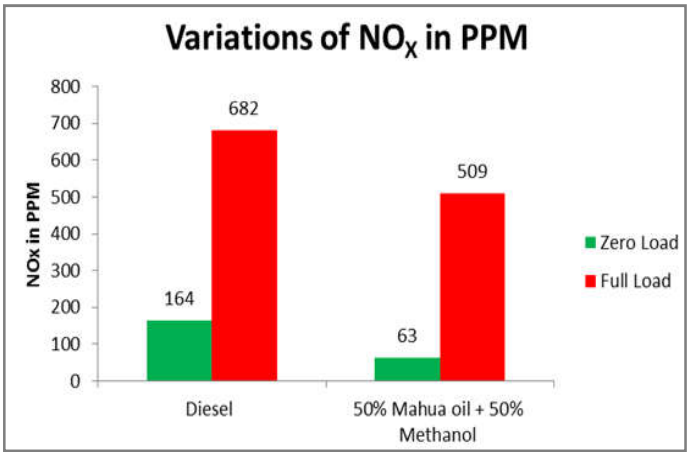

Fig. 5. The variations of Nitrogen dioxide for Diesel and Mahua oil blended with Methanol at Zero Load and Full Load

Carbon Dioxide

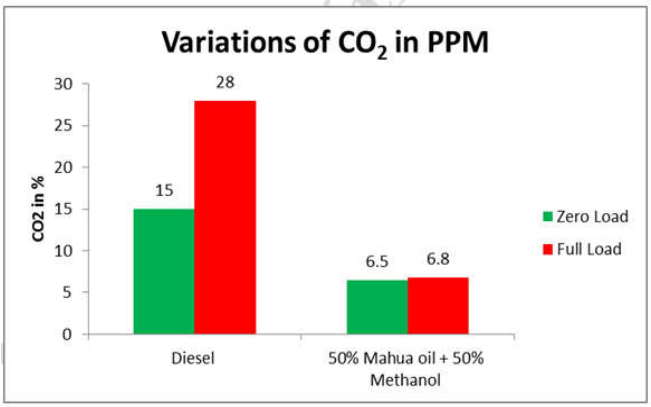

Fig. 6. The variations of Carbon dioxide for Diesel and Mahua oil blended with Methanol at Zero Load and Full Load

Smoke

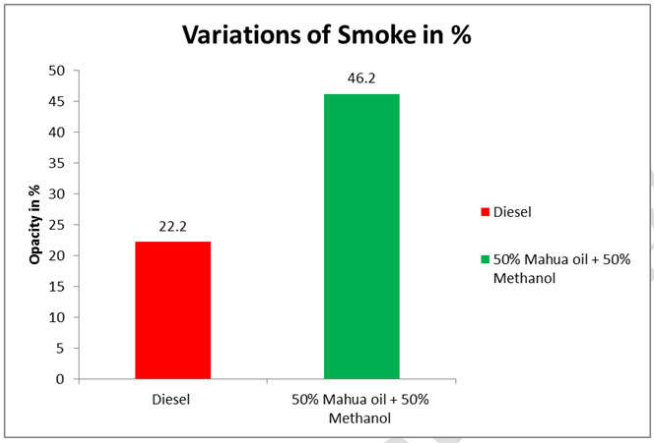

Fig. 7. The variations of Smoke for Diesel and Mahua oil blended with Methanol at Zero Load and Full Load

Conclusion

Based on the performance and emissions of Methanol blended with Mahua oil, it is concluded that the Methanol blended with Mahua oil represents a good alternative fuel with closer performance and better emission characteristics to that of a diesel. From the above Experimental analysis the Methanol blended with Mahua oil shows better performance compared to the Diesel in the sense of better performance characteristics like Brake thermal efficiency, Specific fuel consumption and decrease in the emission parameters like Co_2, HC, Nox and Smoke. Hence the Methanol blended with Mahua oil can be used as a substitute for diesel.

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