

Effect of Pine oil blended with Methanol on Performance and Emissions in a Diesel Engine

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Abstract: The present fossil fuel crisis and increasing vehicle population made us to think of alternate fuels. The abundance of the fossil fuels is expected to be exhaust in another 30-40 years. The cost of the fossil fuels is day by day increasing and also the emission from these fuels increases the air pollution. With keeping in view of all the above said points, it is made us to think of alternate fuels for all CI Engines. Among alternate fuels, the Pine oil blended with Methanol will promise for substituting the diesel. With pure vegetable oils there is combustion problems and which leads to more emissions in the exhaust. The present investigation evaluates Pine oil blended with Methanol in Diesel Engine. A Twin cylinder Diesel Engine adapted to study the Brake thermal efficiency, Brake specific energy consumption, and emissions in Low Cetane fuels. In this study, the diesel engine was tested using Diesel and Low Cetane Fuels. From this study the emissions like HC and CO has been reduced and Low Cetane Fuels are substitute to diesel fuel. To overcome the above problems we use combustion additives at the time of combustion. So here we use Pine oil blended with Methanol as alternative fuels in diesel Engine and perform various tests and evaluate its performance.

Keywords: Diesel, Performance, Emissions, Biofuel, Pine oil

I. 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 PM₁₀ 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 NO_x 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 (NO_x), sulfur, and other harmful compounds [21]. Experimental Investigation of Twin Cylinder Diesel Engine Using Linseed oil blend with Ethanol [22]. Rao et al. (2008) carried out experiment in order to find 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] T. Le Anh, I.K. Reksowardojo, K. Wattanavichien (1) This chapter summarises findings on the use of biofuels in conventional diesel engines [38] Seung Hyun Yoon, Chang Sik Lee (2) This study was performed to investigate the effect of biogas–biodiesel fuel combustion on the emissions reduction and nanoparticle characteristics in a direct injection (DI) diesel engine [39] F.J. Salvador, J. Martínez-Lopez, J.-V. Romero, M.-D. Rosello (3) In this paper, the behavior of the internal nozzle flow of a standard diesel fuel has been compared against a biodiesel fuel (soybean oil) at cavitating and non-cavitating conditions, using a homogeneous equilibrium model [40]

II. Experimental Setup



Fig 1: Test engine (Twin cylinder Diesel Engine)

III. Objective

Objective of the present study is to:

- It is proposed to use Pine oil blended with Methanol in the diesel engine.
- The emissions like HC, CO₂, NO_x, 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 Methanol in the diesel engine.
- To analyse the exhaust emissions and measurement, reduction in the exhaust gas.

IV. Properties of Biofuel blended with Alcohol

Table-1

Sl.No	Fuel	CV KJ/Kg
1.	Diesel	44,800
2.	Pine oil blended with Methanol	33,222

V. 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

VI. Results

1. Performance Graphs

1.1 Brake Specific Energy Consumption

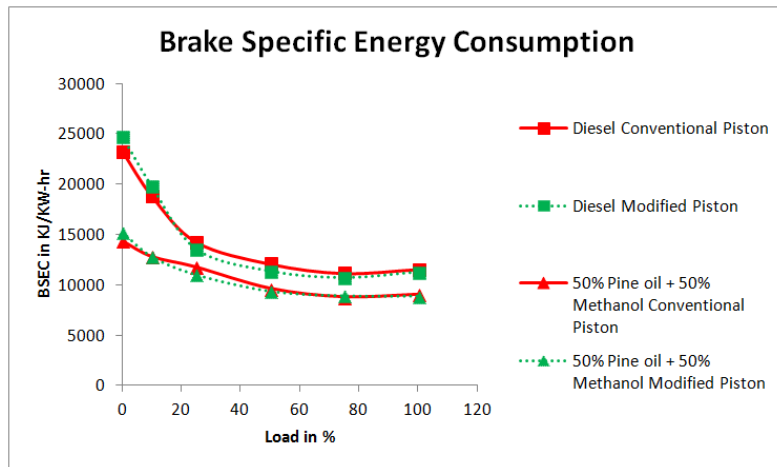


Fig-2 shows the variations of Brake Specific Energy Consumption for Diesel and Pine oil blended with Methanol at Zero Load and Full Load

1.2 Brake Thermal Efficiency

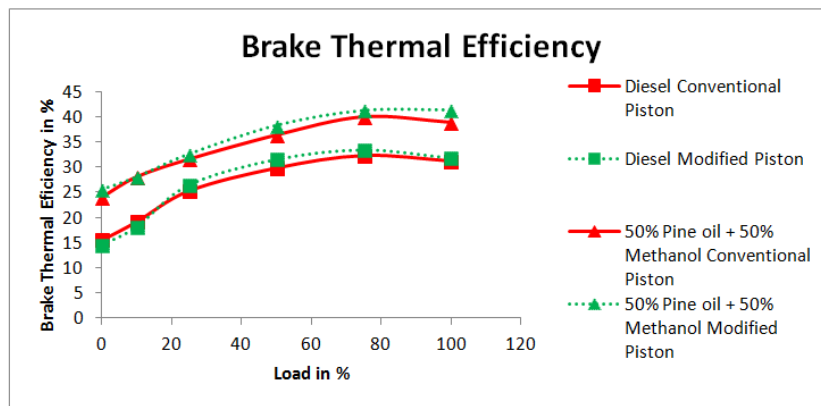


Fig-3 shows the variations of Brake Thermal Efficiency for Diesel and Pine oil blended with Methanol at different Loads

2. EMISSION Graphs

2.1 Unburnt Hydro Carbon

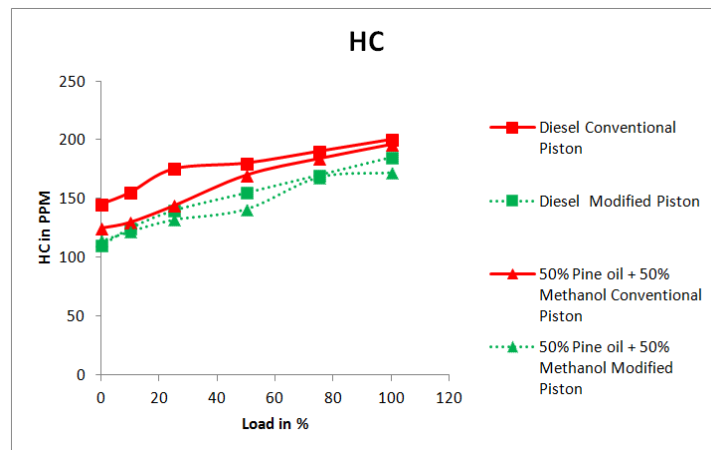


Fig-4 shows the variations of Unburnt Hydro Carbon for Diesel and Pine oil blended with Methanol at Zero Load and Full Load

2.2 Carbon Dioxide

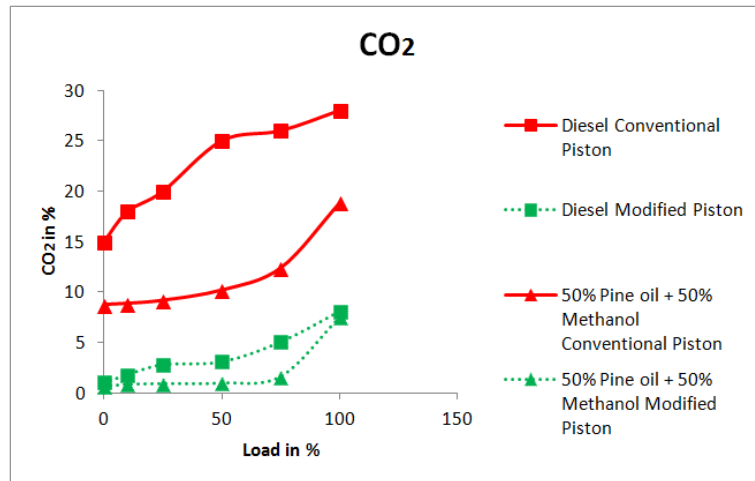


Fig-5 shows the variations of Carbon dioxide for Diesel and Pine oil blended with Methanol at Zero Load and Full Load

2.3 Nitrogen Dioxide

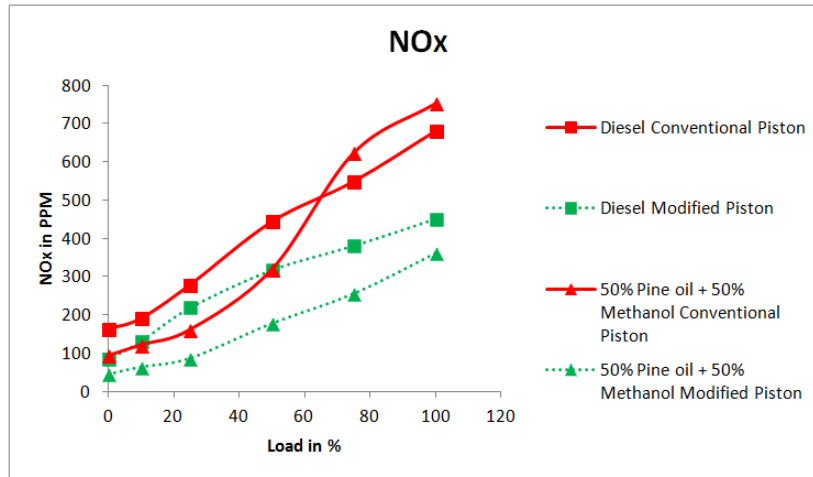


Fig-6 shows the variations of Nitrogen dioxide for Diesel and Pine oil blended with Methanol at Zero Load and Full Load

2.4 Smoke

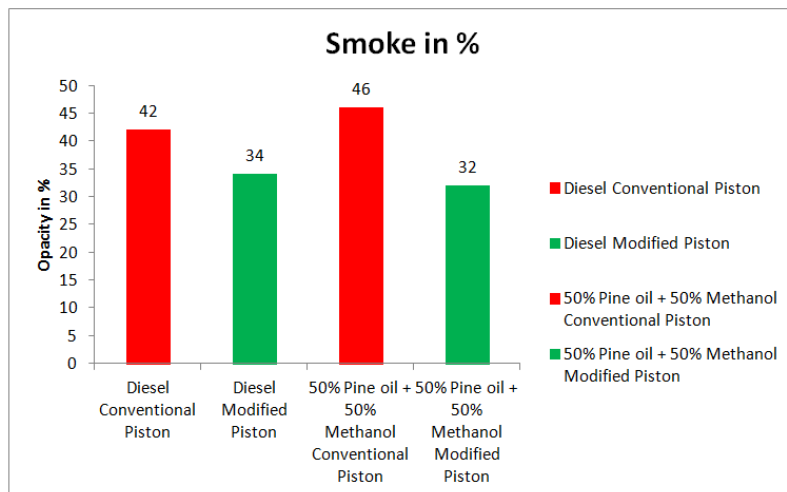


Fig-7 shows the variations of Smoke for Diesel and Pine oil blended with Methanol at Zero Load and Full Load

VII. Conclusion

Based on the performance and emissions of Pine oil blended with Methanol, it is concluded that the Pine oil blended with Methanol represents a good alternative fuel with closer performance and better emission characteristics to that of a twin cylinder diesel fuel engine. From the above analysis the Pine oil blended with Methanol 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 HC, CO₂, NO_x, Smoke in Modified Piston compared to Conventional Piston.

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