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Experimental Investigation on Twin Cylinder Diesel Engine Rubber Seed oil and Hippie oil Blendedas a fuel

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***Abstract*—Biofuel, which may be made from a variety of carbon-based feedstock, may offer a sustainable option in light of the mounting pressure on crude oil sources and the resulting environmental deterioration. In this study, Biofuelis evaluated for its potential as a fuel for C I engines.**

The purpose of this paper is to examine the efficiency and emissions of a Biofuel&-powered twin-cylinder diesel engine in relation to conventional diesel powertrains.

This paper details the experimental setups and procedures carried out to investigate the effects of both fuels on the emission characteristics and fuel consumption of a diesel engine. Before beginning the experiment, thorough preparations were made by studying the experimental apparatus and components in detail. The necessary experimental data for the analysis can be noticed. After collecting all of the necessary data for the thesis, the necessary calculations and analysis have been performed. In the experiment, a C I engine was employed, but it was under no stress.

To investigate the thermal efficiency of the brakes, specific energy consumption, and emissions at varied loads and at full load while using Biofuel, a four-stroke Twin cylinder C I engine was utilised. Biofuel was used to power a diesel engine in this investigation.By the end of the report, the successful of the project have been started which is 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 efficiency of the engine when utilising biofuel as opposed to diesel fuel. The comparison of Bio fuel and Diesel fuel experimental findings is included as well..

Keywords:Synonyms: Biodiesel, Rubber Seed Oil, Hippie Oil, and Performance.

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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 exergetic 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]. This type of inconsistent performance is what has hindered the use of ethanol in diesel. Baker (1981) reported diesel-ethanol emulsions produce similar NOx, hydrocarbon, and particulate emulsions as compared to baseline runs with straight diesel [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]. Ethanol blended diesel (e-diesel) is a cleaner burning alternative to regular diesel for both heavy-duty (HD) and light-duty (LD) compression ignition (CI) engines used in buses, trucks, off-road equipment, and passenger cars.Karabektasand Murat Hosoz (2009) reported the increase of fuel consumption with increase in percentage of ethanol in the blends [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].

Property	Diesel	Rubber seed oil	Hippie oil
Density (kg/m^3)	832	864	965
Sp gravity	0.86	0.930	0.890
K V (c St), 40^{0}C	2.78	3.78	4.25
Flash point ^{0}C	50	198	116
Calorific value (kJ/kg)	43,200	39857	35,800

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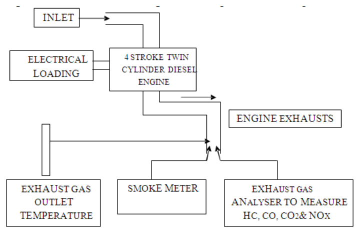

Fig 1: Schematic arrangement of Experimental Set-up

II. OBJECTIVES OF THE PROJECT

- It is proposed to use Bio Fuel in the diesel engine (CI engine).
- The emissions like HC, CO in the exhaust gases areproposed to reduce during the combustionitself.
- To study the performance evaluation of the using Bio fuelas fuel in the diesel engine.
- Analyze the exhaust emissions and measurement, reduction in the exhaust gas.

a) *Properties of diesel and Bio Fuel*.

Table-1

d) **III EXPERIMENTAL SET UP (TEST RIG):** KIRLOSKAR MAKE FOUR STROKE SINGLE CYLINDER DIESEL ENGINES OF AV SERIES.

Fig 2: Test engine

Table-2

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Test Engine specification

Engine type	Four stroke Twin cylinder diesel engine
No. of cylinders	02
Stroke	100 mm
Bore Diameter	87 mm
Engine power	15 KV
Compression ratio	17.5:1
RPM	1500
Type of starting	Crank starting
Load type	Water loading

Table-3

Load bank specification

Max. Output	15 KV
Generator type	1 Phase
Amps	63
RPM	1500
PF	0.8
Volts	240

f) Precaution Observed Starting the Engine

At the time of starting the engine for each of the tests it was measured that the engine level was in the safe zone and its condition is also good in case the condition was bad, then fresh SAE 40 was introduced into the pump after draining the old . The foundation and mounting bolts were checked periodically as they may go loose due to high speed operations and vibrations.

In the course of experiments the following precautions were observed:

- The ambient temperature variations during the experiment should not be more than 6°Cand this was observed as far as possible.
- After each load is applied the engine in allowed to settle before further loads are applied.

Before stopping the engine, it was allowed to run on pure diesel for some time. This is done so that the engine can be restarted easily

g) Experimental procedure

Experiments were initially carried out on the engine using diesel as fuel in order to provide base line data. The Bio fuelwere prepared and made to run on the engine.

1stCase:-The engine was started using neat diesel and allowed to run for at least 30 minutes before taking observations. After engine conditions stabilized and reached to steady state, the base line data were taken. Load was varied using the alternator load bank and the same was recorded. Gaseous emissions, fuel consumption were also recorded from the respective sensor.

2ndCase:-The engine was started on diesel and when engine became sufficiently heated; the supply of diesel was slowly substituted by Bio fuel for which a two way valve was used. After engine conditions stabilized and reached to steady state, the base line data were taken. Load was variedusing the alternator load bank and the same was recorded. Gaseous emissions, fuel consumption were also recorded from the respective sensor.

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I. Results and Discussion

h) Performance parameter

Tabular Column IV

Diesel							
Sl. No	TFC kg/hr	B.P. KW	BSFC kg/kw-hr	$\eta_{B.th}$ %	Emissions		
					CO %	HC ppm	Smoke
1.	0.73	0.92	0.6	10.4	.11	90	47
2.	0.78	0.98	0.794	10.7	.10	70	68
3.	0.85	1.64	0.516	16.4	.09	80	77
4.	0.90	2.62	0.343	24.7	.08	70	80

Tabular Column V

Rubber seed oil B-20							
Sl. No	TFC kg/hr	B.P. KW	BSFC kg/kw-hr	$\eta_{B.th}$ %	Emissions		
					CO %	HC ppm	Smoke
1.	0.67	0.92	0.65	10.1	.06	70	20.3
2.	0.75	0.98	0.765	11.8	.06	80	52.6
3.	0.83	1.64	0.505	17.8	.06	90	65.6
4.	0.87	2.62	0.334	27.0	.06	100	79.2

Tabular Column VI

Hippie oil							
Sl. No	TFC kg/hr	B.P. KW	BSFC kg/kw-hr	$\eta_{B.th}$ %	Emissions		
					CO %	HC ppm	Smoke
1.	0.69	0.9	0.67	10	.05	20	20.3
2.	0.76	0.98	0.769	11.4	.06	30	24.7
3.	0.81	1.64	0.491	17.5	.05	30	51.8
4.	0.83	2.62	0.315	27.8	.05	30	63

i) Comparison of Specific Energy Consumption with Power Output

a) Total fuel consumption:

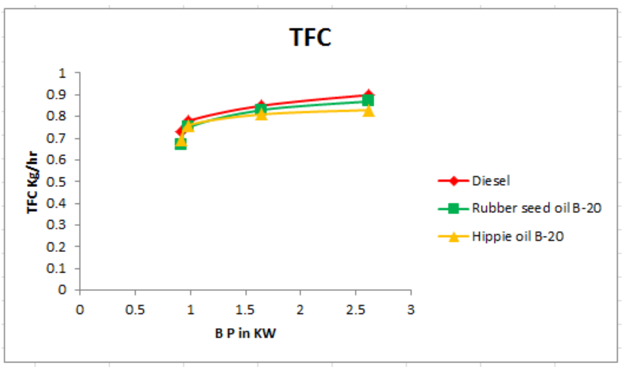

Fig.-2: Variations of TFC at Different BP

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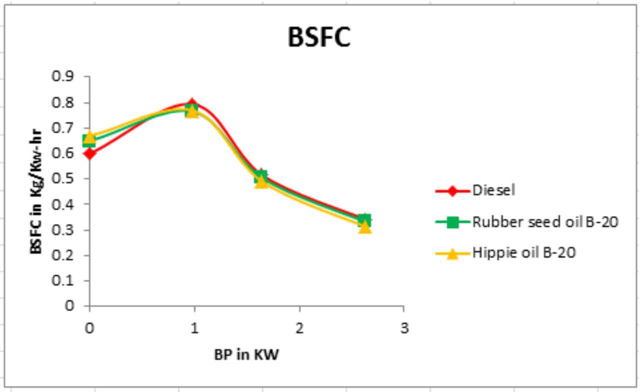

Fig – 3. Variations of BSFC at Different BP

b) Brake thermal efficiency:

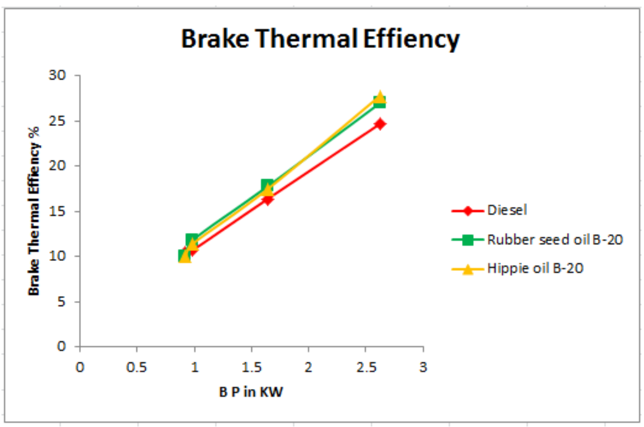

Fig – 4. Variations of Brake Thermal Efficieny at Different BP

J) Emission parameters:

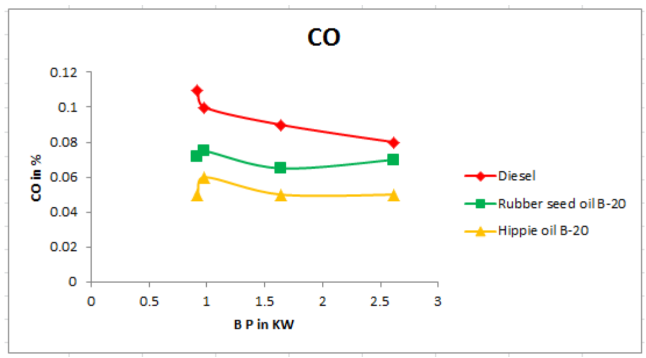

Fig – 5.

Variations of CO at Different BP

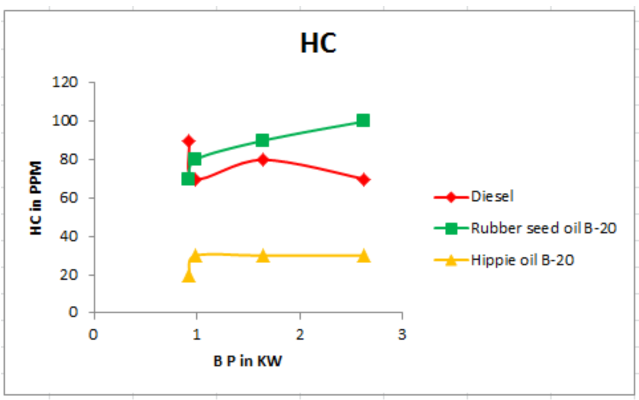

Fig – 6.

Variations of HC at Different BP

h) Smoke

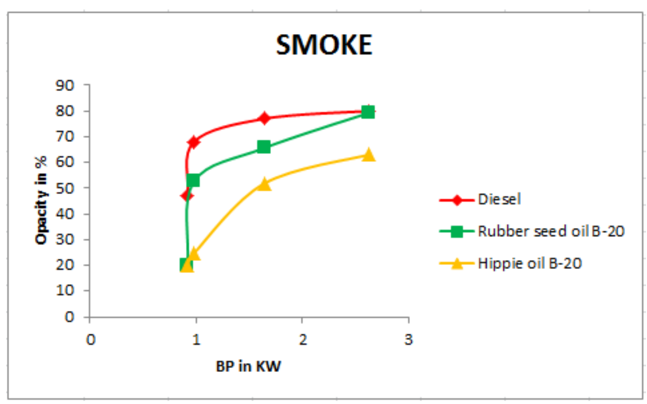

Fig – 7. Variations of Opacity at Different BP

II. CONCLUSION AND FUTURE SCOPE

It has been determined that bio fuel oil is a viable alternative fuel, with performance and emissions characteristics that are more similar to diesel. Based on the data shown above, it is clear that biofuel outperforms diesel in terms of key performance indicators such brake thermal efficiency and specific fuel consumption, as well as in terms of emission parameters like smoke, HC, and CO.This means that diesel can be replaced by bio fuel.

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