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Performance Analysis of CI engine Fueled with Biodiesel/Bio Diesel Blend

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ABSTRACT

An experimental work has been carried out for evaluation of bio-diesel made from vegetable oil of mustardl. To evaluate the bio-diesel seven blends of diesel are prepared with different quantity of afore said bio-diesel and test in a single cylinder CI diesel engine. The engine runs at a constant speed of 1500 RPM. The performance of engine was examined for specific fuel consumption, total fuel consumption and break thermal efficiency. The study found that no difficulty was observed when engine run on the blended fuel. The study No difficulty observed while operating the engine with blends. Efficiency and bsfc increased with the increase in biodiesel upto 25%. Efficiency and bsfc reduced after 25% biodiesel is used. Efficiency and bsfc are maximum i.e. 15.46 & 0.5372 kg/Kwh

INTRODUCTION

In modern industrial civilization the fossil fuels namely oil, coal and natural gases are the primary energy sources. The global consumption of aforesaid wealth was over 9 billion tons of crude oil in 2005, as reported in publication [1]. Also, according to the International Energy Outlook published by the U.S Energy Information Administration of 2011 shows that the world use of liquid fuels will increase from 85.7 million barrels per day (2008) to 112.2 million barrels per day in 2035 [2]. However, the dependency on fossil fuels is not sustainable as fossil fuels are finite, non-renewable and in the case of oil, these resources of oil are rapidly approaching at a point from where we cannot recover these from ground as fast as consumption. The most promising alternates available for compression ignition engines are biodiesels which are essentially fatty acids of vegetable or non-edible oils. Other alternates include compressed natural gas, E-Diesel (Ethanol based), Biomass to Liquid (BTL) [3]. Bio-Diesel can also be extracted from various sources of oils ranging from edible sources such as palm oil, vegetable oil, rapeseed, rice bran oil to non-edible sources i.e. Jatropha, Pongamia, Karanjia seeds etc [4]. Bio-diesel consists of no petroleum products and it can be used in 100% pure form or blended with petroleum diesel. Bio-diesel can be used in compression ignition engine directly with/without any engine modifications because bio-diesel has properties alike to petro-diesel fuels. Biodiesel has almost no sulphur so it is said to be clean fuel, has 10% building oxygen with no aromatics, which helps it to burn fully. Ignition quality blended bio-diesel is better compared with pure diesel due to its higher cetane number. There have been various studies conducted using biodiesel fuels. Palash, S.M. et al. (2013) studied the performance and emissions of a multi-cylinder diesel engine with Jatropha biodiesel blends as fuel and N-dipheny1, 4-phenylenediamine (DPPD) antioxidant as an additive. They found that the additive of DPPD reduces the NOx level and the exhaust gas temperature significantly [5]. Varatharajan (2012) in another work used additives such as DPPD, NPPD, p-phenylenediamine (PPD), ethylenediamine (EDA), a-Tocopherol acetate, BHT and L-ascorbic acid with two combinations of biodiesel 20% and 100% and found that the optimum concentration of DPPD is 0.15%(m). [6]. Varatharajan et al. (2013) performed an experimental study on a single cylinder diesel engine with soybean biodiesel mixed with DPPD and N-phenyl-1, 4-

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phenylenediamine (NPPD) additives. They found NOx reduction by 9.35% and 28.36% for 20% and 100% respectively [7]. Many more researchers have worked this area [8-12]. In present experimental work an attempt has been made to compare the performance of CI diesel engine run with different blend of bio-diesel of Mustard oil. The objective of this study is to find best suitable blend in terms of specific fuel consumption, total fuel consumption and break thermal efficiency.

EXPERIMENTAL SETUP

Present Study is conducted on a single cylinder 4 stroke, C.I. engine test rig. The engine has a capacity of 425cc with 7.5 BHP at 1500 RPM. A dynamo meter (eddy current) was coupled to the engine to apply the load on the engine for loading the engine. Schematic diagram and photograph of foresaid setup is shown in Figure 1.

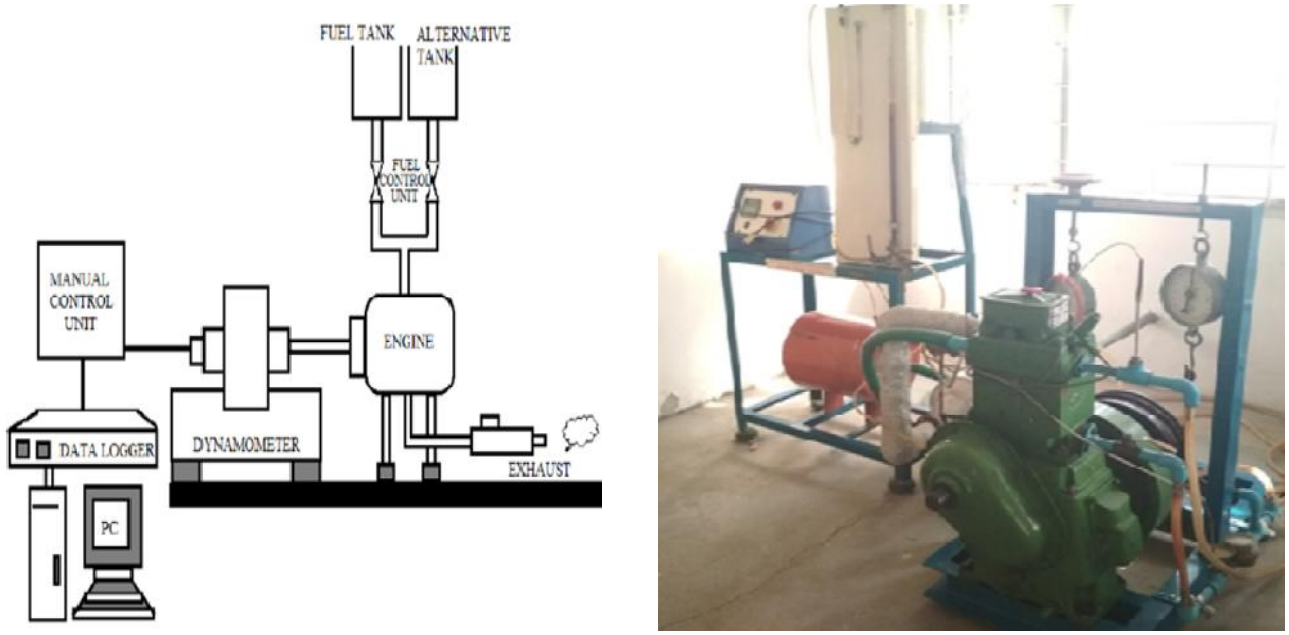

Fig 1: Test Rig Setup

Present experimental study was carried out to examine the performance of a stationary single cylinder CI engine run on vegetable oil (mustard) and the blends with diesel. Seven blends as B1, B2, B3, B4, B5, B6 and B7 were prepared by mixing vegetable oil in ratios 3:97, 5:95, 10:90, 15:85, 20:80, 25:75 and 30:70 by volume respectively. The engine was operated on vegetable oil blends. In order to evaluate the performance of oil blends and pure diesel fuel, following parameters were recorded: (i) Total fuel consumption (TFC), (ii) Specific fuel consumption (SFC), and (iii) Brake thermal efficiency (BTE). The engine was tested under six different concentrations (3, 6, 10, 15, 20, 25 and 30 ml) at a constant rotating speed of 1500 rpm, for each blending percentage of bio-diesel. Thereafter, time taken for 10cc of fuel consumption was noted for each concentration. All the blends are examined through the same procedure in the study.

RESULT AND DISCUSSION

Following test related to Biodiesel (Mustard oil) on the compression ignition diesel engine are performed. There are some readings obtained from that particular experiment, given below in Table 1.

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TABLE 1: experimental analysis of biodiesel for different blends

	BL1	BL2	BL3	BL4	BL5	BL6	BL7
S No.	1	2	3	4	5	6	7
t_1(sec)	4:10	4:28	4:84	4:54	4:58	4:59	5:10
T_1(degree)	25^0c	25^0c	25^0c	25^0c	25^0c	25^0c	25^0c
T_2	70^0c	65^0c	50^0c	45^0c	48^0c	46^0c	47^0c
T_3	175^0c	176^0c	194^0c	173^0c	195^0c	185^0c	191^0c
T_4	80^0c	83^0c	100^0c	83^0c	101^0c	96^0c	102^0c
T_5	25^0c	25^0c	25^0c	25^0c	25^0c	25^0c	25^0c
T_6	52^0c	53^0c	58^0c	60^0c	62^0c	61^0c	64^0c
Tc	1:18	1:14	1:12	1:13	1:18	1:12	1:12
t_E	1:05	1:06	1:08	1:10	1:10	1:08	1:08

(BL- Blend)

The results of the experiments are shown in table 2. It can be analyzed by the results that the blend 5 (B5 25:75) shows maximum thermal efficiency and BSFC i.e. 15.46 and 0.5372 kg/kw-hr

TABLE 2: Results for Thermal efficiency and BSFC

S.No.	**1**	**2**	**3**	**4**	**5**	**6**
n_{bt} (%)	12.88	13.81	14.90	15.23	15.46	15.39
BSFC (kg/kw-hr)	0.6422	0.5991	0.5552	0.5432	0.5372	0.5393

The effect of different blends on the other characteristics of engine outputs like fuel consumption, temperature and volume and temperature curves are shown in figure 2, figure 3 and figure 4 respectively.

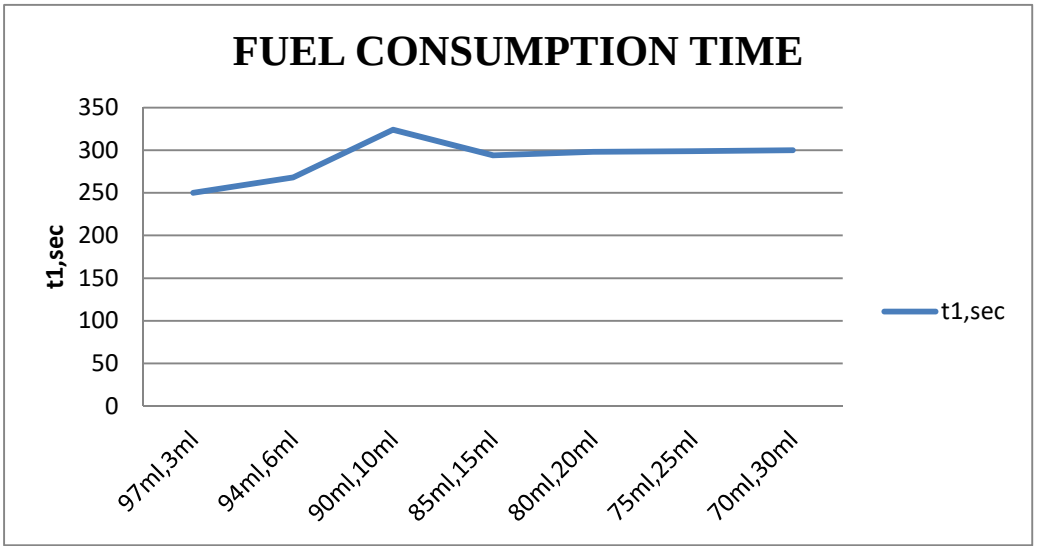

Fig 2: **Graph shows the time consumption in different parameter.**

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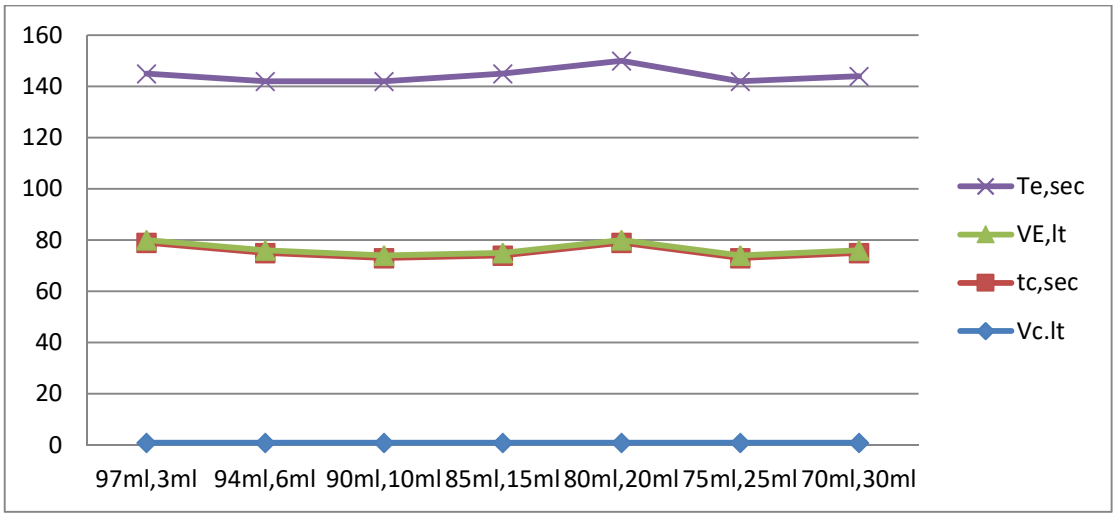

Fig 3: Temp. & Volume graph

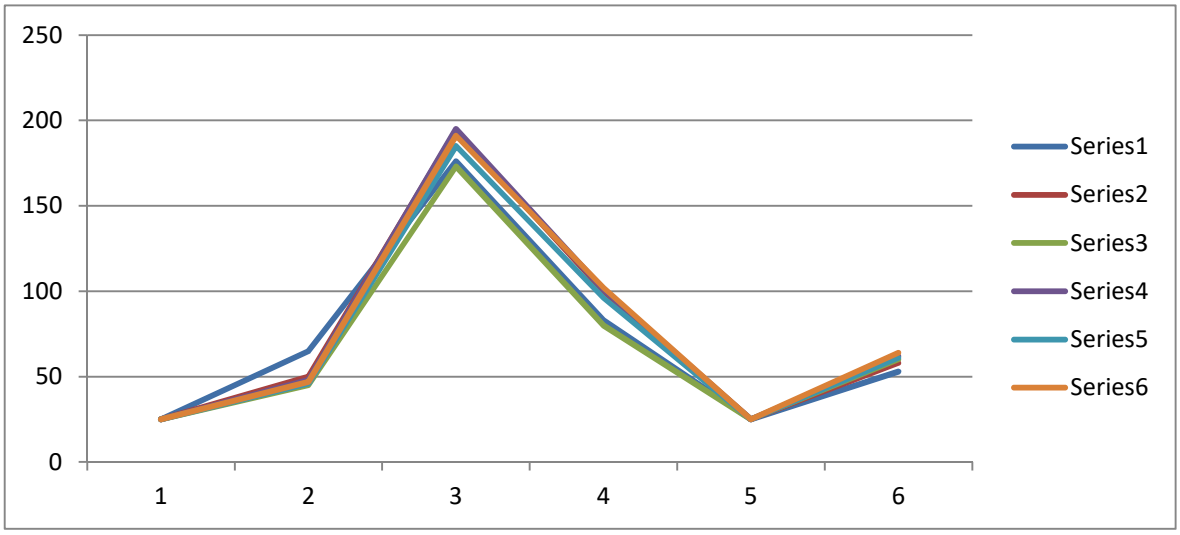

Fig 4: Temp. Curve

CONCLUSION

In the current experimental work that the quality of biodiesel made from edible and non edible oils are comparable with petroleum diesel. The specific gravity of methyl ester vegetable oil is also greater than that of diesel oil. The calorific values of these methyl ester oils is also little bit lower than the diesel oils. But the properties of these methyl ester oils are within the specifications of biodiesels. There are some following conclusions are abstract from the experimental study:

- No difficulty observed while operating the engine with blends.
- Efficiency and bsfc increased with the increase in biodiesel upto 25%.
- Efficiency and bsfc reduced after 25% biodiesel is used
- Efficiency and bsfc are maximum i.e. 15.46 & 0.5372 kg/Kwh.

REFERENCE

[1] B, Khiraiya Krunal Oza, Nityam P, "Review of recent research on palm oil biodiesel as fuel for CI Engine", Int. J. Appl. Res. Stud. 2(1), (2013)1–4.

[2] Coniglio, L. Bennadji, H.Glaude, P.A.Herbinet, O. Billaud, F., "Combustion chemical kinetics of biodiesel and related compounds (methyl and ethyl esters): advances and future refinements", Progr. Energy Combust. 39 (4) (2013) 340–382.
[3] Venu, Harish, Madhavan, Venkataramanan, "Effect of diethyl ether and Al2O3 nano additives in diesel-biodiesel-ethanol blends: Performance, combustion and emission characteristics" Journal of Mechanical Science and Technology, 2017, 31-1, 409-420.
[4] V. Ganesan, Internal Combustion Engines, Tata McGraw-Hill publishing, India, 2006.
[5] S.M. Palash, H.H. Masjuki, M.A. Kalam, B.M. Masum, A. Sanjid, M.J. Abedin, "Impacts of NOx reducing antioxidant additive on performance and emissions of a multi-cylinder diesel engine fuelled with Jatropha biodiesel blends", Energy Convers Manage, 76 (2013) 400–420.
[6] K. Varatharajan, "Effect of antioxidant additives on NOx emissions from a Jatropha biodiesel fuelled Di diesel engine", 2012.
[7] K. Varatharajan, M. Cheralathan," Effect of aromatic amine antioxidants on NOx emissions from a soybean biodiesel powered DI diesel engine", Fuel Process Technol. 106 (2013) 526–532.
[8] Sivalakshmi, S.Lenin, V.R. Hari Prakash, C., "Investigation on the combustion, performance and emissions of a diesel engine fuelled by biodiesel and its blends with different oxygenated organic compounds" 37-5 (2016) 513-519.
[9] Krishnamoorthi, M. Natarajan, A., "Performance and Emission Characteristics of a CI Engine Fueled With Diesel-Waste Fried Oil Blend with Dee as Additive" 3-5 (2015) 65-72.
[10] S. Mohankumar, P. Senthilkumar, "Particulate matter formation and its control methodologies for diesel engine: A comprehensive review". 80 (2017) 1227-1238.
[11] Meisam Ahmadi Ghadikolaei, "Effect of alcohol blend and fumigation on regulated and unregulated emissions of IC engines—A review". 57 (2016) 1440-1495.
[12] Sivalakshmi, S.Balusamy, T. "Effect of biodiesel and its blends with diethyl ether on the combustion, performance and emissions from a diesel engine" Fuel, 106 (2013) 106-110.
[6] S.M. Palash, M.A. Kalam, H.H. Masjuki, B.M. Masum, I.M. Rizwanul Fattah, M. Mofijur, "Impacts of biodiesel combustion on NOx emissions and their reduction approaches", Renew Sust Energy Rev, 23 (2013) 473–490.
[7] S.M. Palash, H.H. Masjuki, M.A. Kalam, B.M. Masum, A. Sanjid, M.J. Abedin, State of the art of NOx mitigation technologies and their effect on the performance and emission characteristics of biodiesel-fueled compression ignition engines, Energy Convers Manage 76 (2013) 400–420.
[8] A. Demirbas, Progress and recent trends in biodiesel fuels, Energy Convers Manage 50 (2009) 14–34.
[9] A.N. Ozsezen, M. Canakci, The emission analysis of an IDI diesel engine fuelled with methyl ester of waste frying palm oil and its blends, Biomass Bioenergy 34 (2010) 1870–1878.
[10] S. Sivalakshmi, T. Balusamy, Effect of biodiesel and its blends with diethyl ether on the combustion, performance and emissions from a diesel engine, Fuel (2012).
[11] A.N. Ozsezen, M. Canakci, Determination of performance and combustion characteristics of a diesel engine fueled with canola and waste palm oil methyl esters, Energy Convers Manage 52 (2011) 108–116. [13] E. Ileri, G. Koc¸ ar, Effects of antioxidant additives on engine performance and exhaust emissions of a diesel engine fueled with canola oil methyl ester–diesel blend, Energy Convers Manage 76 (2013) 145–154. [14] K. Varatharajan, M. Cheralathan, R. Velraj, Mitigation of NOx emissions from a jatropha biodiesel fuelled DI diesel engine using antioxidant additives, Fuel 90 (2011) 2721–2725.
[15] R.L. McCormick, A. Williams, J. Ireland, M. Brimhall, R.R. Hayes, Effects of biodiesel blends on vehicle emissions. Milestone report National Renewable Energy Laboratory (NREL), 2006.
[16] C.J. Mueller, A.L. Boehman, G.C. Martin, An experimental investigation of the origin of increased NOx emissions when fueling a heavy-duty compression–ignition engine with soy biodiesel, SAE paper, 2009, pp. 01–1792.
[17] G.A. Ban-Weiss, J.Y. Chen, B.A. Buchholz, R.W. Dibble, A numerical investigation into the anomalous slight NOx increase when burning biodiesel: a new (old) theory, Fuel Process Technol 88 (2007) 659–667.
[18] R.L. McCormick, A. Williams, J. Ireland, M. Brimhall, R.R. Hayes, Effects of biodiesel blends on vehicle emissions, US National Renewable Energy Laboratory (NREL), 2006.
[20] Amir Khalid, Performance and Emissions Characteristics of Diesel Engine Fuelled by Biodiesel Derived from Palm Oil, in: International Conference on Mechanical & Manufacturing Engineering (ICME2012), vol. 68, 2013, pp. 225–230. [21] V.I.E. Ajiwe, Biodiesel fuels from palm oil, palm oil methylester and ester–diesel blends, Bull. Chem. Soc. Ethiop. 17 (1) (2003) 19–26.