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Research Paper

PERFORMANCE TEST ON DIESEL ENGINE USING ALTERNATIVE FUELS LIKE B5 AND B10

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Alternative fuels, known as non-conventional or advanced fuels, are any materials or substances that can be used as fuels, other than conventional fuels. Conventional fuels include: fossil fuels (petroleum (oil), coal, propane, and natural gas), as well as nuclear materials such as uranium and thorium, as well as artificial radioisotope fuels that are made in nuclear reactors, and store their energy. Some well-known alternative fuels include biodiesel, bio alcohol (methanol, ethanol, and butanol). Biodiesel is a safe alternative fuel to replace traditional petroleum diesel. It has high-lubricity, is a clean-burning fuel and can be a fuel component for use in existing, unmodified diesel engines. Biodiesel acts like petroleum diesel, but produces less air pollution, comes from renewable sources, is biodegradable and is safer for the environment. Producing biodiesel fuels can help create local economic revitalization and local environmental benefits. Biodiesel fuel is made from oils or fats, which are both hydrocarbons, most commonly soybean oil. These hydrocarbons are filtered, and then mixed with an alcohol, which is usually methanol, and a catalyst (sodium or potassium hydroxide). Alcohol has been used as a fuel throughout history. The first four aliphatic alcohols (methanol, ethanol, propane, and butane) are of interest as fuels because they can be synthesized chemically or biologically, and they have characteristics which allow them to be used in current engines. One advantage shared by all four alcohols is their high octane rating. The process of preparing the biodiesel from soya beans and ethanol in different composition like B5 (5% of soybean or ethanol +95% of diesel) and B10 (10% of soya bean or ethanol +95% of diesel) The final product is a petrochemical fuel that will burn in most diesel engines with no modification Biodiesel is environmentally friendly. It can help reduce dependency on foreign oil. It helps to lubricate the engine itself, decreasing engine wear. The volumetric efficiency, specific fuel consumption, heat carried by exhaust emissions and brake power of biodiesel is better than pure diesel. Of all samples blend B10 of soya bean is most desirable.

Keywords: Alternative fuels, Biodiesel, B5, B10 samples

BIOMASS

Biomass is the oldest form of renewable energy, has been used for thousands of years. However, its relative share has declined with the emergency of fossil fuels. Currently some 13% of the world's primary energy supply is

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covered by biomass, but there is a strong regional difference: developed countries source around 3% of their energy needs of biomass, while Africa's share ranges from 70-90%.

With environmental effects such as climate change coming to the forefront, people everywhere are rediscovering the advantages of biomass. Potential benefits include:

- Reducing carbon emissions if managed (produced, transported, used) in a sustainable manner;
- Enhancing energy security by diversifying energy sources and utilizing local sources;
- Providing additional revenues for the agricultural and forestry sectors.

LITERATURE SURVEY

Biodiesel is a safe alternative fuel to replace traditional petroleum diesel. It has high-lubricity, is a clean-burning fuel and can be a fuel component for use in existing, unmodified diesel engines. This means that no retrofits are necessary when using biodiesel fuel in any diesel powered combustion engine. It is the only alternative fuel that offers such convenience. Biodiesel acts like petroleum diesel, but produces less air pollution, comes from renewable sources, is biodegradable and is safer for the environment. Producing biodiesel fuels can help create local economic revitalization and local environmental benefits. Many groups interested in promoting the use of biodiesel already exist at the local, state and national level.

Biodiesel is designed for complete compatibility with petroleum diesel and can be blended in any ratio, from additive levels to 100% biodiesel. In the United States today, biodiesel is typically produced from soybean or rapeseed oil or can be reprocessed from waste cooking oils or animal fats such as waste fish oil. Because it is made of these easily obtainable plant-based materials, it is a completely renewable fuel source.

History of Bio Diesel

Use of Bio diesel in Diesel engines is not a new concept but century old. In fact Rudolf Diesel, the inventor of the Diesel Engine just used Peanut oil in his engine as early as1901. But later on the cheap availability of petroleum diesel completely replaced the use of vegetable oil. Today, since the availability is becoming scarce, it will be wise to go back to the traditional natural fuels like vegetable oil.

Day-by-day the diesel oil is becoming costlier and dearer and within a few years it may not be available at all. Even now its availability is influenced by various extraneous factors like political situations, wars, terrorist activities, etc. The worst affected are the developing countries like India, who do not have adequate resources of Petroleum products.

To-day we import 70% of our crude oil and in the coming years the requirement will increase greatly. Of all the petroleum products diesel oil is the maximum consumed oil constituting more than 40%. Diesel run vehicles are the backbone of Indian Economy and with the ever-increasing price of it our economy is severely strained. Further the everincreasing use of Diesel oil is polluting the atmosphere greatly affecting the health of the people and also changing the climatic conditions of the whole world.

Hence it is high time the world develops an alternate fuel devoid of all the above problems. Bio diesel fits the slot perfectly to replace Petroleum diesel. Bio diesel is nothing but processed vegetable oil or animal fats. The vegetable oil can be either edible or non-edible. Also used as cooking oil or fresh vegetable oil.

PRODUCTION METHODS

There are three basic routes to bio diesel production from biolipids (biological oil and fats):

- Base Catalyzed Trans- Etherification of the bio-lipid.
- Direct Acid Catalyzed Trans-Etherification of the bio lipid.
- Conversion of the bio lipid to its Fatty Acids and then to bio diesel.

Almost all bio diesel is produced using case catalyzed Trans-Etherification, as it is the most economical process requiring only low temperatures and pressures and producing in 98% conversion yield. For this reason only this process will be used mainly.

OIL PREPARATION

Bio diesel processor machines need the vegetable oil to have some specific properties:

- Suspended particles lower than 1% (mass/ mass) and than 5 micrometers because of this, the following are necessary:
  - Filtration to 5 micrometers.
  - Washing with hot water.
  - Decantation.
  - Heating of the oil.
  - Second decantation.
- Anhydrous (waterless) because of this, the final step of preparation, after the second decantation is drying.
- Easy solubility in the alcohol to use.

SOYABEAN HISTORY OF THE PLANT

Soybeans were a crucial crop in eastern Asia long before written records; They remain a major crop in China, Japan, and Korea. Prior to fermented products such as soy sauce, tempeh, natto, and miso, soy was considered sacred for its use in crop rotation as a method of fixing nitrogen. The plants would be plowed under to clear the field for food crops. Soy was first introduced to Europe in the early 18th century and to British colonies in North America in 1765, where it was first grown for hay. Franklin wrote a letter in 1770 mentioning sending soybeans home from England. Soybeans did not become an important crop outside of Asia until about 1910. In America, soy was considered an industrial product only, and was not used as a food prior to the 1920s. Soy was introduced to Africa from China in the late 19th century, and is now widespread across the continent.

ETHANOL FUEL

Ethanol (ethyl alcohol), the same type of alcohol found in alcoholic beverages. It is most often used as a motor fuel, mainly as a bio fuel additive for gasoline. World ethanol production for transport fuel tripled between 2000 and 2007 from 17 billion to more than 52 billion liters. From 2007 to 2008, the share of ethanol in global gasoline type fuel use increased from 3.7% to 5.4%. In 2011 worldwide ethanol fuel production reached 22.36 billion US liquid gallons (bg) (84.6 billion liters), with the United States as the top producer with 13.9 bg (52.6 billion liters), accounting for 62.2% of global production, followed by Brazil with 5.6 bg (21.1 billion liters). Ethanol fuel has a "gasoline gallon equivalency" (GGE) value of 1.5 US gallons (5.7 L).

The Test Samples are

- Pure Diesel
- B5 (5% Soya bean Oil and 95% Pure Diesel)
- B10 (10% Soya bean Oil and 90% Pure Diesel)
- B5 (5% Ethanol Oil and 95% Pure Diesel)
- B10 (10% Ethanol and 90% Pure Diesel)

Testing Procedure

The testing procedure is carried by mixing the specimen samples with diesel in calculated proportions. The mixture of specimen sample and diesel is used in single cylinder diesel engine and several tests are conducted under controlled atmospheric conditions.

Figure 1: Single Cylinder Diesel Engine

Step 1: Take bio diesel blend say ethanol B05, the composition contains 50 ml of ethanol and 950 ml of diesel, as ethanol is very dangerous proper atmospheric condition are to be maintain, water is used as the cooling agent in the experiment when the fuel is added to engine and cranking is done. Calculated proportions are taken and constant atmospheric conditions are maintained.

Step 2: Load to be added to engine to engine and increased simultaneously with the help of the load gauge and the mean difference of the two gauges are calculated to fine the exact torque applied on engine. Loads are added in ascending order of 2 kgs, 4 kgs, 6 kgs, and 8 kgs with help of ropes tight around the crank wheel placed parallel to the engine piston moment. The adding of load the rpm of the engine will be changing simultaneously that will be calculated with help of tachometer all this testing will give the performance of the fuel used in the engine and will be used in calculating to find the brake power and mechanical efficiency of the engine with using different types of test specimens.

Figure 2: Load Applied on Engine

Adding of load can be seen in the below figure. The ropes are tight around the crank wheel and the load can be increased by tighten of rope with the help of screws above the load measuring gauge. These loads will help us calculating the effort on engine and the change in rpm The rpm of engine is calculated using tachometer and there are noted without any error. Four dings of rpm are taken for four different loads of 2 kgs, 4 kgs, 6 kgs, and 8 kgs.

Step 3: The temperature rise in the engine will noted with help of thermo couples placed inside the engine and the time taken for consumption of 10 ml of fuel will be calculated with help of stop watch.

The reading for the gauge and temperature indicators are tabulated, with help of these readings the work done by the engine is calculated and the to test the fuels efficiency is calculated with help calculating the following:

- Volumetric efficiency
- Brake power
- Specific fuel consumption
- Torque
- Heat carried by exhaust gases

Different graphs are plotted to find the effectiveness of specimen fuel and there consistency on the engine working.

Figure 3: Tachometer Reading

Experiments conducted are:

- Performance Analysis
- Heat Balance Sheet

SAMPLE Calculations

Pure Diesel

Brake specific fuel consumption

Under no load condition

Load W_1 = 0 kg

Load W_2 = 0 kg

Net load on engine (W) = $W_1 - W_2 = 0$

Speed (N) = 789 rpm

Time taken for consumption of 10 cc of fuel (t) = 73 sec.

Brake Power (BP) = (2 × ® × N × T/60000) kW

Where T = Torque = 9.81×W×R

(R = Effective Radius of brake drum diameters = 0.19 m)

Therefore T = 9.81 × 0 × 0.19 = 0 Nm

Hence, BP = 0 kW

Total fuel consumed = (10 × 3600 × Sp. Gravity Kg/hr) x (t × 1000)

= (10 × 3600 × 0.8275 Kg/hr) x (73 × 1000) (Sp.Gravity of diesel = 0.8275)

= 0.408 Kg/hr

Brake specific fuel consumption = T.F.C/B.P

Volumetric Efficiency

m_a = mass flow rate of air (Kg/s)

C_d = Coefficient of discharge = 0.65

a = area of orifice = ®/4 × d^2 = ®/4 × $(15 \times 10^{-3})^2$

= 1.744×10^{-4} m^2

$^\circ_a$ = Density of air = 1.2 Kg/m^3

C_a = Velocity of air

$°_w = 1000$ Kg/m^3

Δh_w = Water head difference = $h_2 - h_1$

D = Diameter of cylinder bore = 80 mm

L = Stroke length = 110 mm

A = Cross sectional area of cylinder

$C_a = \surd(2 \times 9.81 \times °_w \times \Delta h_w / °_a)$

$= \surd(2 \times 9.81 \times 1000 \times (8.2 - 5.3) \times 10^{-2}/1.2)$

= 21.77 m/s

$m_a = C_d \times a \times °_a \times C_a$

$= 0.65 \times 1.744 \times 10^{-4} \times 1.2 \times 21.77$

$= 5.33 \times 10^{-3}$ Kg/s

Volumetric efficiency ($¦_v$) = $m_a/[°_a \times V_{dsp} \times N/2 \text{ x } 60]$

$V_{dsp} = (®/4 \times D^2 \times L) = 3.141 \times 80^2 \times 110 \times 10^{-9} = 0.0005$ m

Under no load condition $N = 789$

Volumetric efficiency ($¦_v$)

$= 5.33 \times 10^{-3}/[1.2 \times 0.0005 \times 789/60] \times 100\%$

= 69.07 %

Heat Carried by Exhaust Gas

m_w = Mass flow rate of water (Kg/s)

m_f = Mass of fuel consumed per second (Kg/s)

m_a = Mass flow rate of air (Kg/s)

C_{pw} = Specific heat of water = 4.18 KJ/Kg-K

C_{pa} = Specific heat of air = 1.005 KJ/Kg-K

C_v = Caloric value of fuel = 43626 KJ/Kg

$°_w$ = Density of water = 1000 Kg/m^3

T_1 = Room temperature (°C)

T_3 = Outlet cooling water temperature (°C)

T_5 = Exhaust temperature outlet (°C)

T_6 = Exhaust temperatire inlet (deg celcius)

Calculation of mass flow rate of water

Volume of the water collecting tank = $0.25 \times 0.25 \times 0.06$

$= 3.75 \times 10^{-3}$ m^3

Therefore $m_w = (3.75 \times 10^{-3} \times 1000/30) = 0.13$ Kg/s

m_f = fuel consumption in kg/min

= (fuel consumed in ml x density of diesel x 60)/(1000 x time taken in sec)

= 10 x 0.8275 x 60/1000 x 49

= 0.0104 kg/min

Heat lost in exhaust gases

$= (m_f + m_a) \times C_{pa} \times (T_5 - T_6)$

$= (10.4 \times 10^{-3} + 5.33 \times 10^{-3}) \times 1.005 \times (365-40)$

= 5.137 kj

B05 (5% SOYABEAN + 95% Pure Diesel)

Calculation of Calorific value of B5

Calorific value of Soyabean oil = 39000 KJ/Kg

Calorific value of diesel = 44800 KJ/Kg

By principle of allegations,

Calorific value of B20 = $(0.05 \times 39000) + (0.95 \times 44800)$

= 44510 KJ/Kg

Calculation of density of B05

Density of Soya bean oil = 0.916 g/cm^3

Density of diesel = 0.8275 g/cm^3

By principle of allegations,

Density of B20 = (0.05 × 0.916) + (0.95 × 0.8275)

= 1.24412 g/cm^3

Brake Specific fuel Consumption

Under no load condition

Load W_1 = 0 kg

Load W_2 = 0 kg

Net load on engine (W) = $W_1 – W_2$ = 0

Speed (N) = 790 rpm

Time taken for consumption of 10 cc of fuel (t) = 73 seconds.

Brake Ppower (BP) = 2 × ® × N × TkW/ 60000

Where T = Torque = 9.81 × W × R

(R = Effective Radius of brake drum diameters = 0.19 m)

Therefore T = 9.81 × 0 × 0.19 = 0 Nm

Hence, BP = 0 kW

Fuel consumed = 10 × 3600 × Sp. Gravity Kg/hr/t × 1000

= (10 × 3600 × 1.2441 Kg/hr)/(72 × 1000) = 0.422 Kg/hr

(Sp. Gravity of B05 = 1.2441)

Volumetric Efficiency

m_a = mass flow rate of air (Kg/s)

C_d = Coefficient of discharge = 0.65

a = cross sectional area of orifice = ®/4 × d^2

= ®/4 × (15 × 10^{-3})^2 = 1.744 × 10^{-4} m^2

°$_a$ = Density of air = 1.2 Kg/m^3

C_a = velocity of air

°$_w$ = 1000 Kg/m^3

Δ_{hw} = water head difference = h_2 - h_1

D = Diameter of cylinder bore = 80 mm

L = Stroke length = 110 mm

A = Cross sectional area of cylinder

C_a = √(2 × 9.81 × °$_w$ × Δ_{hw} /°$_a$)

= √(2 × 9.81 × 1000 × (8.2 – 5.3) × 10^{-2}/1.2)

= 21.77 m/s

m_a = C_d × a × °$_a$ × C_a

= 0.65 × 3.141 × 10^{-4} × 1.2 × 21.77

= 5.33 × 10^{-3} Kg/s

Vol efficiency (¦$_v$) = m_a/[°$_a$ × V_{dsp} × N]/2 × 60

V_{dsp} = (®/4 × D^2 × L) = 3.14/4 × 80^2 × 110 × 10^{-9} = 0.0005 m^2

Under No Load Condition

N = 784

Vol efficiency (¦$_v$) = 5.33 × 10^{-3}/[1.2 × 0.0005 × 784/60] ×100%

= 68 %

Heat Carried by Exhaust Gases

m_w = Mass flow rate of water (Kg/s)

m_f = Mass of fuel consumed per second (Kg/s)

m_a = Mass flow rate of air (Kg/s)

C_{pw} = Specific heat of water = 4.18 KJ/Kg-K

C_{pa} = Specific heat of air = 1.005 KJ/Kg-K

C_v = Caloric value of fuel = 44510 KJ/Kg

$°_w$ = Density of water = 1000 Kg/m^3

T_1 = Room temperature (°C)

T_3 = Outlet cooling water temperature (°C)

T_5 = Exhaust temperature outlet (°C)

T_6 = Exhaust temperatire inlet (deg celcius)

Calculation of Mass Flow Rate of Water

Volume of the water collecting tank = 0.25 × 0.25 × 0.06

= 3.75 × 10^{-3} m^3

Therefore m_w = 3.75 × 10^{-3} × 1000/30 = 0.13 Kg/s

m_f = fuel consumption in kg/min

= fuel consumed in ml x density of diesel x 60/(1000 x time taken in sec)

= (10 x 1.24412) x 60/(1000 x 50)

= 0.0149 kg/ min

Heat Lost in Exhaust Gases

$= (m_f + m_a) \times C_{pa} \times (T_5 - T_6)$

$= (14.9 \times 10^{-3} + 5.33 \times 10^{-3}) \times 1.005 \times (365-40)$

= 5.631 kj

Similar calculations are done for the other readings obtained at different loads.

RESULTS

Table 1: Pure Diesel

Speed (rpm)	Load kg	Vol. of Fuel in cc	Time t in sec	h_1 cm	h_2 cm	$h = h_1 - h_2$ cm	Torque Nm	Total Fuel Consumed kg/hr	Specific Gravity	B.P (Kw)	BSFC kg/ kwhr	Vol. Efficiency y (%)
780	2	10	49	5.3	8.2	2.9	1.9	0.6	0.8	0.3	2	77
773	4	10	42	5.3	8.2	2.9	3.7	0.7	0.8	0.6	1.2	77
771	6	10	38	5.3	8.2	2.9	11	0.8	0.8	0.9	0.9	78
765	8	10	30	5.3	8.2	2.9	15	1	0.8	1.2	0.8	78

Table 2: B05 Soya Bean

Speed (rpm)	Load kg	Vol. of Fuel in cc	Time t in sec	h_1 cm	h_2 cm	$h = h_1 - h_2$ cm	Torque Nm	Total Fuel Consumed kg/hr	Specific Gravity	B.P (Kw)	BSFC kg/ kwhr	Vol. Efficiency y (%)
769	2	10	50	5.3	8.2	2.9	1.86	0.9	1.24	0.3	2.97	77.8
750	4	10	43	5.3	8.2	2.9	3.73	1.04	1.24	0.59	1.77	79.7
745	6	10	34	5.3	8.2	2.9	11.2	1.31	1.24	0.87	1.5	80.3
743	8	10	28	5.3	8.2	2.9	14.9	1.6	1.24	1.16	1.38	80.5

Table 3: Soyabean (B10)

Speed (rpm)	Load kg	Vol. of Fuel in cc	Time t in sec	h_1 cm	h_2 cm	$h = h_1 - h_2$ cm	Torque Nm	Total Fuel Consumed kg/hr	Specific Gravity	B.P (Kw)	BSFC kg/ kwhr	Vol. Efficiency y (%)
780	2	10	57	5	8	3	1.86	0.55	0.84	0.3	1.8	77
773	4	10	48	5	8	3	3.73	0.65	0.84	0.6	1.1	78
771	6	10	39	5	8	3	11.2	0.8	0.84	0.9	0.9	78
765	8	10	29	5	8	3	14.9	1.07	0.84	1.2	0.7	79

Table 4: Ethanol (B05)

Speed (rpm)	Load kg	Vol. of Fuel in cc	Time t in sec	h_1 cm	h_2 cm	$h = h_1 - h_2$ cm	Torque Nm	Total Fuel Consumed kg/hr	Specific Gravity	B.P (Kw)	BSFC kg/ kwhr	Vol. Efficiency y (%)
780	2	10	55	5.3	8.2	2.9	1.9	0.5	0.8	0.3	1.8	76.96
773	4	10	46	5.3	8.2	2.9	3.7	0.6	0.8	0.6	1.1	77.76
771	6	10	37	5.3	8.2	2.9	11	0.8	0.8	0.9	0.9	78.68
765	8	10	33	5.3	8.2	2.9	15	0.9	0.8	1.2	0.8	79.41

Table 5: Ethanol (B10)

Speed (rpm)	Load kg	Vol. of Fuel in cc	Time t in sec	h_1 cm	h_2 cm	$h = h_1 - h_2$ cm	Torque Nm	Total Fuel Consumed kg/hr	Specific Gravity	B.P (Kw)	BSFC kg/ kwhr	Vol. Efficiency y (%)
780	2	10	51	5.3	8.2	2.9	1.8639	0.59	0.8365	0.302	1.953	77.16
773	4	10	41	5.3	8.2	2.9	3.7278	0.734	0.8365	0.597	1.229	78.16
771	6	10	34	5.3	8.2	2.9	11.183	0.885	0.8365	0.878	1.007	79.73
765	8	10	28	5.3	8.2	2.9	14.911	1.075	0.8365	1.124	0.956	83.05

Heat Carried by Exhaust Gases

Table 6: Heat Carried by Exhaust Gases—Pure Diesel

Load in kg	Mass of Fuel Consumed (m_f) in kg/s	Mass of Air Consumed (m_a) in kg/s	Exhaust Gas Temp Difference ($T_5 - T_6$) in °C	C_p of Air Kj/Kg- K	Heat Carried by Exhaust Gases in kj
2	$10.4*10^{-3}$	$5.33*10^{-3}$	325	1.005	5.137
4	$12.1*10^{-3}$	$5.33*10^{-3}$	396	1.005	6.936
6	$13.4*10^{-3}$	$5.33*10^{-3}$	487	1.005	9.167
8	$17*10^{-3}$	$5.33*10^{-3}$	595	1.005	13.352

Table 7: Heat Carried by Exhaust Gases—B5 of Soya Bean

Load in kg	Mass of Fuel Consumed (m_f) in kg/s	Mass of Air Consumed (m_a) in kg/s	Exhaust Gas Temp Difference ($T_5 - T_6$) in °C	C_p of Air Kj/Kg- K	Heat Carried by Exhaust Gases in kj
2	$14.9*10^{-3}$	$5.33*10^{-3}$	277	1.005	5.631
4	$17.3*10^{-3}$	$5.33*10^{-3}$	328	1.005	7.459
6	$21.9*10^{-3}$	$5.33*10^{-3}$	426	1.005	11.657
8	$26.6*10^{-3}$	$5.33*10^{-3}$	506	1.005	16.237

Discussion: If we compare the volumetric efficiency of all samples diesel is least efficient so its better to choose other samples, B5 of soyabean at any load is more than B5 of ethanol and if we increase the composition, i.e., B10 of ethanol is more efficient than B10 of soyabean . from the graph it is known that at higher loads B10 of ethanol has higher volumetric efficiency and at lower loads B5 of soyabean has better volumetric efficiency.

Table 8: Heat Carried by Exhaust Gases—B10 of Soya Bean

Load in kg	Mass of Fuel Consumed (m_f) in kg/s	Mass of Air Consumed (m_a) in kg/s	Exhaust Gas Temp Difference ($T_5 - T_6$) in °C	C_p of Air Kj/Kg- K	Heat Carried by Exhaust Gases in kj
2	$8.8*10^{-3}$	$5.33*10^{-3}$	281	1.005	3.99
4	$10.4*10^{-3}$	$5.33*10^{-3}$	353	1.005	5.58
6	$12.8*10^{-3}$	$5.33*10^{-3}$	434	1.005	7.907
8	$17.2*10^{-3}$	$5.33*10^{-3}$	535	1.005	12.113

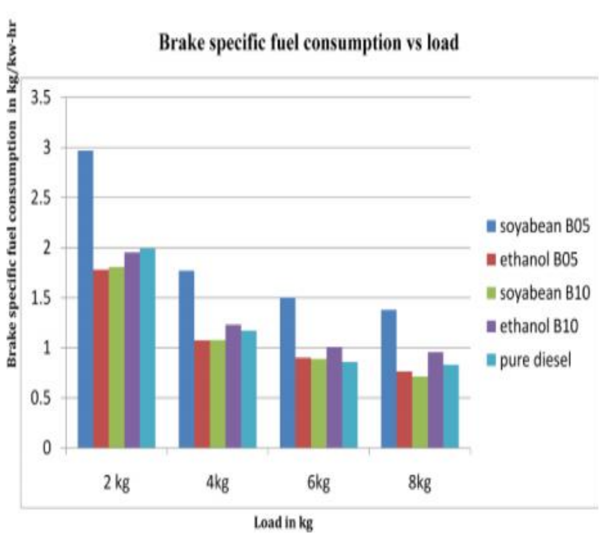
Table 9: Heat Carried by Exhaust Gases—B5 of Ethanol

Load in kg	Mass of Fuel Consumed (m_f) in kg/s	Mass of Air Consumed (m_a) in kg/s	Exhaust Gas Temp Difference ($T_5 - T_6$) in °C	C_p of Air Kj/Kg- K	Heat Carried by Exhaust Gases in kj
2	$8.9*10^{-3}$	$5.33*10^{-3}$	257	1.005	3.675
4	$10.6*10^{-3}$	$5.33*10^{-3}$	313	1.005	5.11
6	$13.2*10^{-3}$	$5.33*10^{-3}$	374	1.005	6.964
8	$14.8*10^{-3}$	$5.33*10^{-3}$	476	1.005	9.629

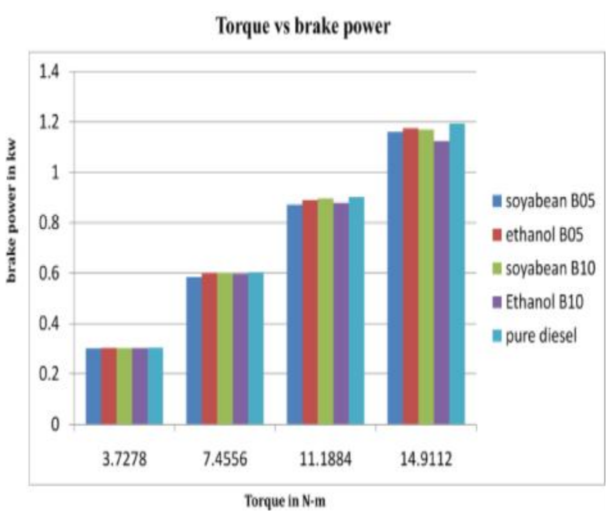
Table 10: Heat Carried by Exhaust Gases—B10 of Ethanol

Load in kg	Mass of Fuel Consumed (m_f) in kg/s	Mass of Air Consumed (m_a) in kg/s	Exhaust Gas Temp Difference ($T_5 - T_6$) in °C	C_p of Air Kj/Kg- K	Heat Carried by Exhaust Gases in kj
2	$9.8*10^{-3}$	$5.33*10^{-3}$	332	1.005	5.048
4	$12.2*10^{-3}$	$5.33*10^{-3}$	433	1.005	7.628
6	$14.7*10^{-3}$	$5.33*10^{-3}$	566	1.005	11.393
8	$17.9*10^{-3}$	$5.33*10^{-3}$	644	1.005	15.034

Graph 1: Volumetric Efficiency vs Load

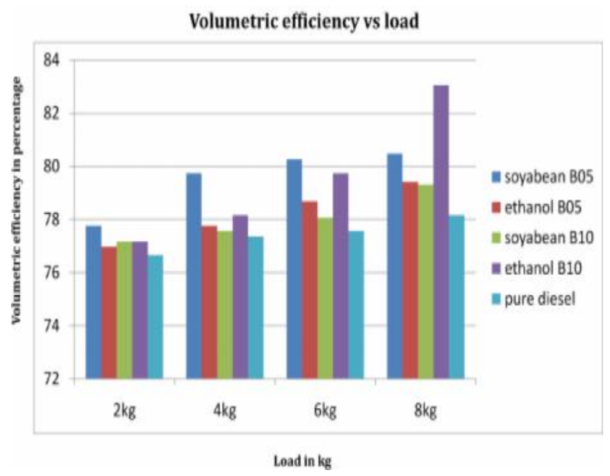


Graph 2: Break Specific Fuel Consumption vs Load



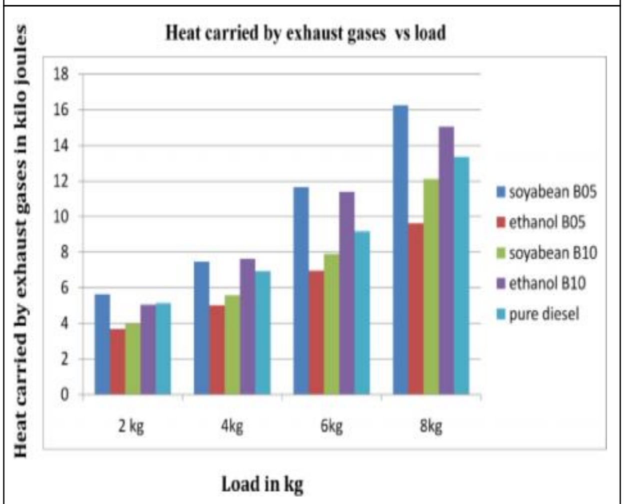
Discussion: If we compare the specific fuel consumption of all samples B5 of soya bean has more B.S.F.C at any load, but if we increase the composition B10 of ethanol has more B.S.F.C than B10 of soyabean eventually B5 of soyabean has more B.S.F.C

Graph 3: Heat Carried by Exhaust Gases vs Load



Discussion: From the graph if we compare the heat carried by exhaust emissions B5 of ethanol carry less exhaust emission of all other samples including diesel regarding this it is better to use ethanol which is of B5 composition.

Graph 4: Break Power vs Torque



Discussion: From the above graph at different torque, pure diesel has more brake power of all other samples. Other than pure diesel by increasing the torque brake power of B5 of ethanol is more than B5 of soya bean. By increasing the composition, B10 of soya bean has more brake power than B10 of ethanol.

CONCLUSION

The experiments are conducted on the Single-cylinder test rig with pure diesel and blends of pure diesel and the following conclusions were made:

- The heat carried by exhaust emissions are less for B5 of ethanol and B10 of soya bean too. So both these samples cause less effect to environment.
- For the blend B05 of soya been the volumetric efficiency is found to be more at moderate loads when compared to diesel and other blends. It is also found that the blend B10 of ethanol have higher volumetric efficiency at higher loads than any other samples. The volumetric efficiency of all other samples is more than pure diesel.
- The brake specific fuel consumption is more for blend B5 of soya bean than any other, from remaining samples it is observed that the specific fuel consumption is nearest to that of diesel at different loads and B10 of soya bean has less specific fuel consumption, therefore blend B10 of soya bean is most desirable and blend B5 of soya bean is not desired.
- Brake power of all samples are near to the pure diesel, B10 of soya bean is very nearer to the diesel.

From the above discussions we conclude that B10 (10% Soya bean and 90% Pure Diesel) is the best blend/mixture amongst all the test samples.

THE FUTURE OF BIODIESEL FUEL

The future of biodiesel is growing. More companies are offering this solution to the consumers. At this stage, only diesel powered automobiles can use the new fuel. This is expected to change in the upcoming years. The mounting concern of off-shore oil as well as the environmental issues has groups in an uproar. Already there are several types of companies using biodiesel as their main source for transportation. The Yellowstone Nation Park bus system uses a mixture of biodiesel and petroleum to run the whole fleet. Tests by the government have proven that this type of fuel is overall more functional and safe than petroleum based products. As fossil beds run dry, everyday scientists come closer to new alterative. Soon biodiesel will become the new source of power. Through research and constant testing, biodiesel is more productive that the petroleum based fuel. It has been discovered that this type of product will become the new source of power. Not only for diesel automobiles but for other power sources individuals desperately require living and surviving. Before long, this type of supply will be not only in vehicles but also in homes and factories.

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