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PERFORMANCE ANALYSIS OF C I ENGINE USING BIODIESEL FUELLED WITH BLENDS OF BIODIESEL EXTRACTED FROM JATROPHA OIL AND DIESEL

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***Abstract*— This dissertation presents the optimization of injection pressure and injection timing of the compression ignition engine. By modifying the two parameters of an engine as injection pressure and injection timing, and engine performance has been observed and data was collected. On the basis of data, many graphs have been drawn between compression ignition engine Load and various performance parameters that are collected such as Indicated Power, Brake Power and specific fuel consumption (I.P., B.P., and S.F.C.).**

By advancing and retarding the injection pressure as well as the fuel injection timing, several data has been collected. By analysing and recognizing the obtained data from compression ignition engine modification and enhance the situation of injection pressure and injection timing had been done.

On the other hand, the fossil fuel or conventional fuel blended with the biodiesel has been done by the fuel modification process. I have used Jatropha seed because it will be easily cultivated with less amount of water or in a dry place. The Jatropha biodiesel blended with diesel for C.I. Engine. B100 (It means that 100 percent biodiesel) biodiesel are used to determine the engine performance on different load. The 2-stroke single cylinder C.I. Engine has been tested with B100 blended fuel. First of all, the engine runs on no-load condition for half an hour time for the test to obtain the real operational condition of an engine. Some blends having high exhaust gases emission such as SOx, NOx but also having high B.P. reading, on the other side some blends having fewer exhaust gases emission of SOx, NOx but also having less B.P. reading. I had made many comparisons between performance parameters and a load of the engine. I have made a conclusion that B20 blends are good in all prospect whether it is exhaust gases emission or engine power. The Jatropha plant can evoke in infertile land so that we can cultivate the Jatropha in those types of areas. So farmers can utilize their infertile land and earn money for their excellence. In the present situation, Jatropha oil are costly as compare to diesel but when the cultivation takes place on the commercial level. The cost will decrease and also do not forget that we have limited conventional fuel for the future generation.

***Index Terms*—Jatropha Oil, Biodiesel, C. I. Engine.**

I. INTRODUCTION

ENERGY CRISIS

The energy crisis is a situation in which the country experience a break-down of energy supplies brought by quickly increasing energy cost that intimidate the economic and security of a country. The intimidates to economic security is represented by the possibility of retardation in economic growth, increasing inflation, increasing unemployment, and deficit in trillions of money in an investment. The intimidates to country security is represented by the incapability of United State Government to exercise various diplomatises options in particular regarding to nations with substantial crude oil reserves. For example, a few years ago disruption of Venezuelan oil supplies may boundary the US diplomatises options towards Iraq.

- We have seen the two energy crisis of 1973 and 1979, then we feel some similar tenors between the two.
- Were allied with low crude oil stocks.
- Were allied in retarding US petroleum product.
- Started with political stampede in some of the crude oil producing nations.
- Were allied with high dependency on crude oil imports.
- Were allied with import concentration from a small number of suppliers.
- Were allied with low level of crude oil industry spending.
- Caused an economic downturn for countries.
- In Middle East international locations restrained the United Nation policy.
- Dismemberment US and punish the west in reaction to support for Israel in the Yom Kippur battle against Egypt led the charge of crude to rise.

As per the International Energy Agency project report minimum 50% enhancement in demand by 2030. The enhancement in consumption was 3% in 2011, but yearly enhancement of only 1.6% would lead to 51% enhancement in consumption by 2030. India and China are both rapidly enhancing their consumption of old. The supply is not enough to meet the demand and rapidly enhancement in global prices of crude oil or petroleum product is making an impact in the economy of many countries. Therefore it is essential to adjust to the retarding oil supply and turn to an alternative source of energy. A table 1.1 show sector wise consumption of diesel.

Table 1 show sector wise consumption of diesel

Sector	Diesel (Fuel Consumption in Percentage)
Road Transport	61-63%
Manufacturing industries	13-14%
Agriculture	10-11%
Railways	4-5%
Other Uses	6-7%

II. LITERATURE REVIEW

A. Introduction

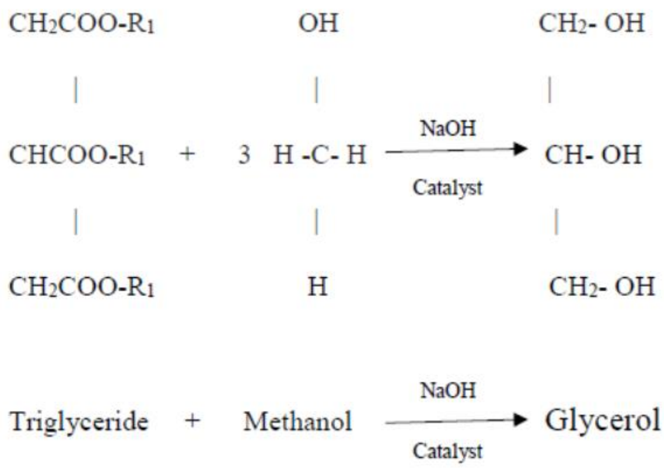
High percentage blends of biodiesel can have a problem due to cold temperature. B100 biodiesel produced from soyabean oil will become cloud at temperatures little above freezing and can prevent fuel filters if the temperature drops below 28 0F. In such conditions, biodiesel blends with diesel fuel are preferred.

Since biodiesel is a strong solvent, it will lose trash in tanks and pipes, clogging filters initially. Remedy this problem is after first use change filters. Sometimes gaskets and rubber hoses on older vehicles with B100 don't hold up well. Pre-1991 vehicles should be monitored for hose reduction. If these happen, the seals and hoses should be replaced with Viton-installed parts.

By the use of biodiesel engine warranties are not affected, notwithstanding dealers are continuously confused on this point. The parts and assembly of the engines only cover manufacturers' warranty statements and problems caused by the fuels never cover, regardless of whether the fuel is biodiesel or petroleum-based diesel. The questions arise about compensation for damages caused by a distinct fuel should be addressed to the supplier of fuel. "For more information, read the National Biodiesel Board's Standards and Warranties (NBBSW) page."

What is Biodiesel?

The biodiesel is made from a number of feedstocks together with tallow, lard, vegetables oil and waste edible oils. ''Biodiesel is defined as mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats which conform to American Society for Testing Materials (ASTD5453) International specifications for use in diesel engines." Biodiesel does not have petroleum, but it can be blended with petroleum diesel at any level to create a biodiesel blend. To make biodiesel, feedstocks can be trans-esterification to made biodiesel by using alcohol. Which has been mixed with a catalyst like sodium hydroxide or potassium hydroxide. Most commonly used alcohol for a trans-esterification process is methanol. Methanol is less expensive and easily reacts so it used more than other alcohols.



(Trans-esterification Reaction)

Biodiesel derived from soybean is generally used in the US. While in Europe generally used feedstock for biodiesel production is rapeseed. "Biodiesel is aromatics, biodegradable, nontoxic and essentially free from sulphur, in nature." It is mostly produced from the product that can be grown domestically and internationally, so it is also presumed as a renewable resource.

B. Biodiesel Production

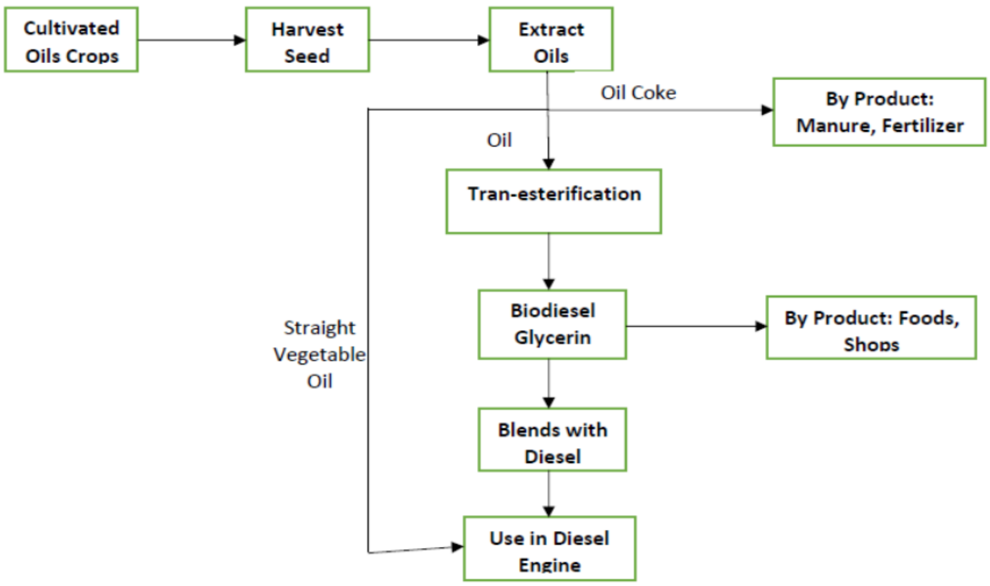


Figure 2 Schematic Diagram of Biodiesel Production.

Figure 2 Schematic Diagram of Biodiesel Production

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Biodiesel is produced by trans-esterification reaction process from animal fats, vegetable oils, and alcohol. The ones chemical reaction trade animal fats and vegetable oils right into a aggregate of esters of the fatty acids, which make up the oil from fat. Then the combination fatty acid methyl esters are purified to received biodiesel. A catalyst is also mixture in reaction to enhance the chemical reaction of biodiesel formation. On the basis of the catalyst used in the enhancement of reaction, trans-esterification can be classified into acidic (enzymatic), basic, and former being is most commonly used. A usual trans-esterification reaction is shown in equation RC00RO represent an ester, R0O0H alcohol, RO0H glycerol (another alcohol), RC00ROO an ester mixture and a catalyst RC00RO Þ R0OOH, cat RO0H Þ RC00ROO. While methanol alcohol used inside the trans-esterification manner, the produced made of the response is a aggregate of methyl esters, further if ethanol became more essential alcohol used in biodiesel manufacturing methanol. It most widely used, in spite of its venomousness. It is a liquid material of petrochemical origin. Ethanol fewer used, because it needs more sophisticated production technology and reaction process are lower. It can be easily produced from biomass.

III. EXPERIMENTAL SETUP

A. Generator Specification

B.P.	:	3 kW
MAXIMUM SPEED	:	1500 rpm
NUMBER OF CYLINDER	:	1
TYPE OF IGNITION	:	COMPRESSION IGNITION
METHOD OF STARTING	:	CRANK START
METHOD OF LOADING	:	ELECTRICAL LOADING

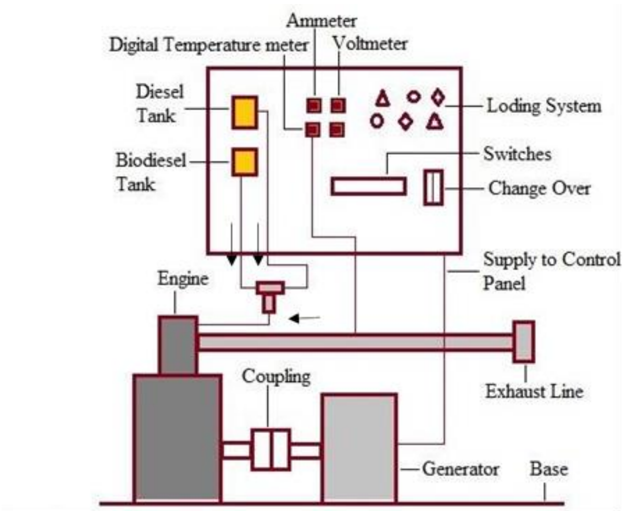

Figure 3 Schematic diagram of experiment setup

COMPRESSION RATIO	:	16.5:1
AIR INTANK	:	NATURALLY ASPIRATED
THERMAL MANAGEMENT:		WATER COOLED
INTAKE VALVE OPEN	:	6^0 BEFORE TDC
INTAKE VALVE CLOSE	:	35^0 AFTER BDC
EXHAUST VALVE OPEN	:	45^0 BEFORE BDC
EXHAUST VALVE CLOSE :		6^0 AFTER TDC

B. Loading System

Test rig to D.C. Compound is attached to the generator and loaded by an electric bulb. Fuel provided by the central fuel tank through a measuring jar. To prevent the time to stop the fuel consumption of many times to estimate fuel consumption of the engine, fill 40ml fuel the jar by opening the cocked tank several times.

B.P. = (V*I)/ (ηg*1000) kW
V= Voltage in volt (V).
I= Current in appear (A).
ηg = Efficiency of generator.

C. Fuel Measurement

The fuel gave from the focal fuel tank through an estimating burette with 3 way intricate background. To judge the fuel utilization of the motor charges the burette by opening the plug stamped "tank" in the complex square, by beginning a halted clock measure the time taken to deplete 10 ml of fuel.
Mass of fuel (mf) = (10*density of fuel*3600)/ (1000*time) kg\hr
Density of diesel = 848 kg\m3
Density of biodiesel = 875 kg\m3

D. Formula Used

- Brake power (B.P.) = (V*I) / (ηg *1000) kW
  `*
- Mass of fuel consumed (mf) = (10*ρ*3600) / (tf*1000) kg/hr.
- Specific fuel consumption (s.f.c.) = mf / B.P. kg/kW-hr
- Brake thermal efficiency (ηbth) = (B.P*3600*100) / (mf*c.v.) %
- Gross calorific value (G.C.V.) = w*(T2-T1) / (weight of fuel in gm.) Cal. /gm.

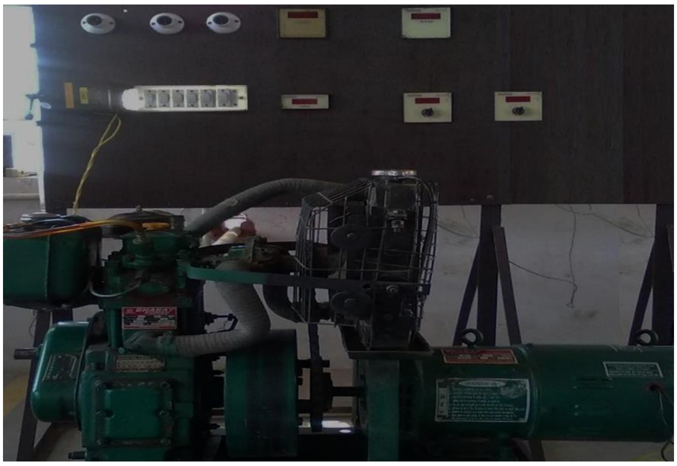

Figure 4 Experimental setup

result and discussion

E. Observations

- Time for 10 ml fuel consumption from jar = tf , (S)
- Voltage = Volt, (V)
- Current = Ampere, (I)
- Exhaust Gas Temperature = E.G.T., (0C)

1) For Normal Pressure and Normal Injection Timing

On diesel fuel

Table 2 shows the speed versus load for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 212 V and 1.8 A at 770 rpm while 252 V and 8.4 A at 698 rpm.

Table 2

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	tf (Sec)
0.25	770	212	1.8	77.2799
0.50	782	218	2.2	73.0949
0.75	767	227	2.7	68.8938
1.00	762	223	3.2	64.8053
1.25	741	231	3.9	58.6340
1.50	749	234	4.6	52.5738
1.75	732	238	5.4	47.9916
2.00	714	236	6.3	42.8646
2.25	724	243	7.1	37.0369
2.50	706	249	7.8	31.9598
2.75	687	246	8.1	28.9082
3.00	698	252	8.4	25.8574

On biodiesel fuel

Table 3 shows the speed versus load for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 207 V and 1.5 A at 776 rpm while 225 V and 8.4 A at 697 rpm.

Table 3

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	tf (Sec)
0.25	776	207	1.5	47.1231
0.50	765	219	1.8	46.5767
0.75	770	214	2.1	48.0855
1.00	758	224	2.6	41.3727
1.25	749	228	3.1	36.8059
1.50	732	234	3.7	31.2807
1.75	741	231	4.4	23.5350
2.00	723	236	5.1	21.2152
2.25	705	242	6.6	16.8199
2.50	712	239	7.3	17.4727
2.75	688	252	7.8	16.1525
3.00	697	225	8.4	14.1680

2) For High Pressure and Normal Injection Timing

On diesel fuel

Table 4 shows the speed versus load for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 207 V and 1.5 A at 776 rpm while 225 V and 8.4 A at 697 rpm.

Table 4

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	tf (Sec)
0.25	741	208	2.4	93.3705
0.50	724	212	3.2	80.5997
0.75	732	219	3.7	61.4777
1.00	712	215	4.7	44.8465
1.25	697	223	5.2	45.6743
1.50	705	224	5.3	51.2665
1.75	690	227	5.8	44.3702
2.00	668	216	6.9	36.8194
2.25	679	208	8.1	36.4421
2.50	652	209	9.4	33.8134
2.75	627	202	9.9	21.4801
3.00	638	203	10.8	15.9001

On biodiesel fuel

Table 5 shows the speed versus load for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 224 V and 1.3 A at 769 rpm while 189 V and 11.3 A at 664 rpm.

Table 5

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	tf (Sec)
0.25	769	224	1.3	94.6518
0.50	736	229	1.7	91.9734
0.75	742	221	2.8	87.4631
1.00	719	217	3.9	73.3304
1.25	709	214	4.5	69.8331
1.50	713	216	5.4	61.7122
1.75	695	208	6.3	53.4996
2.00	681	204	7.4	45.2989
2.25	691	207	8.8	36.9296
2.50	676	202	9.4	33.8893
2.75	642	197	10.4	26.1610
3.00	664	189	11.3	14.4576

3) For High Pressure and Advance Injection Timing

On diesel fuel

Table 6 shows the speed versus load for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 198 V and 1.3 A at 728 rpm while 192 V and 13.8 A at 638 rpm.

Table 6

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	t_f (Sec)
0.25	728	198	1.3	108.3435
0.50	723	204	1.6	110.6758
0.75	716	209	2.4	84.7411
1.00	724	213	3.4	75.6188
1.25	712	216	4.6	64.0850
1.50	702	221	5.4	55.4759
1.75	695	215	6.7	47.3648
2.00	677	218	7.7	42.9241
2.25	682	204	8.5	39.0235
2.50	650	198	9.4	35.2992
2.75	664	203	11.4	27.3690
3.00	638	192	13.8	22.0053

On biodiesel fuel

Table 7 shows the speed versus load for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 194 V and 1.2 A at 734 rpm while 194 V and 11.4 A at 669 rpm.

Table 7

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	t_f (Sec)
0.25	734	194	1.2	99.5689
0.50	728	203	1.8	84.6215
0.75	722	208	2.5	78.5430
1.00	706	213	3.4	77.0221
1.25	712	218	4.6	64.6261
1.50	705	224	5.8	52.8362
1.75	708	216	6.3	55.0595
2.00	698	206	7.4	51.1388
2.25	691	192	8.7	49.9456
2.50	684	210	9.6	44.6176
2.75	677	206	10.8	34.2358
3.0	669	194	11.4	28.3468

4) For Normal Pressure and Advance Injection Timing

On diesel fuel

Table 8 shows the speed versus load for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 195 V and 1.1 A at 722 rpm while 172 V and 10.2 A at 652 rpm.

Table 8

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	tf (Sec)
0.25	722	195	1.1	168.2820
0.50	712	183	1.7	159.3133
0.75	701	198	2.4	141.5092
1.00	688	205	3.5	110.8045
1.25	692	208	4.6	89.1738
1.50	677	202	5.4	85.7189
1.75	684	212	6.8	62.4419
2.00	671	203	7.4	68.7748
2.25	663	194	8.2	69.5214
2.50	652	186	8.9	70.0011
2.75	643	176	9.4	66.1861
3.00	652	172	10.2	57.3018

On biodiesel fuel

Table 9 shows the speed versus load for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has electricity 196 V and 0.9 A at 718 rpm while 181 V and 10.7 A at 655 rpm.

Table 9

Load (kW)	Speed (RPM)	Voltage (V)	Ampere (I)	tf (Sec)
0.25	718	196	0.9	96.9150
0.50	712	192	1.4	87.2072
0.75	686	203	2.5	61.3572
1.00	696	205	3.4	52.9973
1.25	689	202	4.8	41.5831
1.50	676	209	5.3	40.0998
1.75	672	197	6.6	35.5884
2.00	648	193	7.4	34.7806
2.25	634	207	8.1	30.7963
2.50	662	194	8.8	31.7150
2.75	642	189	9.5	31.2605
3.00	655	181	10.7	26.3242

F. Results

1) For Normal Pressure and Normal Injection Timing

On diesel fuel

Table 10 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 0.4892 kW, s.f.c. 0.8074 kg/kW-hr, and brake thermal efficiency 10.49% at 0.25 kW load while B.P. 1.9061 kW, s.f.c. 0.3736 kg/kW-hr, and brake thermal efficiency 22.67% at 2.00 kW load.

Table 10

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.4892	0.8074	10.49	238
0.50	0.6148	0.6792	12.47	249
0.75	0.7857	0.5639	15.02	256
1.00	0.9148	0.5149	16.45	267
1.25	1.1550	0.4507	18.79	281
1.50	1.3800	0.4207	20.13	292
1.75	1.6476	0.3860	21.94	299
2.00	1.9061	0.3736	22.67	306
2.25	2.2119	0.3726	22.73	314
2.50	2.4900	0.3836	22.08	323
2.75	2.5546	0.4133	20.49	334
3.00	2.7138	0.4350	19.47	349

On biodiesel fuel

Table 11 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 0.3980 kW, s.f.c. 1.6792 kg/kW-hr, and brake thermal efficiency 6.71% at 0.25 kW load while B.P. 2.5200 kW, s.f.c. 0.7738 kg/kW-hr, and brake thermal efficiency 14.56% at 2.75 kW load.

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Table 11

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.3980	1.6792	6.71	224
0.50	0.5053	1.3381	8.42	229
0.75	0.5761	1.1369	9.91	237
1.00	0.7466	1.0196	11.05	252
1.25	0.9061	0.9444	11.93	261
1.50	1.1100	0.9072	12.42	268
1.75	1.3030	1.0271	10.97	281
2.00	1.5430	0.9622	11.71	294
2.25	2.0476	0.9145	12.32	302
2.50	2.2367	0.8059	13.98	315
2.75	2.5200	0.7738	14.56	321
3.00	2.4230	0.9175	12.28	329

2) For High Pressure and Normal Injection Timing

On diesel fuel

Table 12 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 2.5638 kW, s.f.c. 0.5543 kg/kW-hr, and brake thermal efficiency 15.28% at 2.75 kW load while B.P. 2.5187 kW, s.f.c. 0.3584 kg/kW-hr, and brake thermal efficiency 23.63% at 2.50 kW load.

Table 12

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.6400	0.5108	16.58	247
0.50	0.8697	0.4354	19.45	259
0.75	1.0388	0.4780	17.72	268
1.00	1.2955	0.5254	16.12	277
1.25	1.4866	0.4495	18.84	288
1.50	1.5220	0.3912	21.65	296
1.75	1.6879	0.4076	20.78	308
2.00	1.9107	0.4339	19.52	324
2.25	2.1600	0.3878	21.84	334
2.50	2.5187	0.3584	23.63	341
2.75	2.5638	0.5543	15.28	353
3.00	2.8107	0.6830	12.40	366

On biodiesel fuel

Table 13 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for normal injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at normal injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 0.3733 kW, s.f.c. 0.8914 kg/kW-hr, and brake thermal efficiency 12.64% at 0.25 kW load while B.P. 2.3353 kW, s.f.c. 0.3652 kg/kW-hr, and brake thermal efficiency 30.85% at 2.25 kW load.

Table 13

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.3733	0.8914	12.64	261
0.50	0.4991	0.6862	16.42	273
0.75	0.7933	0.4539	24.82	281
1.00	1.0850	0.3959	28.46	291
1.25	1.2346	0.3653	30.84	297
1.50	1.4953	0.3413	33.01	309
1.75	1.6800	0.3504	32.15	321
2.00	1.9353	0.3592	31.36	336
2.25	2.3353	0.3652	30.85	344
2.50	2.4343	0.3818	29.51	352
2.75	2.6266	0.4584	24.58	361
3.00	2.7380	0.7957	14.16	372

3) For High Pressure and Advance Injection Timing

On diesel fuel

Table 14 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 0.3300 kW, s.f.c. 0.8538 kg/kW-hr, and brake thermal efficiency 9.92% at 0.25 kW load while B.P. 1.8467 kW, s.f.c. 0.3489 kg/kW-hr, and brake thermal efficiency 24.27% at 1.75 kW load.

Table 14

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.3300	0.8538	09.92	233
0.50	0.4184	0.6591	12.85	238
0.75	0.6430	0.5601	15.12	247
1.00	0.9284	0.4348	19.48	255
1.25	1.2738	0.3739	22.65	278
1.50	1.5300	0.3596	23.55	301
1.75	1.8467	0.3489	24.27	319
2.00	2.1520	0.3304	25.63	335
2.25	2.2230	0.3518	24.07	347
2.50	2.3861	0.3624	23.37	361
2.75	2.9669	0.3759	22.53	372
3.0	3.3969	0.4083	20.74	381

On biodiesel fuel

Table 15 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with high pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and high pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 0.2984 kW, s.f.c. 1.0599 kg/kW-hr, and brake thermal efficiency 10.63% at 0.25 kW load while B.P. 2.5846 kW, s.f.c. 0.2731 kg/kW-hr, and brake thermal efficiency 41.25% at 2.50 kW load.

Table 15

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.2984	1.0599	10.63	221
0.50	0.4684	0.7946	14.18	229
0.75	0.6666	0.6015	18.73	239
1.00	0.9284	0.4404	25.58	247
1.25	1.2856	0.3791	29.72	269
1.50	1.6656	0.3579	31.48	288
1.75	1.7446	0.3279	34.36	311
2.00	1.9543	0.3151	35.75	322
2.25	2.1415	0.2945	38.26	334
2.50	2.5846	0.2731	41.25	348
2.75	2.8523	0.3225	34.93	362
3.0	2.8353	0.3919	28.75	373

4) For Normal Pressure and Advance Injection Timing

On diesel fuel

Table 16 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with diesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 0.2750 kW, s.f.c. 0.6596 kg/kW-hr, and brake thermal efficiency 12.84% at 0.25 kW load while B.P. 2.1223 kW, s.f.c. 0.2054 kg/kW-hr, and brake thermal efficiency 41.34% at 2.50 kW load.

Table 16

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.2750	0.6596	12.84	229
0.50	0.3988	0.4804	17.63	234
0.75	0.6092	0.3541	23.92	244
1.00	0.9198	0.2995	28.28	256
1.25	1.2266	0.2790	30.35	268
1.50	1.3984	0.2546	33.26	281
1.75	1.8482	0.2645	32.02	294
2.00	1.9258	0.2304	36.75	309
2.25	2.0394	0.2153	39.34	327
2.50	2.1223	0.2054	41.22	341
2.75	2.1210	0.2174	38.95	345
3.00	2.2492	0.2368	35.76	354

On biodiesel fuel

Table 17 shows the load versus brake power, s.f.c., brake thermal efficiency, and exhaust gas temperature for CI engine with biodiesel fuel. Fuel injection timing and pressure has a major influence on engine performance, combustion, and emission, and these impacts have mainly executed in case of late injection cases. But, for advance injection timing with normal pressure and high heat liberation will attain high values. For homogeneous charging combustion operation engine, compression stroke at advance injection timing and normal pressure has been set to ensure better fuel/air mixture quickly. For the end of the ignition, it has B.P. 0.2261 kW, s.f.c. 1.4371 kg/kW-hr, and brake thermal efficiency 7.84% at 0.25 kW load while B.P. 2.3019 kW, s.f.c. 0.4377 kg/kW-hr, and brake thermal efficiency 25.74% at 2.75 kW load.

Table 17

Load (kW)	B.P. (kW)	s.f.c (kg/kW-hr)	B.T.E. (%)	E.G.T. (^{0}C)
0.25	0.2261	1.4371	7.84	224
0.50	0.3446	1.0481	10.75	236
0.75	0.6506	0.7890	14.28	246
1.00	0.8935	0.6651	16.94	258
1.25	1.2430	0.6093	18.49	271
1.50	1.4201	0.5531	20.37	284
1.75	1.6669	0.5309	21.22	294
2.00	1.8310	0.4946	22.78	300
2.25	2.1496	0.4758	23.68	313
2.50	2.1887	0.4537	24.83	328
2.75	2.3019	0.4377	25.74	344
3.00	2.4829	0.4819	23.38	361

G. Graphs For Different Parameters

1) Brake Power

Normal Pressure and Normal Injection Timing

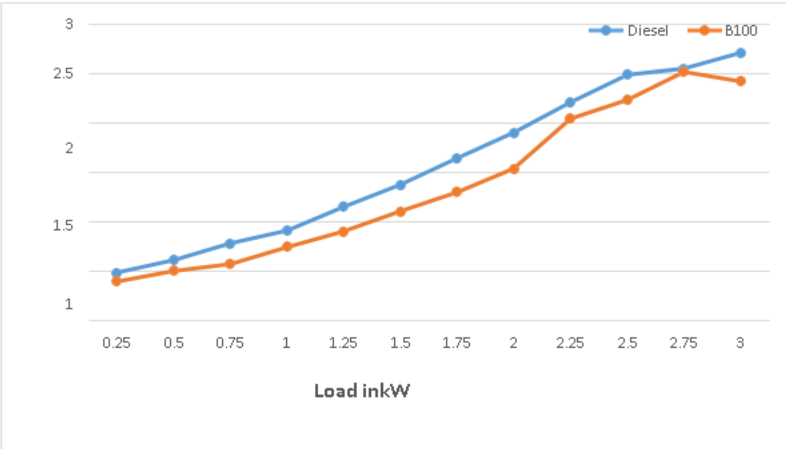

Figure 5 Graph between break power and load High Pressure and Normal injection timing

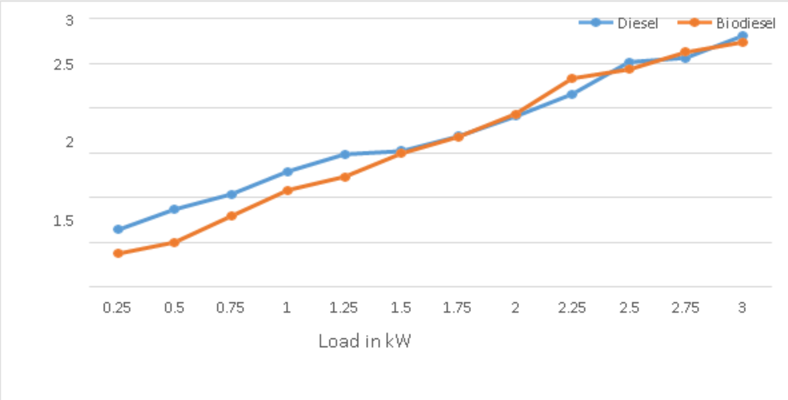

Figure 6 Graph between break power and load

Normal Pressure and Advanced Injection Timing

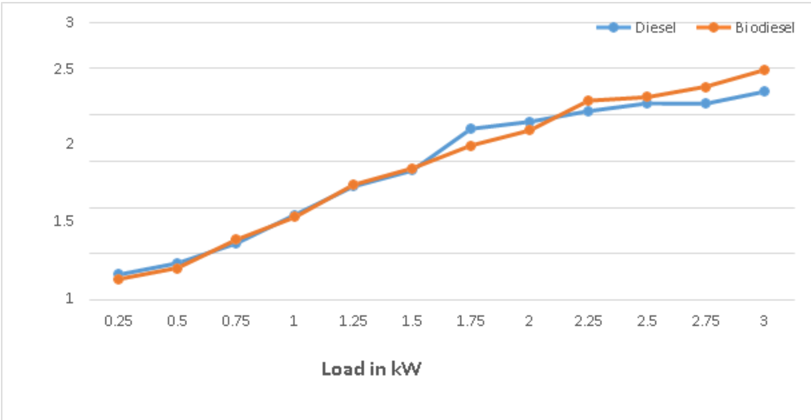

Figure 7 Graph between break power and load High Pressure and Advanced Injection Timing

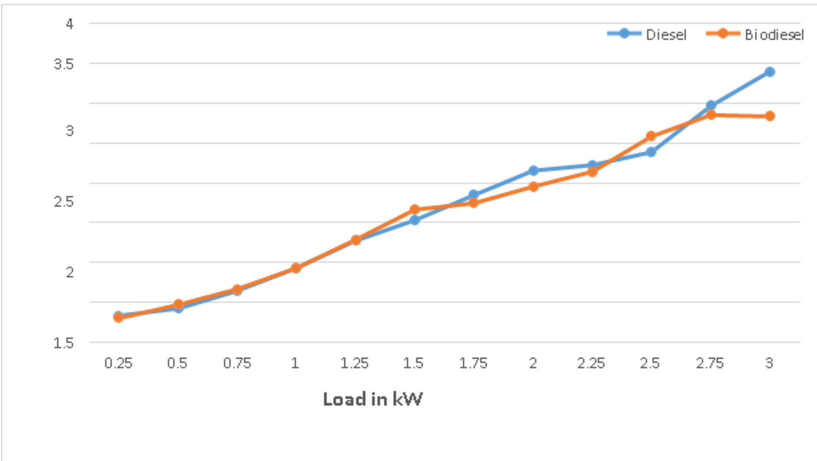

Figure 8 Graph between break power and load

2) Specific Fuel Consumption

Normal Pressure and Normal Injection Timing

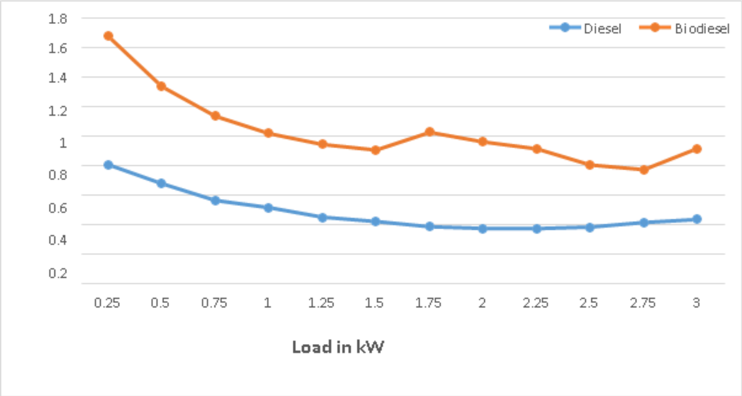

Figure 9 Graph between s.f.c. and load High Pressure and Normal Injection Timing

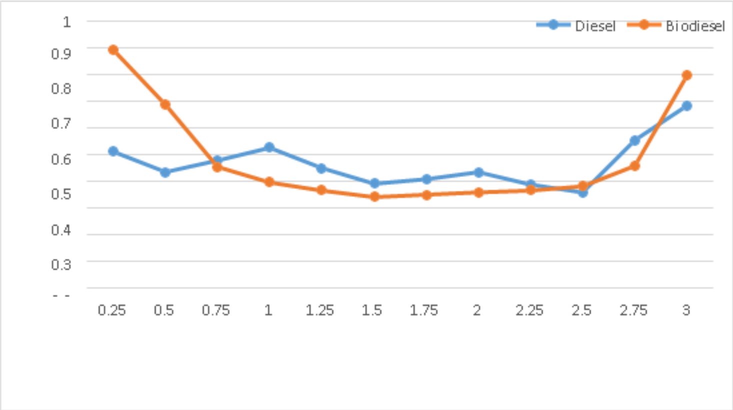

Figure 10 Graph between s.f.c and load

Normal Pressure and Advanced Injection Timing

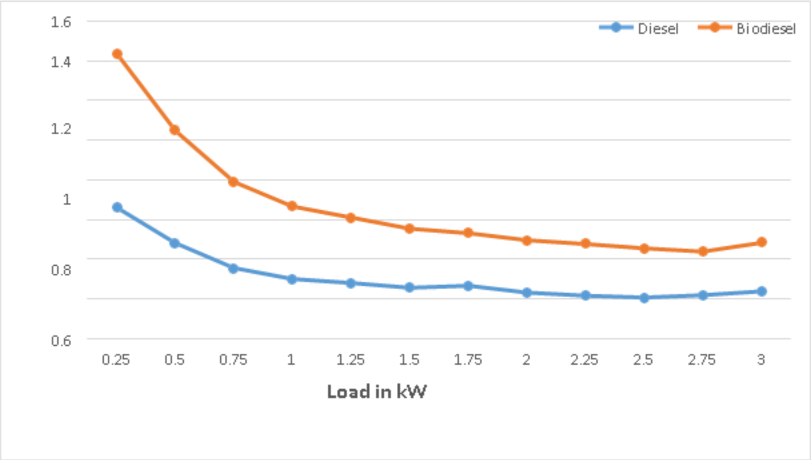

Figure 11 Graph between s.f.c. and load High Pressure and Advanced Injection Timing

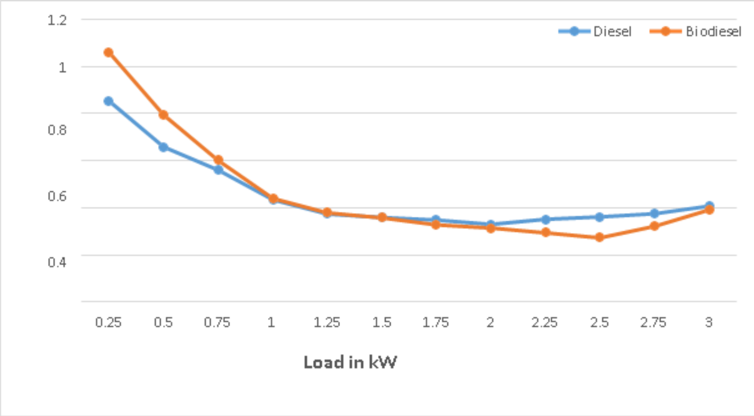

Figure 12 Graph between s.f.c. and load

3) Exhaust Gas Temperature

Normal Pressure and Normal Injection Timing

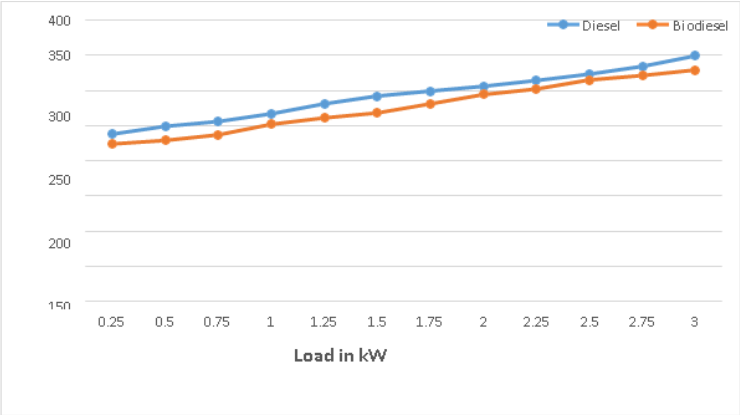

Figure 13 Graph between temperature and load High Pressure and Normal Injection Timing

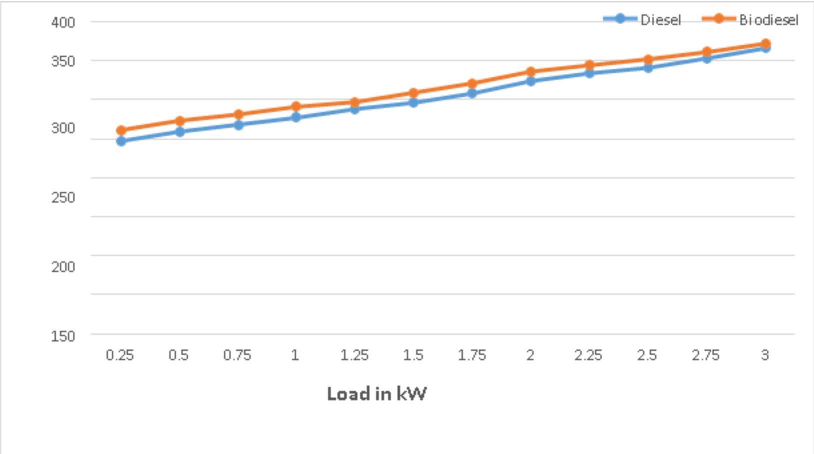

Figure 14 Graph between temperature and load

Normal Pressure and Advanced Injection Timing

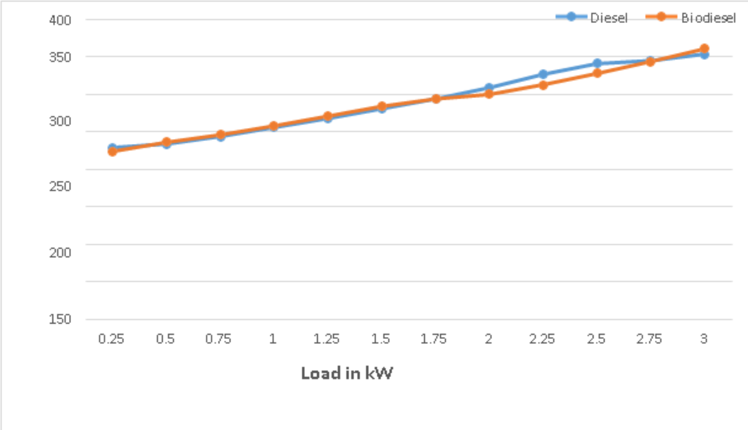

Figure 15 Graph between temperature and load High Pressure and Advanced Injection Timing

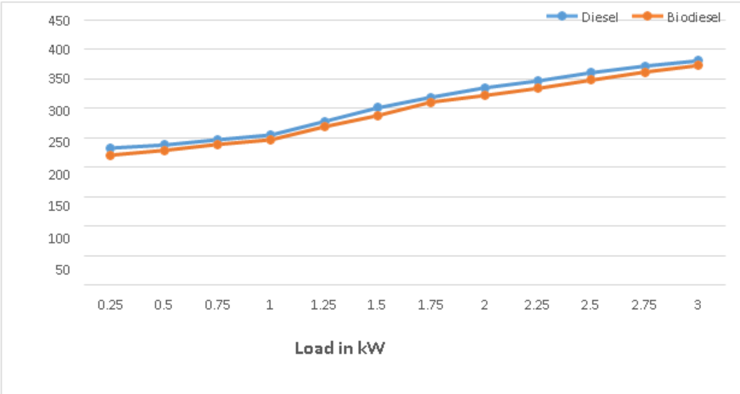

Figure 16 Graph between temperature and load

4) Thermal Efficiency

Normal Pressure and Normal Injection Timing

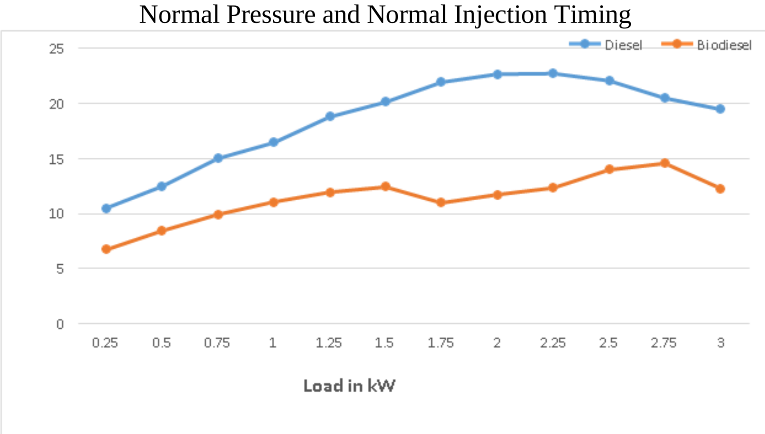

Figure 17 Graph between thermal efficiency and load High Pressure and Normal Injection Timing

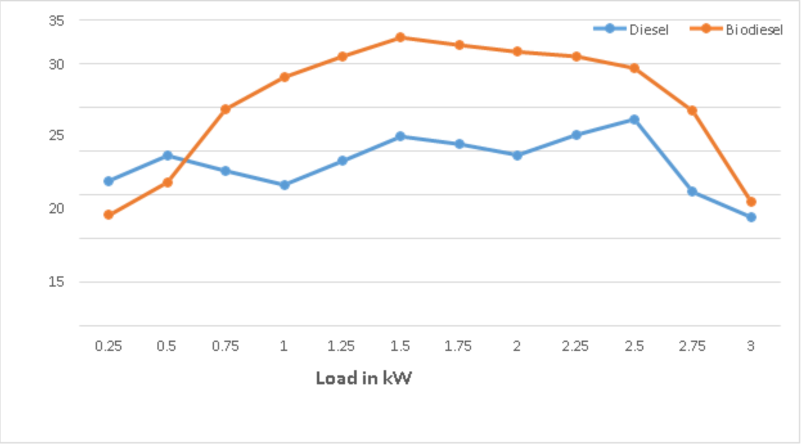

Figure 18 Graph between thermal efficiency and load

Normal Pressure and Advanced Injection Timing

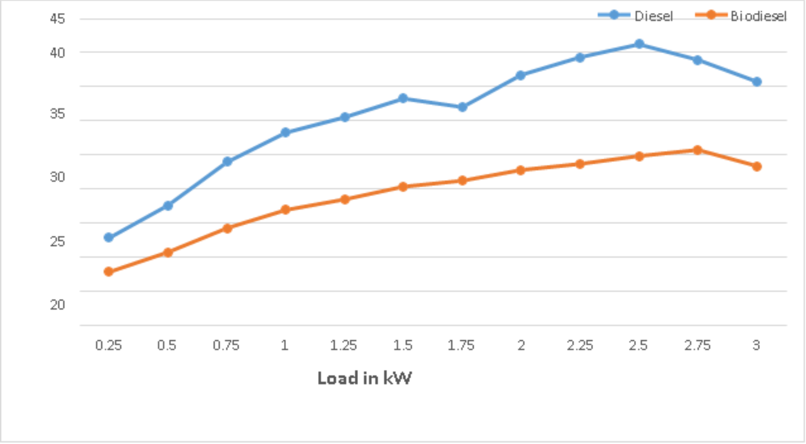

Figure 19 Graph between thermal efficiency and load High Pressure Advanced Injection Timing

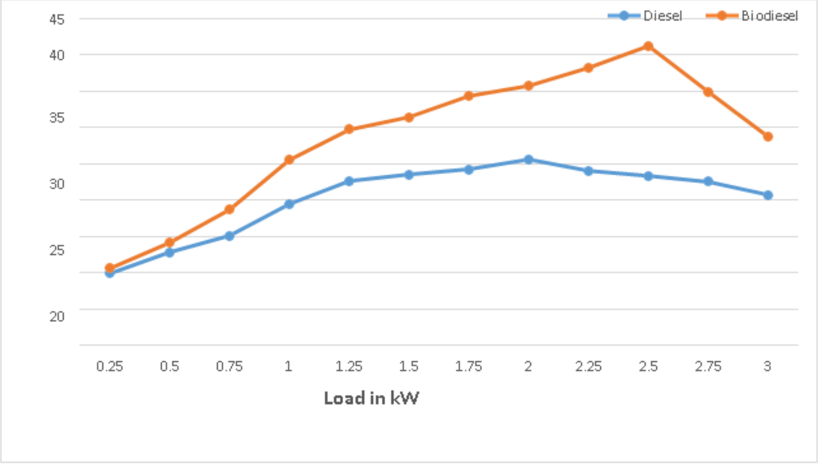

Figure 20 Graph between thermal efficiency and load

IV. CONCLUSIONS

After examining the record and expertise of those practicing biodiesel, this is desirable that biodiesel is an effective supplement for petroleum diesel for use in heavy vehicles. It provides too many advantages to overlook biodiesel transit agencies. Unlike petroleum diesel, biodiesel is a renewable energy source which is fabricated domestically, which can diminish the reliance on foreign holes and provide more energy assurance. These circumstances singly create biodiesel deserving attention. Comparative experiments were performed to estimate the performance of biodiesel corresponded to diesel on single cylinders compression ignition engine, water cooled. Engine load, engine speed, fuel consumption, and exhaust gas temperature measurement are taken. The result of the experiment can be compiled as follows.

Outcomes confirm that when the fuel is charged with biodiesel, the engine's performance are alike with petroleum diesel.

Fuel consumption with biodiesel is higher than fuel, when fuel is provided with petroleum diesel, because the engine should be provided with a bit more biodiesel to produce the similar amount of work, as before the low calorific value described was done by.

- Biodiesel performance in high pressure is compared to diesel.
- Combustion properties of the engine confirmed that the highest peak mixture has been shown for diesel after B20.
- Better thermal efficiency with high pressure but with advanced timing there is a little more reformation occur.
- Performance report of the engine shows that mixes B20 and B50 as a result of high BTE (brake thermal efficiency) corresponded to diesel. The maximum BTE was recorded for the B50, which is 17% more than the diesel.
- The brake power for both the fuel examined is comparable. There are little changes with changed parameters.
- At advance injection timing and normal injection pressure the thermal efficiency of engine enhanced.
- There was slight increase in the broken power of the engine under advance pressure.
- When the engine fueled the biodiesel, it would take time to get a steady state.
- Exhaust gas temperature (EGT) enhanced when the engine fuels the biodiesel.
- In the blends, B20 and B50 produced low CO emissions, compared to Diesel, in B50 a decrease of 34.21% compared to the maximum recorded diesel.

Current test results confirm that biodiesel can be successfully used in existing diesel engines with injection time and injection pressure changes. Biodiesel fuel can be recognized as a competent, engine friendly and environmentally friendly alternative to diesel oil. From the perspective of the social economy. The use of biodiesel a partial diesel option can increase the earnings of farmers. This will also help overcome the uncertainty of the availability of fuel.

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