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ANALYSIS OF PERFORMANCE PARAMETERS WITH RESPECTIVE TO PERCENTAGE OF LOAD ON COMPRESSION IGNITION ENGINE FOR BLENDS OF JATROPHA

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Abstract: Performance Characteristics of bio-fuel (blends of Jatropha with conventional diesel) on Compression Ignition Engine at various proportions such as B-10, B-15, B-20, B-25 and B-30 (B-10:10% Jatropha and 90% diesel) were studied. The analysis is made on the standard performance parameters like torque, brake power, fuel consumption and specific fuel consumption (SFC) etc with reference to the percentage of load on the engine. It is found that the variation in most of the analysis is very little from using pure diesel.

Key Words: Jatropha, Blends, Performance, bio-diesel, C.I. Engine.

I. INTRODCTION

Majority of the world's energy needs are supplied through petro-chemical sources, coal and natural gases, with the exception of hydro-electricity and nuclear energy, all these sources are finite and as current usage rates will be consumed shortly [4]. The utilization of liquid fuels such as biodiesel produced from Jatropha oil by transesterification process represents one of the most promising options for the use of conventional fossil fuels [2]. Compared to the other tree borne oil species and other sources, jatropha is viewed as appropriate choice for the production of bio-fuel in current Indian scenario, due to it's features like proven ability to thrive in the variety of agro climate, Lower gestation period and Low water requirement per plant per day during non-rainy days [1]. It is estimated that the Jatropha seeds contain 25-40% oil [5][6]. There is about 63 million ha. Wastelands in the country, out of which about 40 million ha. area can be developed by undertaking plantations of Jatropha[8]. The experimental test set-up is explained in section-II, observations during the test and performance parameters are tabulated in section-III. Analysis of performance parameters and discussion is made in section-IV followed by conclusion in section-V.

II. EXPERIMENTAL TEST SET-UP

After thorough mixing of specified percentage of Jatropha with conventional Diesel like B-10, B-15 etc., the performance parameters are collected by conducting load test on compression ignition engine. The engine specifications and test set-up in Thermal Engineering Lab of our Institute are briefed as follows.
Make: Kirloskar, four stroke, Twin cylinder, Water cooled, Cold start, Compression Ignition diesel Engine.
Rated Speed: 1500RPM

Brake Horse Power (BHP): 10 H.P. (7.36 kW)

Bore (D): 80mm, Stroke (L): 110mm
Compression ratio(r): 16:1
Fuel oil: H.S. Diesel.

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III. OBSERVATIONS AND TABULATIONS

The observations made during the load test on compression ignition engine for various performance parameters are tabulated and corresponding graphical representations are as follows.

TABLE-01: Mass of fuel consumed in Kg/hr

SL NO	% OF LAOD	DIESEL	B-10	B-15	B-20	B-25	B-30
1	18	0.955	0.847	1.198	0.942	0.909	0.85
2	34	1.146	1.066	1.354	1.115	1.125	1.46
3	50	1.392	1.427	1.559	1.347	1.345	1.77
4	66	1.671	1.622	1.805	1.647	1.588	1.82
5	84	1.972	1.905	2.035	2.135	1.896	1.86
6	100	2.041	2.233	2.35	2.257	2.132	2.41

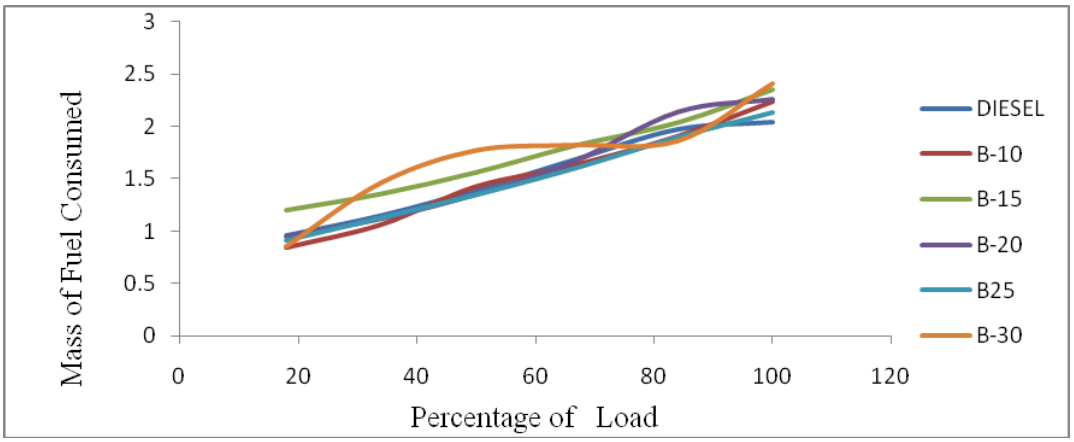


TABLE-02: Percentage of Load V/S Torque Produced

SL NO	% OF LAOD	DIESEL	B-10	B-15	B-20	B-25	B-30
1	18	10.375	10.37	9.33	10.37	10.375	10.37
2	34	19.712	20.75	18.67	19.71	19.712	19.71
3	50	29.053	30.08	26.97	29.05	30.081	29.05
4	66	39.425	39.42	36.31	39.42	39.425	37.35
5	84	47.725	48.76	45.65	47.72	49.857	47.72
6	100	58.15	58.12	57.83	58.12	57.061	56.02

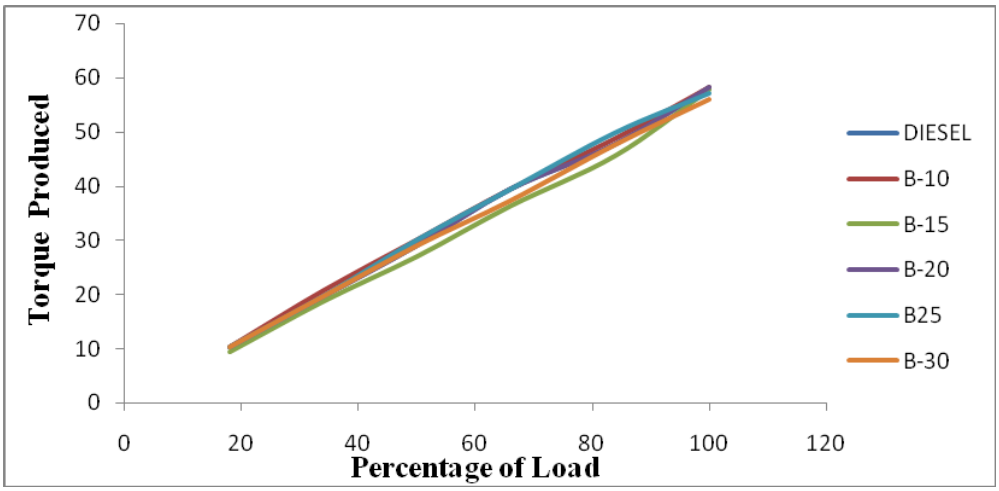


TABLE-03: Percentage of Load V/S Brake Power Produced in Kw

SL NO	% OF LAOD	DIESEL	B-10	B-15	B-20	B25	B-30
1	18	1.662	1.662	1.487	1.66	1.66	1.66
2	34	3.108	3.289	2.928	3.13	3.13	3.11
3	50	4.526	4.707	4.196	4.58	4.75	4.51
4	66	6.069	6.077	5.612	6.19	6.14	5.75
5	84	7.286	7.455	6.979	7.43	7.71	7.29
6	100	8.834	8.797	8.782	8.94	8.72	8.48

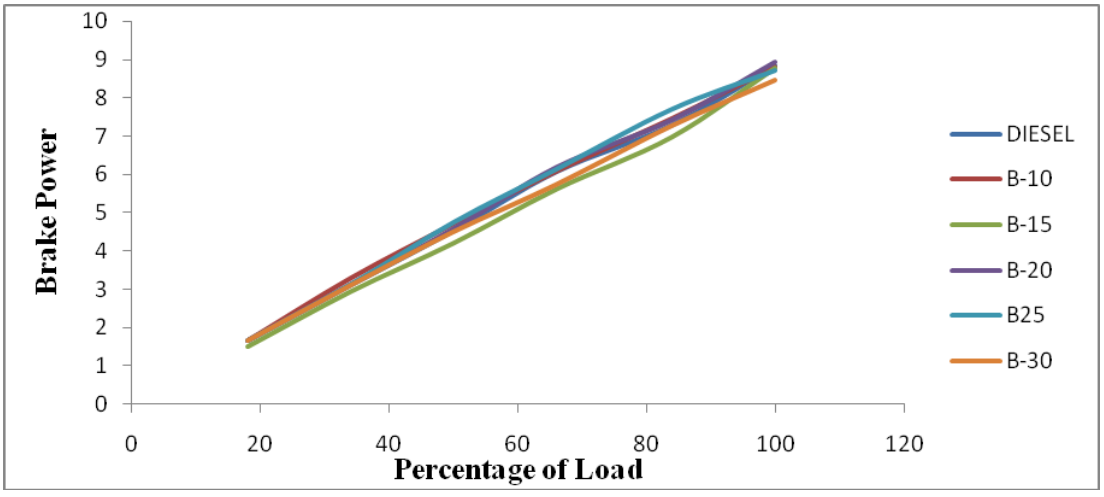


TABLE-04: Percentage of Load V/S Specific Fuel Consumption

SL NO	% OF LAOD	DIESEL	B-10	B-15	B-20	B25	B-30
1	18	0.574	0.522	0.628	0.567	0.547	0.512
2	34	0.368	0.324	0.46	0.366	0.358	0.471
3	50	0.307	0.303	0.37	0.293	0.283	0.394
4	66	0.275	0.266	0.32	0.265	0.258	0.317
5	84	0.27	0.255	0.29	0.287	0.246	0.286
6	100	0.231	0.253	0.252	0.257	0.244	0.254

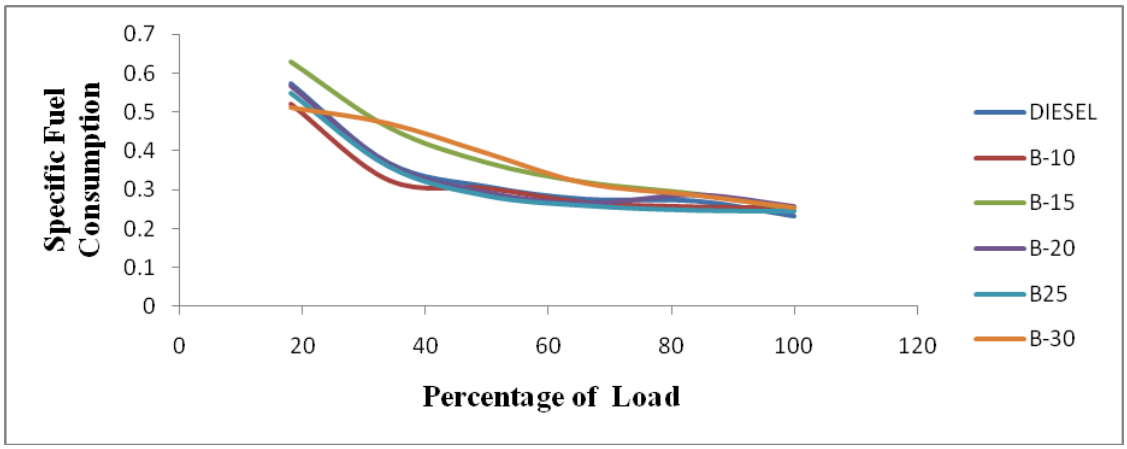
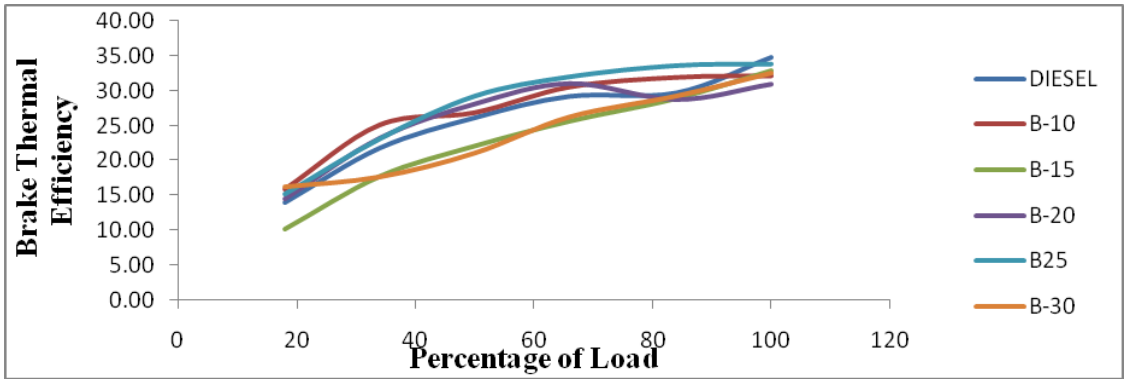


TABLE-05: Percentage of Load V/S Brake Thermal Efficiency

SL NO	% OF LAOD	DIESEL	B-10	B-15	B-20	B25	B-30
1	18	13.98	15.95	10.15	14.57	15.12	16.25
2	34	21.79	25.08	17.69	23.26	23.09	17.67
3	50	26.12	26.82	22.01	28.15	29.24	21.09
4	66	29.18	30.46	25.56	31.08	32.03	26.27
5	84	29.68	31.82	28.81	28.79	33.65	29.27
6	100	34.76	32.03	32.768	30.99	33.87	32.55



IV. RESULT ANALYSIS AND DISCUSSION

From the table-01 and corresponding fig, it is observed that the mass of fuel consumption will increase with increase in percentage of load and the results are not much differ from the parent curve except for B-30 at 50 percent load the fuel consumption is almost 20 percent more than the normal diesel. For B-15, at lower loads, it found little variation but decreases with higher percentage of load. It is observed from Table-02 and Table-03 with corresponding figure that the Torque and Brake power produced increases almost linearly with that of conventional diesel curve for entire load variation. The specific fuel consumption (Table-04) will be higher at lower loads than conventional diesel and decreases with increase in percentage of load. For B-15 and B30 at lower loads there is about 21% more specific fuel consumption but decreases with higher loads above 78%and above 80% to full load almost neare to standard values. It is observed from Table-05 that the brake thermal efficiency for all the blends is slightly lower than the normal results for entire variation of loads.

V. CONCLUSION

The experiments are carried out on a twin cylinder diesel engine using biodiesel derived from Jatropha oil as an alternate fuel. Comparison of performance characteristics with normal diesel is presented. For most of the performance parameters at higher percentage of loads the difference of results observed is very small. It is clear from above experimental results that the Jatropha can be considered for blends with normal diesel as it is an environmental friendly fuel which is renewable in nature. As the Jatropha can be produced in all climatic conditions, it is need of the day to encourage the rural mass towards its production thereby achieving the self sustainability in the country as the mass production of Jatropha will definitely decrease the cost of fuel.

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