Emission Characteristics with Palm Oil Methyl Ester blended with Diesel

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Abstract

The present work presents some experimental results on the palm oil base methyl ester as an additive in diesel as an alternate fuel. Emission characteristics are are measure using AVL 5-gas analyzer. The results show significant improvement in the reduction of greenhouse gases. CO, HC, CO2, CO and O2 are measured and reported in the present work.

Introduction

Bio-diesel is produced from vegetable oils and animal fats [1]. The main sources for bio-diesel for production can be non-edible oils obtained from seeds of Jatropha Curcas, Pongamia Pinnata, Calophyllum inophyllum, Hevca brasiliensis etc. [2]. Bio-diesel can be blended with diesel to create a bio-diesel blend. Bio-diesel operating in CI requires little or no engine modifications [3]. Further, these bio-diesels can be stored easily and does not require special infrastructure. The emission from conventional diesel engines such as HC, CO, CO2 and PM are reduced due to the implementation of bio-diesel [4]. Bio-diesels are mainly esters and hence contains oxygen molecule in it. Further, no Sulphur component and no aromatic compounds are present thereby helping it to burn completely [5,6,7,8,9]. Higher cetane number of Bio-diesel aids the quality of ignition even in blended form.

RESULTS & DISCUSSIONS

Table 1 shows Exhaust emissions with High Speed Diesel (HSD). Table 2 shows Exhaust emissions with High Speed Diesel (HSD) and 10% Biodiesel (POME). Table 3 shows Exhaust emissions with High Speed Diesel (HSD) and 20% Biodiesel (POME). Table 4 shows Exhaust emissions with High Speed Diesel (HSD) and 30% Biodiesel (POME).

Table 1: Exhaust emissions with High Speed Diesel (HSD)

LOAD kg	HC (HSD) Ppm	CO (HSD) % vol	CO2 (HSD) % vol	NO2 (HSD) ppm	O2 (HSD) % vol
0	15	0.04	1.9	96	18.07
3.5	26	0.04	2.4	212	17.18
6.5	27	0.03	3.2	444	15.92
9	24	0.03	4	648	14.7
15	21	0.02	6.5	1200	12.1

Table 2: Exhaust emissions with High Speed Diesel (HSD) and 10% Biodiesel (POME)

LOAD	HC	CO	CO2	NO2	O2
kg	ppm	% vol	% vol	ppm	% vol
0	17.1	0.0416	2.55	25	18.9
3.5	29.2	0.0386	3.07	144	18.5
6.5	28.8	0.029	4.2	316	17.4
9	25.3	0.0283	5.4	553	14.7
15	23.2	0.0171	6.89	972	10.9

Table 3: Exhaust emissions with High Speed Diesel (HSD) and 20% Biodiesel (POME)

LOAD kg	HC (20%BD) ppm	CO (% vol	CO2 (20%BD) % vol	NO2 (20%BD) ppm	O2 (20%BD) % vol
0	18.5	0.0274	3.77	25	17.5
3.5	29.5	0.0302	4	101	15.9
6.5	31.3	0.0228	4.5	200	15
9	27.7	0.0203	6.68	381	13.8
15	27.4	0.009	8.5	775	10.9

Table 4.: Exhaust emissions with High Speed Diesel (HSD) and 30% Biodiesel (POME)

LOAD kg	HC (30%BD) ppm	CO (30%BD) % vol	CO2 (30%BD) % vol	NO2 (30%BD) ppm	O2 (30%BD) % vol
0	20.1	0.0161	4.1	20	16.3
3.5	33.4	0.0296	4.8	98	14.8
6.5	37.2	0.0202	5.1	185	13.6
9	30.1	0.0182	7.2	301	12.9
15	29.2	0.004	9.3	703	9.8

Results show that the emissions are minimized with 30 % Biodiesel blend with HSD. Fig 6.1 shows the variation of HC emissions with High speed diesel (HSD) and also with blends composition ranging from 10 % to 30 % with Palm oil Methyl Ester (POME).

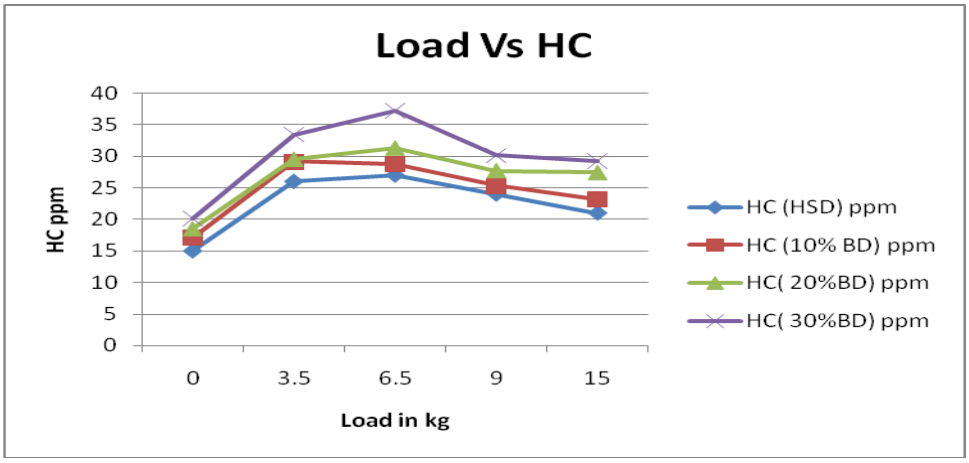

Fig 1 HC Vs Load

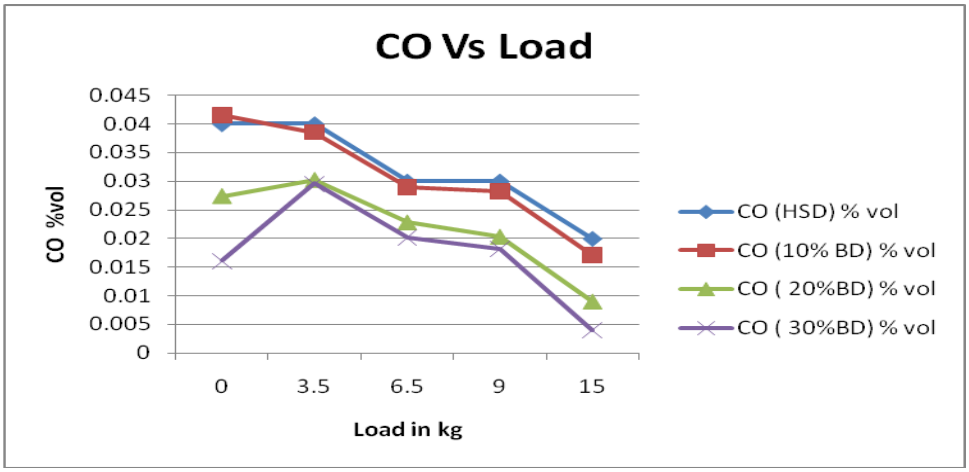

Fig 2 CO Vs Load

Fig 6.2 show that CO emissions are not much varied with 20 % and 30 % blends. Fig 6.3 shows that CO_2 emissions are drastically differing with CO emissions which indicate that the oxidation of the CO to CO_2 is expected with percentage increase of the POME with HSD.

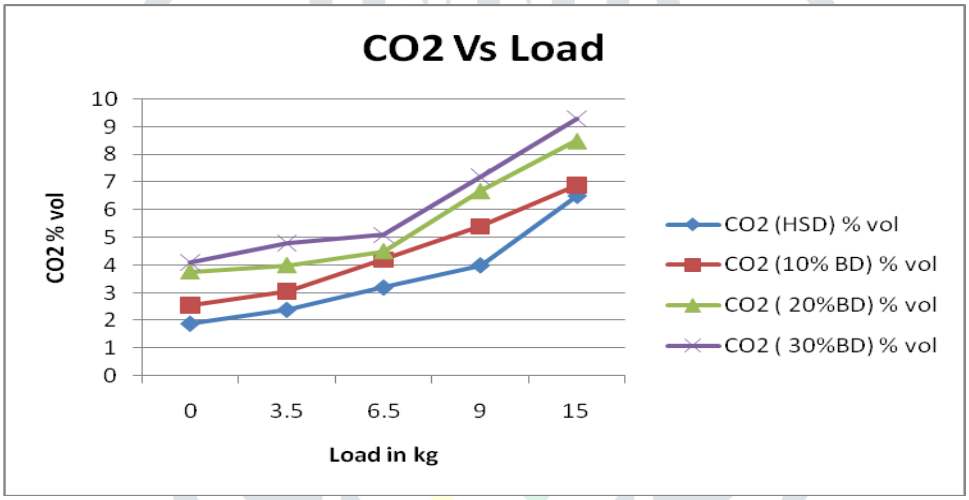

Fig 3 CO_2 Vs Load

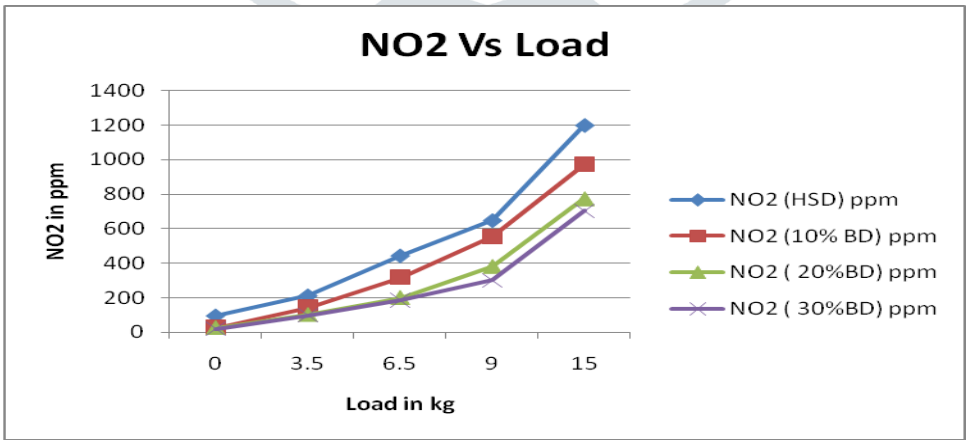

Fig 4 NO_2 Vs Load

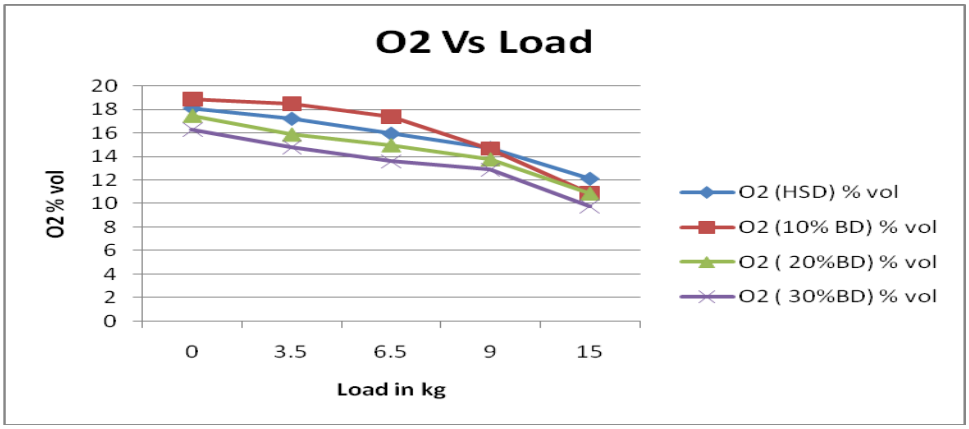

Fig 5 O_2 Vs Load

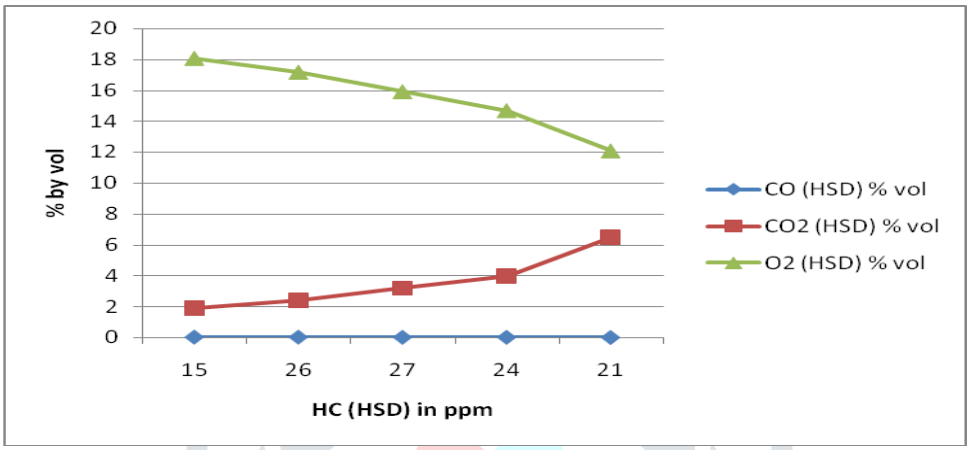

Fig 6 HC Vs CO, CO_2 and O_2 % by vol

Fig 6.4 shows that NO2 emissions are minimized when the 30% blend with HSD is used. Fig 6.5 reveals that the O2 emissions with load decreases. This is due to more oxidation of exhaust emissions take place to form CO2 rather than CO emissions. Fig 6.6 shows with respect to the same composition (pure HSD) and with respect to HC emission, the CO emissions are minimized as compared to CO2 and O2.

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