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Hydrocarbon Emission Analysis of Single Cylinder Diesel Engine for Acacia Nilotica (Babul Seed) Biodiesel

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Abstract - *Foremost requirement of population for healthy life is clean air. Tremendous growth in industrial and transport sector is responsible for emission of harmful gases causing prominent effect on human health and environment. Due to recent advancement in technologies, conventional fuel consumption rate has increased rapidly which has contributed multiple times to pollution. Conventional fuel which are based on fossil fuel are limited and are depleting with time. This made researches interest in developing alternative which is sustainable, ecofriendly and economic. Biodiesel is becoming prominent alternative for conventional fuel due to numerous advantages .Following paper represents investigation result carried to study Hydrocarbon emission of single cylinder, four stroke diesel engine using babul bio fuel and blend with diesel. It is observed that for blend 5% Hydrocarbon emission reduces and can be suitable alternative helping in controlling pollution of air.*

Keywords:- **Diesel engine, Babul seed biodiesel, emission, hydrocarbon, Prediction equation**

1. INTRODUCTION

From last few decades developing countries are focusing on advancement for faster development. This development may be in various sectors like transportation, industrial etc which intern has increased demand for conventional fuel. Conventional fuel are prominently responsible for increasing pollution and affecting environment adversely and rate of fuel consumption is increased, its demand has also increased causing its depletion. This made researches interest in developing alternative which is sustainable, ecofriendly and economic. Due to similar properties as conventional fuel and numerous advantages biodiesel has became potential alternative. Recent studies and research have made it possible to extract bio-diesel at economical costs and quantities. Major role of biodiesel is to form balanced policy, energy security and increase diesel longetivity. The blend of Bio-diesel with fossil diesel has many advantages like it is biodegradable, environmental friendly and economic. It has been seen that if whole lifecycle of biodiesel is considered it almost emits zero percent of sulphates , net small quantities of other pollutant and significantly has reduced emission up to 85% of carcinogenic compound It is observed that efficiency of engine increases and emission is controlled by use of Bio-diesel making it sustainable energy source. "Transesterification" method is used for production of biodiesel from vegetable oil. An alcohol and With the oil, alcohol is mixed in presence of catalyst so to crack in esters and glycerin is substituted by alcohol due to catalyst , and from mixture the heavy weight glycerin are to falls, leaving behind alkyl esters. Alkyl esters of fatty acids are left after removal of glycerol that is called as Biodiesel. Babul seeds has potential to extract oil from it and required properties for its use as biofuel and hence is used for making biodiesel.

2.EXPERIMENTAL SETUP AND DESIGN OF EXPERIMENT

2.1. Biodiesel produced from babul seed was tested using a single cylinder, four stroke diesel engine. Through fuel filter, fuel enters in engine. In fuel filter, filtration takes place and particular work is done by combustion at the end of working and from outlet manifold emission is exhausted. Exhaust emission is analysed using AIRREX HG-540 4-GAS EMISSION ANALYSER. Nearly for 20 years this analyzer has been produced and enhanced with time .The airrex hg-540 4-gas emission analyzer is used to measure emission from exhaust like HC,O2,CO,CO2,NOx. In a hard case with all accessories as a complete the analyzer comes and has ready-to-use gas analyzer. Switch on the power, make connection of the hose and probe, push the Zero button. The analyzer is ready for measurement of exhaust emissions gas when the zero is complete. In present paper emission for HC is measured.

AIRREX HG-540 5-gas emission analyzer

2.2 Specifications

AIRREX HG-540 5-GAS EMISSION ANALYSER

Range of measurement :

o CO : 0~9.999%(0.001%)

CO_2 : 0~20.00%(%)

HC : 1~15,000ppm(1ppm)

O_2 : 0~25.00%(0.01%)

NOX 0~5000ppm(1ppm)

Response: 10sec. (more than 90%) o_2, Nox≤20sec

- Auto Zero:20sec
- Repeatability: ≤±2%FS
- Operational temp: 0°c ~40°c
- Measuring Method: HC, CO,CO_2-NDIR (Non-dispersive infrared)
- Measuring Method: O_2 No_x-Electrochemical
- Built in thermal printer
- Fuel selectable(Gasoline/LPG/CNG/Alcohol)
- Leakage Test
- HC residual test
- RS-232communication
- 4 Gas (Model: HG-540) & 5Gas(Model:HG-550)
- Weight: About 5kg
- Power supply: AC 110/220v, 50/60Hz

2.3. Emission is measured using following condition

Compression Ratio : 18

load : 0 , 4, 8,12

Blend% : 5, 10, 15,20

biodiesel : Babul seed

Total 20 trial are carried for above combination. as per given below

Sr. No.	C.R.	Load	Blend
1.	18	0	0
2.	18	4	0
3.	18	8	0
4.	18	12	0
5.	18	0	5
6.	18	4	5
7.	18	8	5
8.	18	12	5
9.	18	0	10
10.	18	4	10
11	18	0	10
12	18	4	10
Sr. No.	C.R.	Load	Blend
13	18	8	15
14	18	12	15
15	18	0	15
16	18	4	15
17	18	8	20
18	18	12	20
19	18	0	20
20	18	4	20

3. TESTING PARAMETERS AND HYDROCARBEN (EXPERIMENTAL)

Hydrocarbon (Experimental)			
Sr, No	% Blend	Load	HC
1	0	0	0
2	0	4	0
3	0	8	4
4	0	12	32
5	5	0	0
6	5	4	0
7	5	8	0
8	5	12	25
9	10	0	0
10	10	4	0
11	10	8	2
12	10	12	28
13	15	0	0
14	15	4	0
15	15	8	3
16	15	12	38
17	20	0	0
18	20	4	23
19	20	8	50
20	20	12	113

4. HYDROCARBON EMISSION BY REGRETION EQUATION

Regression equation for prediction of HYDRO CARBON for %Blend and load by using MINITAB 19 Software as given

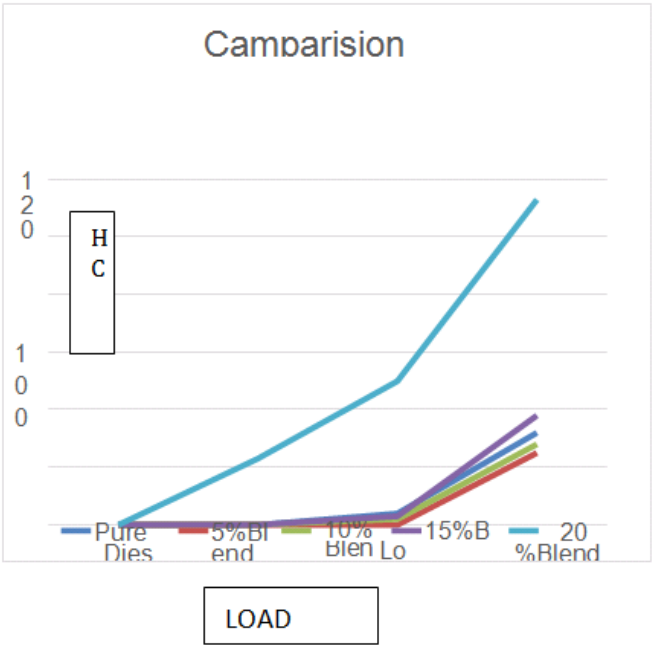
HC = -22.22+ 1.580 Blend +3.720 Load

Hydrocarbon By Regression Equation			
Sr, No	% Blend	Load	HC
1	0	0	22.22
2	0	4	7.34
3	0	8	4.54
4	0	12	29.42
5	5	0	14.32
6	5	4	0.56
7	5	8	15.44
8	5	12	30.32
9	10	0	6.42
Sr, No	% Blend	Load	HC
10	10	4	8.46
11	10	8	2.334
12	10	12	38.22
13	15	0	1.48
14	15	4	16.36
15	15	8	3.124
16	15	12	46.12
17	20	0	9.38
18	20	4	24.26
19	20	8	49.14
20	20	12	104.02

5. RESULT TABLE

HYDROCARBON% Error between experimental and Regression Equation					
Sr. No.	Load	% Blend	HC(Expt.)	HC(RE)	% Error
1	0	0	0	22.22	0
2	4	0	0	7.34	0
3	8	0	4	4.54	13.5
4	12	0	32	29.42	8.06
5	0	5	0	14.32	0
6	4	5	0	0.56	0
7	8	5	0	15.44	0
8	12	5	25	30.32	21.28
9	0	10	0	6.42	0
10	4	10	0	8.46	0
11	8	10	2	2.334	16.7
12	12	10	28	38.22	36.5
13	0	15	0	1.48	0
14	4	15	0	16.36	0
15	8	15	3	3.124	4
16	12	15	38	46.12	21.36
17	0	20	0	9.38	0
18	4	20	23	24.26	5.47
19	8	20	50	49.14	1.72
20	12	20	113	104.02	7.94

6. GRAFICALLY ANALYSIS OF HYDROCARBON AT VARIOUS LOAD AND % BLEND



7. CONCLUSIONS

After Analysis of HC emissions from single cylinder ,four stroke diesel engine at variable load 0,4,8,12 and constant compression ratio of 18 for babul biodiesel and its blend , it has been observed that

1. Emission of hydrocarbon highly depends upon load

2. Hydrocarbon emission increases as load increases.

3. At maximum load, hydrocarbon emission is minimum for 5% blend emission is 25%, 10%blend it is 28% ,15%blend it is 38 and for 20%blend 113%

4. It is efficient and safe when operated at minimum load

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