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Emission Study on SI Engine Fuelled with Petrol and ISO-butanol Blends

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Abstract—*An Emission study was carried out on a 4Stroke Single Cylinder with Electrical load Spark Ignition Engine at constant speed of 3000rpm for all loads, Fuelled with petrol and Iso-Butanol blends at different proportions i.e IBu0%, IBu10%, IBu20%, IBu30%, IBu40%. All blends are by volume based Proportions. The Engine Emission parameters like CO, HC, CO_2 emission readings were analyzed and discussed at Full load and partial load for the above mentioned fuel blends compared with base line readings of petrol. The Experimental results showed that the Reduction of CO, HC, CO_2 Emission levels for blended fuels when compared with pure petrol at both.*
Full load and partial loads. From the analysis Iso-Butanol is found to be a better alternative fuel (or) fuel blend to petrol for Reduction of polluting Emissions.

Keywords: *Iso-butanol, Alcohols, Iso-butanol-Gasoline blend, Emission, Alternative Fuels.*

1. INTRODUCTION

Iso-Butanol is a longer chain hydrocarbon The Iso-butanol can be used in vehicles with petrol without any modification of the engine. So the Iso-butanol can be used as an additive fuel with petrol in SI Engine's Operation.

Bio-butanol is having high energy content but little lesser to petrol. Bio-butanol having ability to reduce green house gas emission level. At present Ethanol at millions of gallons was added with petrol, but ethanol is having lower energy content per gallon as compared to petrol. So the Iso-butanol (or) the Bio-butanol can be blended with petrol up to the optimum level, without any modification of the engine. So, the butanol is a much better fuel blend (or) an alternative fuel along with petrol, so the Iso- butanol emerging reputation as "the gasoline of the future".

2. BACKGROUND

[2]- Neat n-butanol reduced the tendency to knock. Engine torque can be improved at full load with n-butanol as compared to gasoline. By the use of butanol general decrease in NO_x Emissions significant Change in CO Emissions. The knock limited spark timings were more advanced because of the reduction in the charge temperature with butanol. This enabled higher torques to be achieved. [3]-Use of N-Butanol improves the torque and efficiency at higher throttle position. Injecting n-butanol just before the start of injection of gasoline is beneficial for reducing HC and CO emissions than simultaneous injection. Engine performance also improves by the use of butanol at wide range of operating conditions and ratio of the fuels can be varied. [4]- Positive results have been achieved in the engine torque, BSEC, CO emission and HC emission with 35% volume butanol and 1% H_2O addition, combined with using the modified ignition timing. But NO_x and CO emissions go up. The influences of butanol–gasoline blend on engine performance, fuel economy and emissions have the same trend at engine full load and partial load. [5] - Use of pure N-butanol, (i) HC, CO Emissions and decreases NO_x and particle number concentration compared to those of gasoline. (ii). Specific HC, CO and NO_x emissions fueled with gasoline and n-butanol blends are lower than those of gasoline. [6]. Due to N-butanol Volume Fraction, 1.Auto ignition (timing) of the fuel advances, 2. Aldehyde's concentration is high, 3.Combustion duration is decrease.

3. BLENDING METHOD

For my project I took the blends of IB0%, IB10%, IB20%, IB30%, IB40% and All the blends are by volume based mixed proportions. Here Petrol is blended with Iso-butanol, after it is kept in to airtight crucible. Then it was kept in a rotator. All the blends are divided in too many small blends. Then the crucible was kept on the rotary rotator. Initially it looks like two different layers, when the blending ratio was increased that time the small, small precipitation layers can be seemed in the fuel. Before start blending the Iso-butanol with petrol, if Iso-butanol was added more and more like IB0%, IB10%,

IB20%, IB30%, IB40% etc… the white precipitation color can be seemed clearly. "It indicates that the volume fraction will occur in between the Iso-butanol and petrol". Then the rotator starts to rotates up to we required to get the uniform layer throughout the whole fuel. It indicates the Iso-butanol will be well blended with petrol. Crucible top was covered with air-tight cock. So, there is no vaporization will takes place.

4. SPECIFICATION OF THE TEST ENGINE

Maximum HP - 3HP, at 3000RPM
Rated Power - 2.28kw at 3000RPM
Capacity of Operation- Four Stroke
Capacity - 256cc
Cylinder Bore - 70mm
Stroke - 66.7mm
SFC - 600KWH
Alternator Capacity connected with SI
Engine - 1.2 kw (Electrical Load)

5. AVL EMISSION GAS ANALYZER:

Fig. 1

6. TEST ENGINE PHOTO

For Experimental- Spark Ignition Engine

Fig. 2

7. EXPERIMENTAL WORK ON TEST ENGINE

The Four stroke single cylinder Shriram mini-Gen set 256cc Honda engine as a test engine for my project work. The Engine is coupled with 1.2Kw alternator. Electrical load was applied on the engine by through the alternator by the steps of 0kw to 1.2kw in each steps 200watts were increased the load on the engine up to 1.2kw. Followed by the load was decreased from 1.2kw to 0kw. Here emission readings were studied by the fuel blends of IBu0%, IBu10%, IBu20%, IBu30%, IBu40% by the help of AVL emission gas analyzer. Here I was studied the HC, CO, CO_2 emissions. Here I plotted the Emission Result Readings from full load to No load followed by No load to Full load by the help of above Shriram mini-Gen set 256cc Honda engine. All values are plotted in graph as in Percentage values.

8. RESULT AND DISCUSSION

From NO Load to Full Load Emission Readings (0kw to 1.2kw):

Hydro-Carbon (HC):

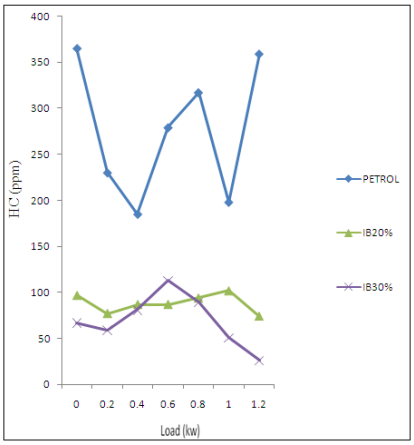

Fig. 3

9. AT FULL LOAD

- Decreasing HC Emission for the fuel blend IB30% in percentage-92.75% as compared to the base line readings of petrol.
- Decreasing HC Emission for the fuel blend IB20% in percentage-79.38% as compared to the base line readings of petrol.

10. AT PARTIAL LOAD

- Decreasing HC Emission for the fuel blend IB30% in percentage-71.92% as compared to the base line readings of petrol.

11. CARBON MONOXIDE(CO)

At Full Load

- Decreasing CO Emission for the fuel blend IB30% in percentage-92.00% as compared to the base line readings of petrol.

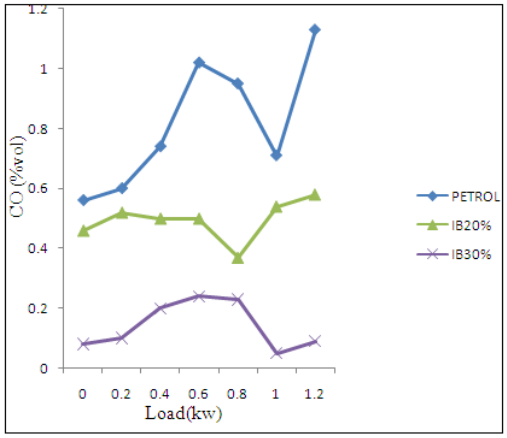

Fig. 4

- Decreasing CO Emission for the fuel blend IB20% in percentage-48.67% as compared to the base line readings of petrol.

12. AT PARTIAL LOAD

- Decreasing CO Emission for the fuel blend IB30% in percentage-75.78% as compared to the base line readings of petrol.

13. CARBON-DI-OXIDE (CO_2)

At Full Load: (Fig.No:5)

- Decreasing CO_2 Emission load the neat Petrol is much opted as compared to all other fuel blends.

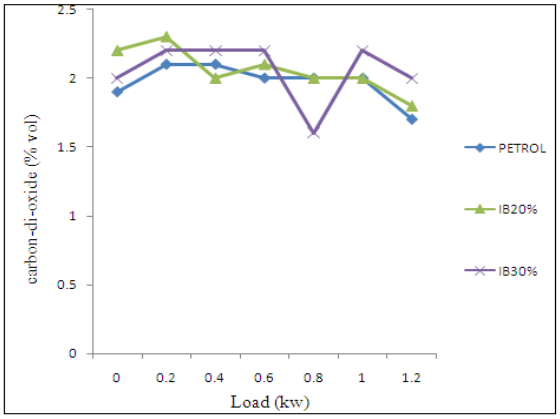

Fig. 5

At Partial Load: (Fig.No:5)

- Decreasing CO_2 Emission for the fuel blend IB30% in percentage- 20% as compared to the base line readings.

From Full Load to No Load Emission Readings (1.2kw to 0kw)

Hydro-Carbon (HC)

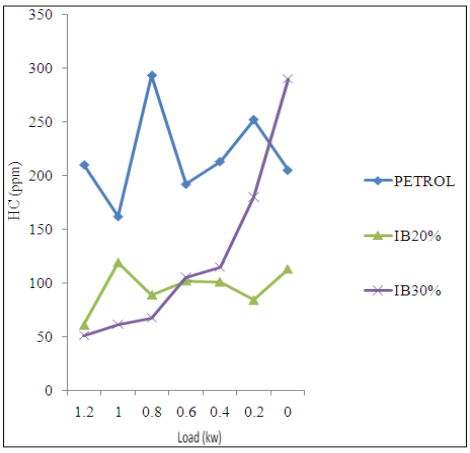

Fig. 6

At Full Load: (Fig.No: 6)

Decreasing HC Emission for the fuel blend IB30% in percentage-75.714% as compared to the base line readings of petrol.

- Decreasing HC Emission for the fuel blend IB20% in percentage-70.95% as compared to the base line readings of petrol.

At Partial Load: (Fig.No: 6)

- Decreasing HC Emission for the fuel blend IB30% in percentage-77% as compared to the base line readings of petrol.

Carbon Monoxide (CO)

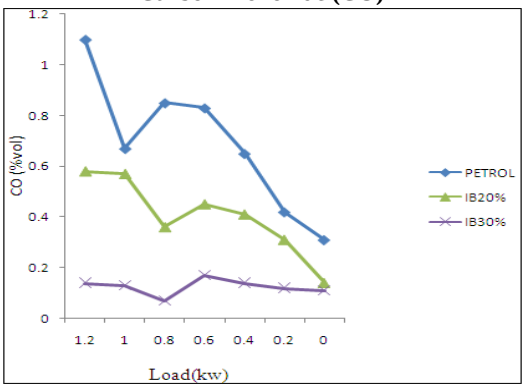

Fig. 7

14. AT FULL LOAD

- Decreasing CO Emission for the fuel blend IB30% in percentage-87.27% as compared to the base line readings of petrol.
- Decreasing CO Emission for the fuel blend IB20% in percentage-47.27% as compared to the base line readings of petrol.

15. AT PARIAL LOAD

- Decreasing CO Emission for the fuel blend IB30% in percentage-91.76% as compared to the base line readings of petrol.

16. CARBON-DI-OXIDE (CO_2)

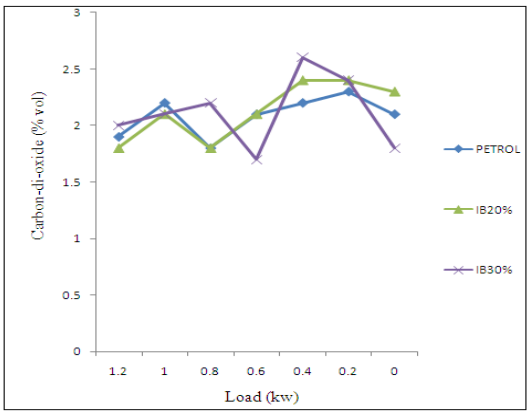

Fig. 8

(From Fig. 8)

- Decreasing CO_2 Emission at Full Load for the fuel blend IB20% in percentage-5.26% as compared to the base line readings of petrol.
- At Partial Load For Reducing CO_2 Emission For the fuel blend of IB20% and Neat Petrol, both are too good.

17. CONCLUSION

As I Carried out Emission Study on 4Stroke, Single Cylinder Mini-GenSet 256cc Honda Engine, I was studied the following Results:

- For Reducing HC and CO Emissions at both Load conditions (From No Load to Full Load followed by Full load to No load) for the Fuel blends of IB30% and IB20% are much best as compared to the base line reading
- For reducing CO_2 Emission for the fuel blend of IB20% then neat petrol is much opted.

18. AT PARTIAL LOAD

- For reducing HC (77%) and CO (91.76%) Emissions at both Load conditions IB30% fuel blend is very reputed blend.
- For reducing CO_2 Emission IB30% , IB20% and Neat Petrol all are much best.
- Finally I was concluded for Reducing HC,CO,CO_2 Emissions for the fuel blend of IB30% is much Optimized blend as compared to Base line and other fuel blends at both Engine Load Conditions.

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