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Research Article

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Study of emission characteristics of single cylinder four stroke spark ignition engine using gasoline-ethanol blends

Krishna Mohan Agarwal, Mayank Chhabra and R. K. Tyagi

Amity School of Engineering and Technology, Amity University, Noida, India

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ABSTRACT

Ethanol is considered as an alternative fuel for spark ignition engine because of its ability to reduce the air pollution and cost of the fuel. The purpose of this experimentation is to investigate the emission characteristics of a single cylinder four stroke petrol engine using ethanol–gasoline blended fuels with various blends (0%, 20%, 40%, 60%, 80% and 100%). Exhaust emissions were analyzed for CO, CO_2, NOx and HC by using different ethanol gasoline blends on volume basis at 1/4 throttle and variable engine speed from 1000 to 4000 rpm. Results were compared with the pure gasoline. It showed that as the ethanol content in blend increases, HC and CO emission decreases as a result of the leaning effect caused by the ethanol addition whereas CO_2 and NOx emission increases.

Keywords: SI engine, gasoline – ethanol blends

INTRODUCTION

Energy is the most important requirement for any of the activity. For this energy, some fuels are required but these fuels are not available in abundance. Basically these fuels play a very important role in the modern development and rapid industrialization. The important fossil fuels are Coal, Petroleum and Natural Gas. The automobiles are the most important sector for the social development; it has enhanced the life standards of the human beings. But these are causing a lot of pollution.

Decreasing emissions from automobiles and increasing engine efficiency are necessary steps towards improving air quality and reducing green house effect. Transportation vehicles are the largest consumer of imported oil and a major source of pollution that affects the air quality. It is well known that alcohol addition to SI Engines can reduce the exhaust emissions and increase its efficiency. With the addition of alcohol to the gasoline, SI Engines can run on lean air fuel ratios and this lean operation of SI Engines can reduce NOx emissions by a significant amount relative to NOx emissions at stoichiometric conditions. Some researchers also studied the emission characteristics of engine on other alternate fuels like hydrogen and gasoline blends and also on biodiesels.

EXPERIMENTAL SECTION

The engine selected for the performance and emission test is very much popular in small two wheelers such as motorbike and scooters and small gensets. This is basically a single cylinder Four stroke air cooled spark ignition petrol engine.

Engine specifications

Following are the Engine specifications for the present investigations.

TABLE I Engine specifications

1	Honda; SI Engine	5 BHP @ 3600 rpm
2	Bore	76 mm
3	Stroke	60 mm
4	Cubic capacity	272 cc
5	Rated speed	3600 rpm
6	Maximum speed	3600 rpm
7	Minimum speed	800 rpm
8	Compression ratio	6.5 : 1

Following test fuels are used for the present investigations along with pure gasoline. Different fuels are designated as follows.

TABLE II Test fuels

1	E 0	Ethanol 0% and Gasoline 100%
2	E 20	Ethanol 20% and Gasoline 80%
3	E 40	Ethanol 40% and Gasoline 60%
4	E 60	Ethanol 60% and Gasoline 40%
5	E 80	Ethanol 80% and Gasoline 20%
6	E 100	Ethanol 100% and Gasoline 0%

TABLE III Fuel properties of blends

S.No	Blends	Calorific Value, KJ/Kg	Specific Gravity
1	E 0	44000	0.740
2	E 20	40580	0.749
3	E 40	37160	0.758
4	E 60	33740	0.767
5	E 80	30320	0.776
6	E 100	26900	0.785

Calculation of Emission parameters

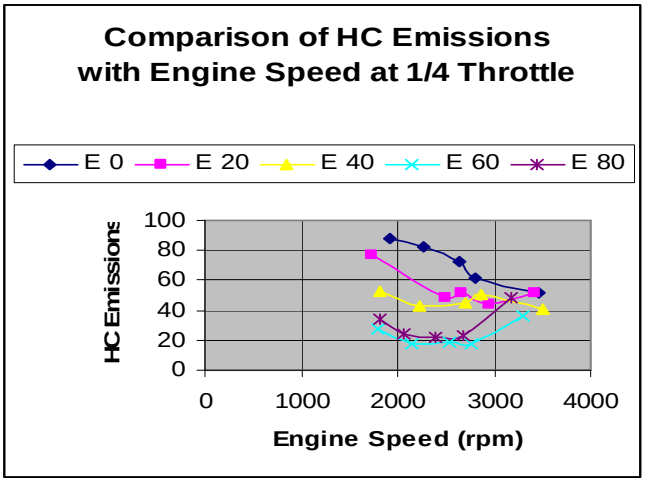

Fig. 1 comparison of HC Emission at ¼ throttle (gasoline-ethanol blend)

Figure shows the comparison of HC Emissions at ¼ throttle of different blends gasoline – ethanol. In general as the speed increases, the HC emissions decreases. Further, with the increase of ethanol percentage in the blended fuel, the HC emissions decreases.

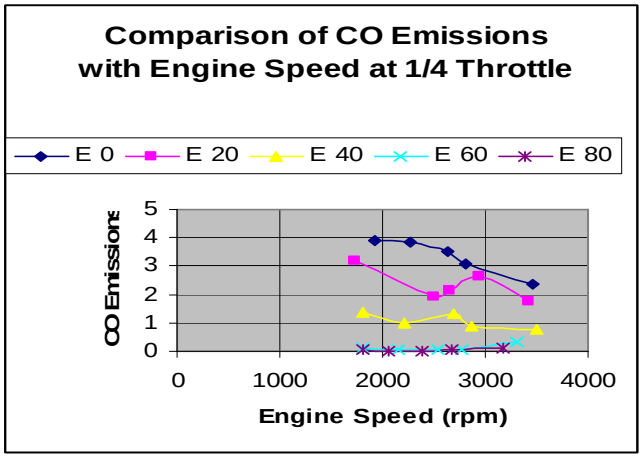

Fig. 2 comparison of CO Emission at ¼ throttle (gasoline-ethanol blend)

Figure shows the comparison of CO emissions at ¼ throttle of different blends gasoline – ethanol. In general as the speed increases, the CO emissions decreases. Further, with the increase of ethanol percentage in the blended fuel, the Co emissions decreases drastically.

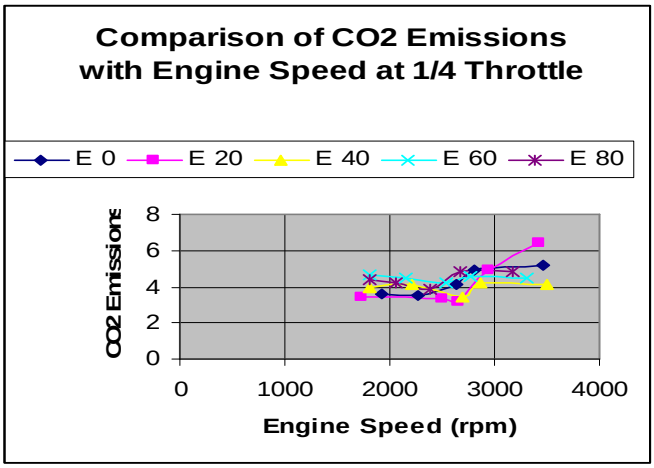

Fig. 3 comparison of CO_2 Emission at ¼ throttle (gasoline-ethanol blend)

Figure shows the comparison of CO2 emissions at ¼ throttle of different blends gasoline – ethanol. In general as the speed increases, the CO2 emission increases. Further, with the increase of ethanol percentage in the blended fuel, the CO2 emission increases.

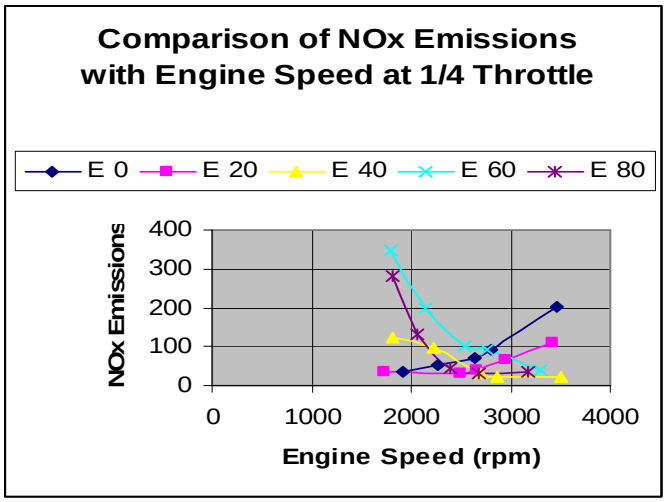

Fig. 4 comparison of NOx Emission at ¼ throttle (gasoline-ethanol blend)

Figure shows the comparison of NOx emission at ¼ throttle of different blends gasoline – ethanol. In general as the speed increases, the NOx emission increases. Further, with the increase of ethanol percentage in the blended fuel, the NOx emission increases.

CONCLUSION

Experimental investigations were carried out using single cylinder four stroke spark ignition engine. The results and conclusions obtained from the present investigations are as follows:

1. As the percentage of ethanol in blend increases, HC and CO emission decreases as a result of the leaning effect caused by the ethanol addition whereas CO2 and NOx emission increases due to improved combustion.
2. At higher ethanol blends, emission of CO reduced between 2 to 29 %, CO_2 increased by 6 to 18 %, HC falls between 20 to 49 % and NOx reduced between 60 to 76 %.
3. Hence, blending mechanism works effectively and hence improved engine combustion performance and emission reduction.

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