International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Comparative Study of Performance of Two Wheeler Using Ethanol-Gasoline Blends

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Abstract: ***This work deals with the performance study of a two wheeler using gasoline and different Ethanol-gasoline blends as fuel. The experiment is conducted on a two- wheeler chassis dynamometer, to determine the vehicle performance in terms of power, acceleration and fuel consumption. The performance is studied on Ethanol-Gasoline blends of various percentages ranging from 5-18% Ethanol in Gasoline and Compared with the performance of the vehicle using 100% gasoline. Also emission characteristics of the vehicle are determined for the vehicle operating on different ethanol-gasoline blends. The results show that the E8 and E16 Ethanol-Gasoline blends show a comparatively good performance compared with that of pure gasoline.***

Keywords: Alternative fuels, Ethanol, gasoline-ethanol blends, Emission

1. Introduction

Alcohols have been suggested as an engine fuel almost since automobile was invented [1]. Ethanol which is a colorless liquid with mild characteristic odor and can be produced from coal, natural gas and biomass, have high octane rating and can be used as one of the realistic alternative fuels. As fuel, it is renewable and having a higher octane rating than gasoline with similar storage and dispensing and can be mixed with conventional fuels (diesel fuel or gasoline) [2]. It is known as the most suited fuel for spark-ignition (SI) engines [3, 4] and can be used in SI engines as pure or by blending with gasoline [4, 5, 6] Ethanol can be blend with gasoline at low concentrations without any modification to be used in SI engine [7]. Ethanol–gasoline blends (gasohol) can be used as fuel in order to substitute some part of gasoline in engine applications. It was reported that using gasoline–ethanol blends including ethanol at low concentrations could improve engine performance and exhaust emissions [7, 8]; such as increasing the octane rating, which is particularly important in unleaded fuel, and reduce carbon monoxide (CO) emissions from the engine. This led the gasohol (a mixture of 10% alcohol with 90% gasoline) to be a commercial fuel in over 35 countries of the World including the USA, Canada and France [9].

Gasohol gain importance within these recent years as alternative fuel due to this high octane number, especially with ethanol which has low carbon [10]. Alternative renewable fuels such as bioethanol-gasoline blended fuels are becoming essential due to increasing oil prices, environmental concerns and their potential to preserve the agricultural activity. Ethanol–gasoline blends which has high octane rating can be used as fuel in order to substitute some part of gasoline in engine applications as it has higher heat of vaporization compared to gasoline, which means that freezes the air allowing more mass to be drawn into the cylinder and increases the power output [11].

Palmer (1986) [12] indicated that 10% ethanol addition increased the engine power output by 5%, and the octane number can be increased by 5% for each 10% ethanol added. Abdel-Rahman and Osman (1997) [13] had tested 10%, 20%, 30% and 40% ethanol of blended fuels in a variable-compression-ratio engine and found that the increase of ethanol content increased the octane number, but decreased the heating value. Under various compression ratios of engine, the optimum blend rate was found to be 10% ethanol with 90% gasoline. Later, Hsieh et al (2002) investigated the engine performance and pollutant emission produced by commercial SI engine using ethanol–gasoline blended fuels with various blended E0, E5, E10, E20, and E30 which were classed into its group with ASTM standard analysis. The ‘‘E’’ designates ethanol and the number next to E designates the volume percentage of ethanol in the total fuel blend. The outcomes showed that by increasing the ethanol content, the heating value of the blended fuels was decreased, the octane number of the blended fuels increased while better combustion can be achieved and higher torque output can be acquired.

It is well understood from the above literature review that using ethanol in SI engines by blending with gasoline is more practical than using it alone. If ethanol production can meet the demand and the cost of blended fuels can compete with that of conventional gasoline, widespread use of gasoline–ethanol blends can be possible. However, before using these blends in engines, the whole effects on engine must be evaluated. For this reason, the present study is focused on this topic. Here, the effects of ethanol addition to gasoline in various concentrations on engine performance and exhaust emissions are examined by conducting both theoretical and experimental studies.

2. Methods and Methodology

Blending of ethanol and gasoline used for this experiment

Code	*% Ethanol*	*% Gasoline*
E5	5	95
E8	8	92
E10	10	90
E12	12	88
E14	14	86
E16	16	84
E18	18	82

The ''E'' designates ethanol and the number next to E designates the volume percentage of ethanol in the total fuel blend.

2.1 Experimental Setup

This work deals with the performance study of two wheeler four stroke BAJAJ pulsar 200 DTS-I vehicle using ethanol as alternative fuel was carried out on chassis dynamometer. Chassis dynamometer is an apparatus where in the road condition can be simulated in lab itself. Which can be termed as all weather roads for the test vehicle? Chassis dynamometer is an apparatus which is used at the end of the production line and is designed for testing the two-wheeler coming off the production line. It would work as a comparator stand to identify the performance of a vehicle with respect to standard specification.

Emission study was carried out using 4-gas analyzer used for analysis of the exhaust gases of Otto cycle engines by using infrared sensors. It is essential to check the values of CO, HC, CO_2 and O_2 exhaust from the engine and to set it correctly. ECO GAS-4 can also measure engine speed (RPM). ECO GAS-4 uses an optical bench for gas analysis by NDIR (non dispersive infra red) technique.

3. Result and Discussions

3.1 Power Test

Figure a and b indicate the power in KW and torque in N-m available at the wheel respectively for the test vehicle running under gasoline and different ethanol-gasoline bends. It is found that the E8 and E16 ethanol gasoline blends show better torque and power characteristics when compared with that of gasoline and the remaining ethanol-gasoline blends.

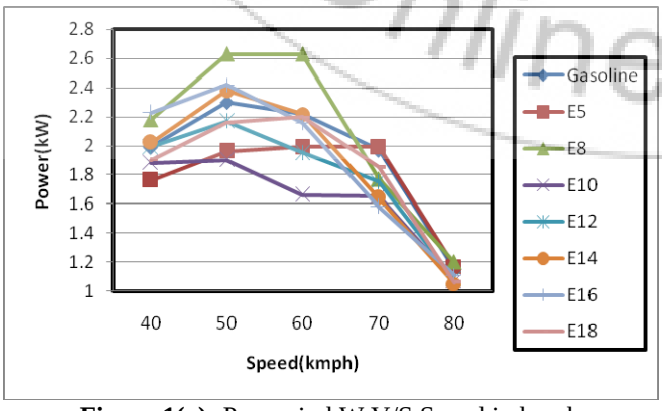

Figure 1(a): Power in kW V/S Speed in kmph

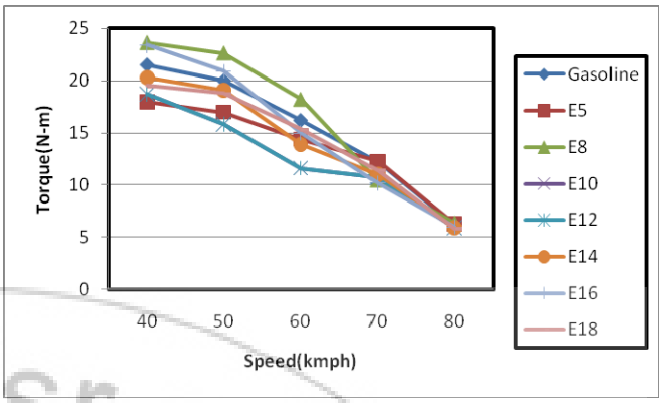

Figure 1 (b): Torque in N-m V/S Speed in kmph

3.2 Fuel Consumption Test

Figure 2 indicate that the fuel consumption characteristics for the test vehicle used. The mileage is better in gasoline than all the other blends. However it is found that among the ethanol-gasoline blends, E5 and E10 have better mileage compared to the other blends with E8 and E16 being under the lower side.

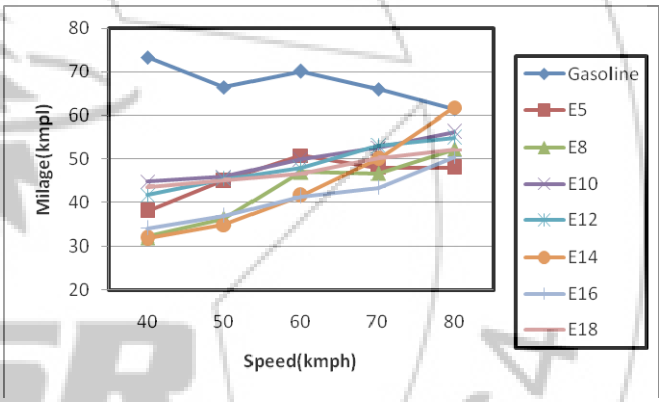

Figure 2: Fuel consumption V/s Speed in kmph

3.3 Acceleration Test

Figure 3 indicates the time for acceleration from 10-60 kmph for gasoline and ethanol-gasoline blends for the vehicle. It is found that acceleration time is less for E8 and E16 blends when compared to gasoline and other blends. This may be due to the fact that we have increases torque and power characteristics at these two blends.

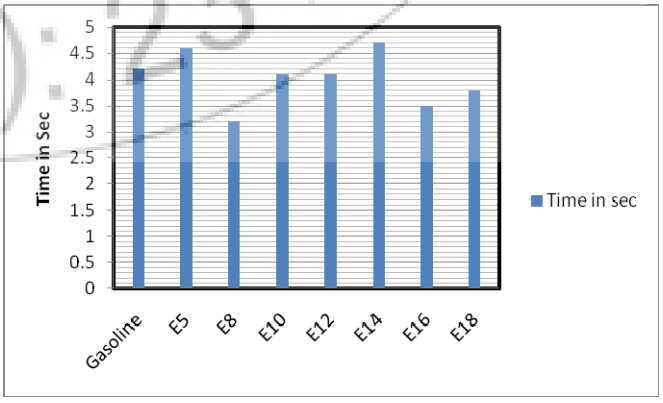

Figure 3: Time for acceleration V/s Fuel used

3.4 Emission Test

Figure 4 indicated the values for emission constituents using eco 4 gas analyzer for the test vehicle using different ethanol gasoline blends and gasoline. It is found that the emission characteristics for carbon monoxide, HC and O_2 improve considerably at higher blends. However it is found that carbon dioxide emissions increase at higher blends.

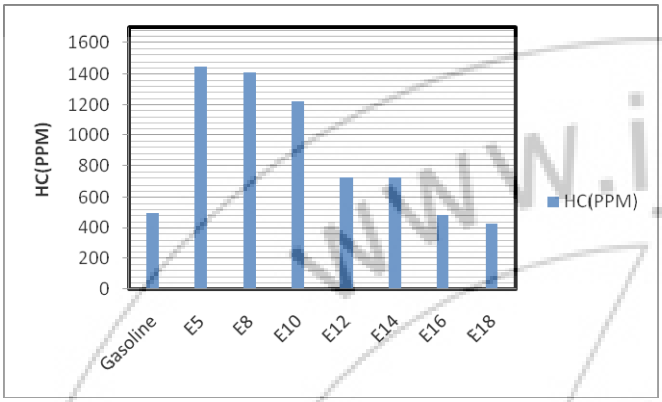

Figure 4 (a) : HC (PPM V/s Fuel used

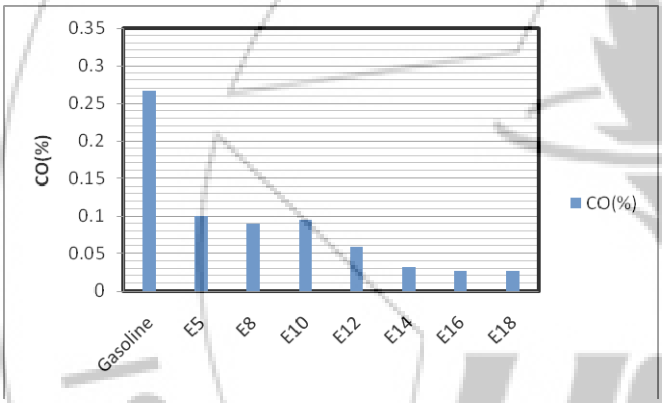

Figure 4(b): CO (%)V/s Fuel used

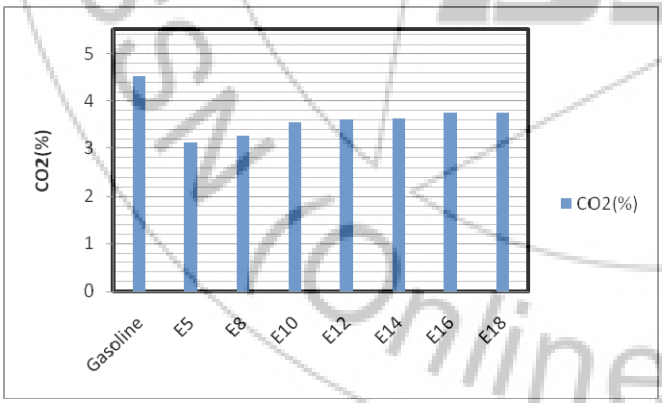

Figure 4 (c): CO_2 (%) V/s Fuel used

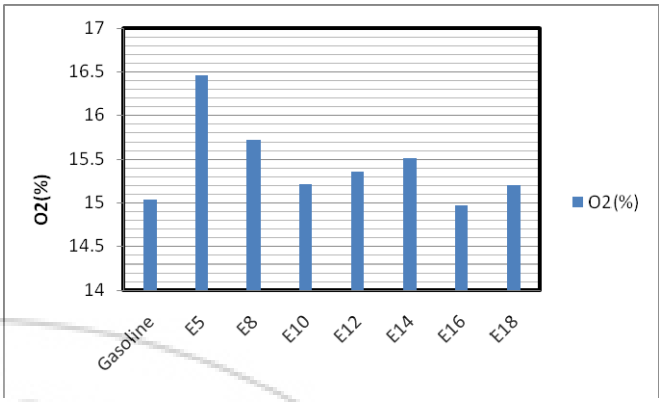

Figure 4(c): O_2 (%) V/s Fuel used

4. Conclusion

From the experiments carried out by running the test vehicle on gasoline and different ethanol-gasoline blends, the following observations can be made

- In terms of torque and power characteristics, the E8 and E16 blends are better for the test vehicle.
- Whereas in terms of better fuel economy the E5 and E10 blends show a favorable results when compared to the remaining blends, but gasoline is still better in terms of fuel economy.
- However, in terms of acceleration time E8 and E16 blends showed better results.
- But the percentage of exhaust gas emission reduce considerably exception for CO2, which shows an increasing trend when compared to the other as the blending percentage is increased.
- Thus we conclude that, ethanol can be blended with gasoline in percentages equal to E8 and E16 and thus resulting in reduced use of gasoline in automobiles.

4.1 Scope for Future Work

- This work can also be executed on two wheelers and four wheelers for higher blends.
- Research work can also be carried out on the lubricants and engine materials which are not affected by the corrosive nature of ethanol.
- Further research can be carried out by increasing the compression ratio of the test vehicle and studying the performance characteristics.

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