

To Perform the Flue Gas Analysis on S.I Engine by Adding HHO Generator

B Hari¹, G Sai Lokesh², M K R M V Sai Teja³, P Srinuvas⁴, J Suresh Kumar⁵, K. Abhinash⁶

1, 2, 3 4 Student, Dept of ME, NS Raju Institute of Technology, Visakhapatnam, Andhra Pradesh, India

5,6 Assistant Professor, Dept of ME, NS Raju Institute of Technology, Visakhapatnam, Andhra Pradesh, India

Corresponding Authors : suresh.me@nsrit.edu.in, abhinash.me@nsrit.edu.in

ABSTRACT

This paper is all about the study of hydrogen-hydrogen-oxygen (HHO) generator. With increasing the cost of conventional fossil fuels and harmful effects caused due to higher level of pollutants in the environment. To deal with such type of scenario, researchers are working on the alternative fuel which can be used in SI engine. HHO gas can used as a supplementary fuel in a single cylinder, spark engine without any modification. Its effects on exhaust emissions, engine performance characteristics and specific fuel consumption are investigated.

Keywords : HHO, electrolyte, flue gas analyzer, emission, pollutant.

1. INTRODUCTION

Generally, renewable energy has a large potential to displace emissions of green house gases from the combustion of fossil fuels and mitigate climate change. Renewable energy source can serve as alternative to non-renewable fossil fuel, which is depleting gradually. However, not all renewable energy source and energy carriers are clean, such as biogas, biodiesel etc. All of these energy carriers which finds major application in transportation and power industries contribute to environmental pollution when burnt. These energy carriers are needed to continually drive the growth rate of a country's economic

development. Thus, it is more practical to explore on cleaner source of energy and energy carrier such as hydrogen from water. Hydrogen, a clean energy carrier, exists in enormous quantities, but people are unaware of it or its significance in daily life because it maintains a low profile in combination with other elements such as petrol and other hydrocarbon fuels. More than 70% of hydrogen existing in our economy is produced by steam reforming. This method has been considered to be the cheapest means of producing hydrogen however, during production large quantities of greenhouse gases are released into the environment. Based on this fact, this method has become unsuitable for our environment. Producing hydrogen by splitting water using the method of electrolysis can be a simple method to achieve clean hydrogen production. This method has the advantage of being able to produce hydrogen using clean renewable clean energy sources such as wind, solar etc. This also increases the amount of energy losses in the production process.

Cite this article as: B Hari, G Sai Lokesh, M K R M V Sai Teja, P Srinuvas, J Suresh Kumar & K. Abhinash " To Perform the Flue Gas Analysis on S.I Engine by Adding HHO Generator", International Journal & Magazine of Engineering, Technology, Management and Research (IJMETMR), ISSN 2348-4845, Volume 7 Issue 11, November 2020, Page 18-23.

Thus, to expand the use of hydrogen production by direct water splitting with the method of electrolysis, it is mandatory to reduce energy consumption, cost, and maintenance of current electrolyzers and, on the other hand, to increase their efficiency, durability, and safety. Since the sterling engine can utilize solar energy as source of fuel and has shown to be more efficient than solar pv, thus in our own opinion, utilizing a sterling engine as source for powering electrolyzers to produce hydrogen for expanded use of energy in various engineering system will be a cost effective method in realizing a hydrogen economy. A.Shajahan et al. [1] says that The valuable and fast exhausting non-sustainable power source asset "petroleum" can be spare by substituting "hydroxyl gas" in oil motor. The undertaking work executes a hydroxyl gas delivering unit that can be utilized with petroleum motors to diminish oil utilization. This substitutes the petroleum up to 20% and builds the motor warm productivity and lessens the fuel utilization. It is basically producible and eco-accommodating hydroxyl gas from water, alongside oil to run the two-stroke petroleum motor and achieve significant change in mileage than ordinary fuel. The unit devise, break the water by the strategy called 'electrolysis' with less electric ebb and flow to frame hydroxyl gas. This hydroxyl gas is utilized as a part of a decent proportion in ignition chamber to consume with oil. The unique versatile pack to deliver hydroxyl gas and it's blending amid consuming in appropriate proportion to consume with oil, has been concocted. Bhavesh V. Chauhan et al. [2] says that Looked with the regularly expanding expense of traditional non-

renewable energy sources, inquiries about worldwide are working additional time to cost viably enhance interior ignition motor (ICE) efficiency and execution attributes. As of late, numerous scientists have concentrated on the investigation of elective powers which advantage upgrading the motor monetary and execution qualities. The benefits of utilizing hydrogen as fuel for inward ignition motor is among other a long haul sustainable and less dirtying fuel, non-harmful, scentless, and has wide range combustibility. Choongsik Bae et al. [3] says inner ignition motors (ICEs) are mama chines that change over the warmth delivered from burning into mechanical work. The primary sub-jects of this paper are responding motors, for example, start (SI) and pressure start (CI) motors. They have been generally received as power hotspots for traveler and business vehicles, power control age, and in other mechanical fields, because of their powerful thickness and high effectiveness.

2. EXPERIMENTAL SETUP & FORMULAS

BASED ON THE ENGINE SPECIFICATIONS :

Engine CC	125 cc
No Of Cylinder	1
Max Power	10.84 bhp @ 7500 rpm
Max Torque	11 Nm @ 5500 rpm
Valves Per Cylinder	2
Fuel Delivery	Carburetor
Cooling System	Air Cooled
Starting Mechanism	Self / Kick Start

Mileage and Performance

ARAI Mileage	82.4 kmpl
Max Speed	100 kmph

2.1 EXPERIMENTAL SETUP AND PROCEDURE; LIST OF EQUIPMENT

1. Bike
 2. HHO generator
 3. NAOH solution
 4. Aluminum electrode
 5. Flue gas analyzer
 6. Battery.
- The Bike which plays a major role and shows the output and accurate result. We have taken the bike (Bajaj Discover 125cc) having the respective specifications according to that we can only change the mileage, break power and the beating of the vehicles, remaining will be same and no changes will be taken place.



HHO generator:



The HHO generator is second heart of vehicle, which plays a major contribution Towards output result. In HHO generator which is connect to battery anode (+) and cathode (-) after that the LED lights turns ON, and in

HHO generator the NAOH solution is taken with the help of syringe(ml) and water is placed on it. So after few seconds the hydrogen starts to liberate through pipes which is connected to air filter pipe and it passes through carburetor and amount of air flue and hydrogen mixes and passes to engine combustion takes places. The amount of toxic gases release from the muffler or exhaust will be reduced.

Electrodes:



In HHO generator the heatsink transfers thermal energy from a higher temperature device to a lower temperature fluid medium contributes heat towards the output. We can check the working of heatsink with an equipment of regulator power supply DC. The amount of heat can be produced based on the capacity of generator, firstly the supply which passes through heat singer and after few seconds heat comes out with the aluminum coils and passes out through pipe.



The NAOH solution is weak base, molecular weight of NAOH is 40 g/mol. The solution can be prepared by pellets with little amount of water. The pellets are completely dissolved by shaking in a conical flask, which is used in HHO generator to produce hydrogen.

Flue gas analyzer:



The flue gas analyzer is one of the major applicable in environment as well as in our project, the main moto of flue gas analyzer is to known the real time pollution caused by vehicles can be calculated, coming to the project the flue gas analyzer is used to check the pollution comes out from exhaust without adding HHO generator and with HHO generator. The toxics gases which are reduced by adding HHO generator, the toxics gases which are NO_x, CO, CO₂, O₂ changes takes places and result comes out in the form of paper.

Battery:



The battery which is placed in vehicle, and makes connections through battery, self motor to self start. The battery capacity is 5amp 20 volts, and it is connected to HHO generator to run it. While running of the vehicle the battery charge occurs there is no drawback for connecting the HHO generator to battery.

2.2 EXPERIMENTAL PROCEDURE:

1. Firstly, we place bike and the HHO generator is connected to battery.
2. In HHO generator the NAOH solution is added to produce energy in the form of vapor.
3. In HHO generator the hydrogen comes out through pipe which is connected to air filter pipe.
4. Then we turn ON the ignition switch, and the vehicle started running both air and hydrogen pass through the carburetor.
5. The air & hydrogen mixed and passed through combustion chamber combustion takes places with the help of flue.
6. So the vehicle starts running and the toxic gas release from muffler will be reduces by HHO generator.
7. The reduction of TOXIC gases can be checked by using flue gas analyzer, to know the values of NO_x, CO, NO present it.
8. We can calculate the values toxic gases before and after adding of HHO generator.

3. RESULTS AND DISCUSSION

3.1 TESTING AND ANALYSIS: The electrolysis unit installed in a two wheeler and a road test is conducted.

According to Engine specification:

Engine CC	124.5 cc
No Of Cylinder	1
Max Power	10.84 bhp @ 7500 rpm
Max Torque	11 Nm @ 5500 rpm
Valves Per Cylinder	2
Fuel Delivery	Carburetor
Cooling System	Air Cooled
Starting Mechanism	Self / Kick Start

Without Hydrogen: -

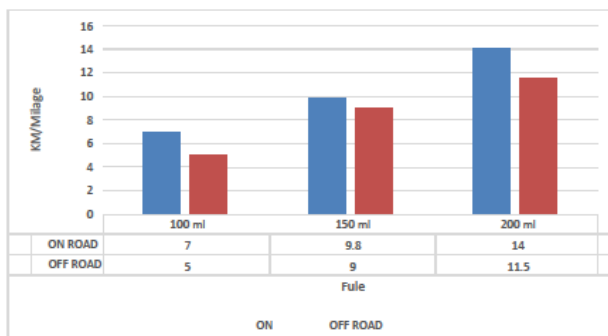
TRAIL NO.	AMOUNT OF GASOLINE CONSUMPTION	DISTANCE COVERED ONROAD (KM)	DISTANCE COVERED OFF ROAD (KM)
1	100 ml	7	5
2	150 ml	9.8	9
3	200 ml	14	11.5

With Hydrogen: -

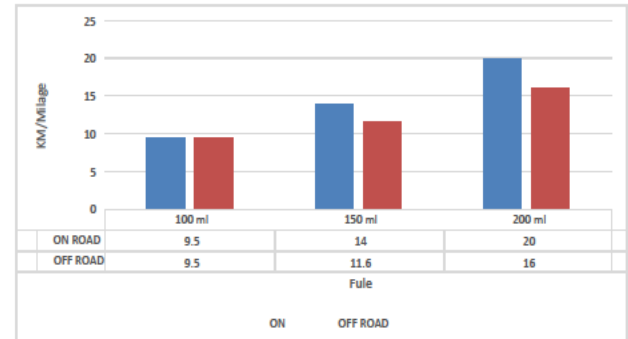
TRAIL NO.	AMOUNT OF GASOLINE CONSUMPTION	DISTANCE COVERED ONROAD (KM)	DISTANCE COVERED OFF ROAD (KM)
1	100 ml	9.5	7.5
2	150 ml	14	11.6
3	200 ml	20	16

Graphs:

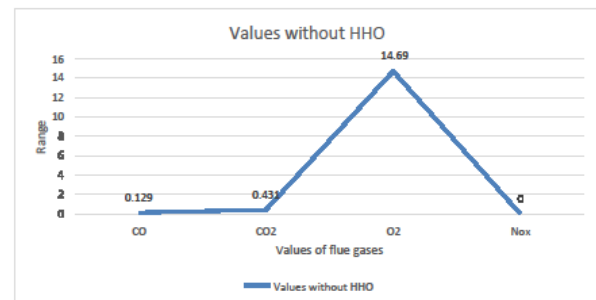
Without HHO generator



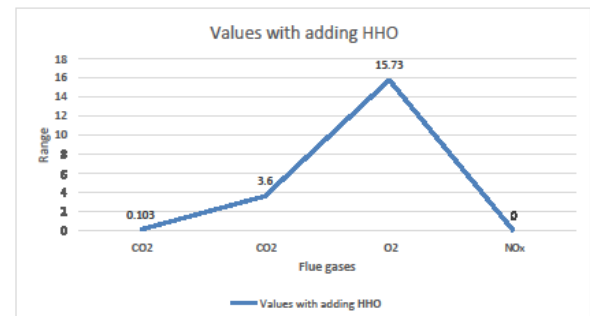
With HHO generator:



Flue gas analyzer without HHO generator:



Flue gas analyzer with HHO generator:



DATE : 13/03/2020
TIME : 16:03:41
CO : 00.129 %
CO2 : 04.31 %
HC : 00000 ppm
O2 : 14.69 %
NOx : 00000 ppm

Without HHO Generator

DATE : 13/03/2020
TIME : 16:14:17
CO : 00.103 %
CO2 : 03.60 %
HC : 00000 ppm
O2 : 15.73 %
NOx : 00000 ppm

With HHO Generator

To achieve the main aim of this research work is, to find the effect of EGR on petrol Engine

with the mode of SI and HCCI running at different EGR ratings and at different load conditions of engine. For the performance and engine emissions the following steps are formulated

- Experimentation is carried out for diesel fuel on SI Engine.
- Experimentation is carried out for petrol fuel on HCCI mode of Engine running.
- Experimentation is carried out for diesel fuel on SI Engine using exhaust gas recirculation.
- Experimentation is carried out for petrol fuel on HCCI mode of Engine running with exhaust gas recirculation
- Results are compared and graphs are plotted.

4. CONCLUSION

In our project we are driving a normal petrol bike using HHO gas as a fuel. By simply placing the HHO generator, bike is running with HHO gas as a fuel. It is successfully working and it reduces the emissions. So many researches are undergoing on Green engines in Automobile industry. By adding some additional equipment to this project it will work efficiently. By using this technology in automobile will drastically reduce the emissions and be helpful in rapid development of the mankind on the whole. This technology has great promises and will help in creating a clean & green world for our future generations. Thus this project work is much useful in all the growth of automobile industry.

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