

Performance Analysis of HHO Generator & ITS Comparison with Conventional S. I. Engine

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ABSTRACT

As we are all aware of the harmful emission and its causes over mankind & environment due to the combustion of fossil fuels. Though fossils have enhanced the mankind in all the sectors but have eroded their health and still it's going on. We can't stop using our vehicle therefore to keep it going we need to find an alternative. Due to industrializations and population growth our economy and technologies today largely depend upon natural resources, which are not replaceable [1]. The solution to this problem is simple. We need to find something that burns quickly and emits no harmful gases or fumes. When studies were done many researcher's scientist and engineer came across on word that is hydrogen and have agreed upon it so there's a need to use system which would be hydrogen powered. It is one of the easy available source of fuel. There are many methods to obtain hydrogen but due to large variation in cost and more time period, it is very difficult to deal with it. There is one more method which is easier and cheap to obtain that is electrolysis. During electrolysis of water, 'H' ions and 'O' ions are liberated at respective electrode. Hydrogen is purely a combustible gas and oxygen supports burning. When these two gases burn the reaction left over is pure water. This was used to drive submarine and pure water was available for the crew members for drinking. Even the torpedo's were hydrogen driven [3]. And next advantage is it produces a buoyance effect due to its lightness. So hydrogen can be the next fuel with clean and clear properties.

Keywords :- HHO Generator, Bubbler, Electrolysis and Emission.

I. INTRODUCTION

We are on the verge of extinction of fossil fuels. For over the years fossil fuels had served the nation's economic growth and industrial growth but have left with tremendous change in the environmental balance. This imbalance has ruined the ecological system of the surrounding and mankind. The global temperature is rising, ozone depletion, unethical natural calamities are some of the reasons for the ecological imbalance and heart disease, lung disease, asthma and many more are increasing day by day due to the combustion emission of the fossil fuels. So there is a requirement of replacing fossil fuel by an alternative. Many researchers have worked upon the non-conventional mode of energy but due to its more cost in production, installation

& maintenance and overall it is non-continuous means the supply isn't continuous due to weather condition, so it is really very hard to reach out in the market. There is another mean that can prove to give a continuous mode of energy though isn't non-conventional. Hydrogen can prove to be the next fuel for the system as its high combustible property, lighter in weight and most important that it does not produce any emission on combustion as it does not have any carbon chain. Next issue is to obtain hydrogen but surely this is not the major issue as it can be easily obtained by the process called electrolysis[B] and on the other hand we have plenty of water available on earth.

II. METHODOLOGY

There are various methods but those are time consuming and costly but there is one mean that hydrogen can be obtained which is through electrolysis. In this experiment setup we'll have one reactor container which will hold the reactor plates. This container will be filled up by the electrolyte. We can use NaCl or KOH to increase the rate of reaction. 555 PWM IC would be used to produce a trigger at a required intervals. This is due to, at lower rpm it is been observed that there was a constant production of HHO. To avoid this situation 555 PWM IC is used to trigger the circuit at regular interval of time. The frequency of 555 PWM is set to 61 % so it gives around 7.1V to 7.5V to the reactor plates. The HHO is cooled down as the reaction will produce some heat due to this some moisture content can enter the combustion chamber.

III. COMPONENT USED IN HHO UNIT

There are basically three main component used to carry out this experiment. These component were easy to produce and it didn't had a rocket science behind it.

1) Reactor container

The reactor container is nothing but where the reaction is going to take place. It has reactor plates and electrolyte filled in it.

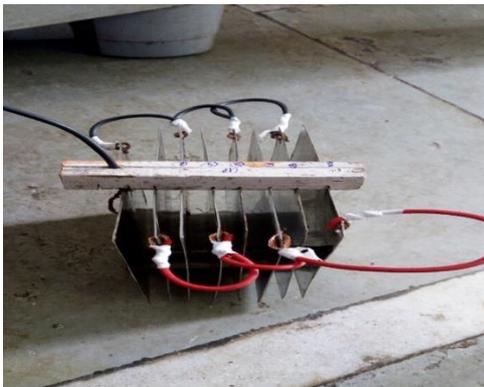


Figure 1. Reactor Plates Arrangement



Figure 2. Reactor Container

2) Bubbler

Bubbler is used to cool down the gas coming out from the reactor container.

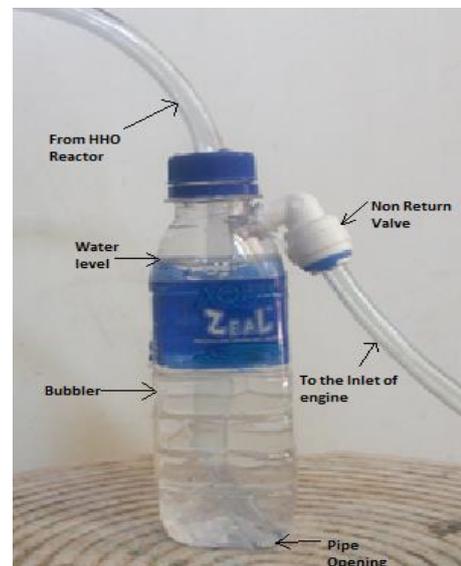


Figure 3. Bubbler

3) 555 PWM IC

Triggering circuit, it is used to send voltage in pulse. In this we can change the frequency as required.



Figure 4. 555PWM

IV. WORKING METHODOLOGY

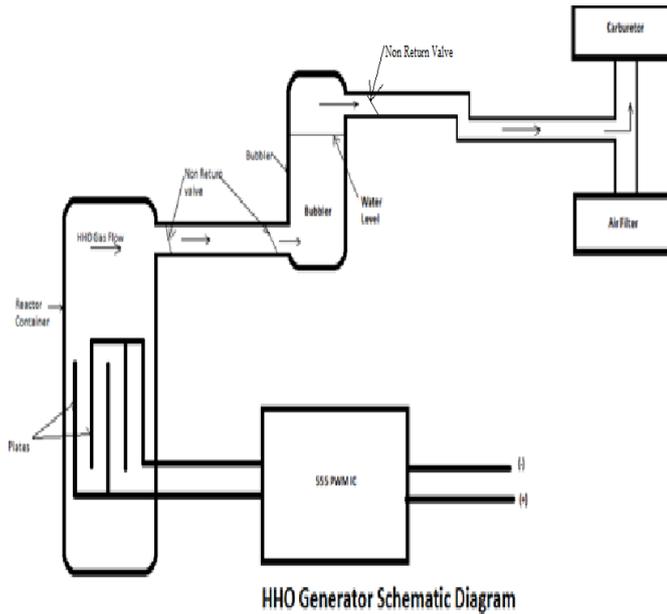


Figure 5. Schematic Diagram of HHO Generator

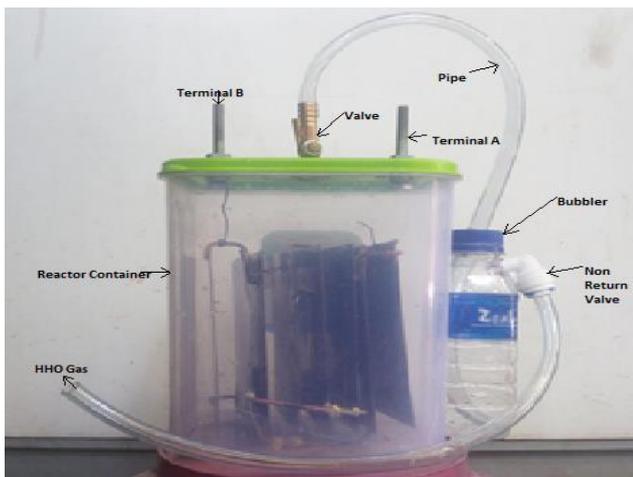


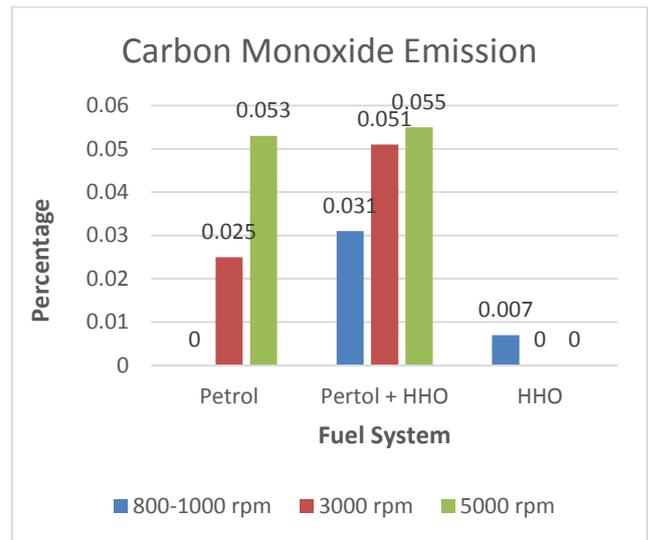
Figure 6. Assembled View of HHO Generator

The current from the battery which is 12 V is supplied to the 555 PWM IC which brings down the voltage and starts triggering. It means the 555 PWM will send the voltage to the reactor plates in pulses which is 7.1 V to 7.5 V. This is to reduce the production of HHO at lower rpm. These reactor plates are made up of stainless steel which gives out the maximum efficiency. Alternate reactor plates are been supplied by negative charge and positive charge respectively. On triggering the reactor plates reacts with the electrolyte in the reactor container liberating HHO at a temperature. This HHO is passed through reactor container to bubble with help of pipe fitted with non-return valve. This pipe enters the bubble from the top till bottom of the bubbler. This bubbler is filled up with the normal water. This water

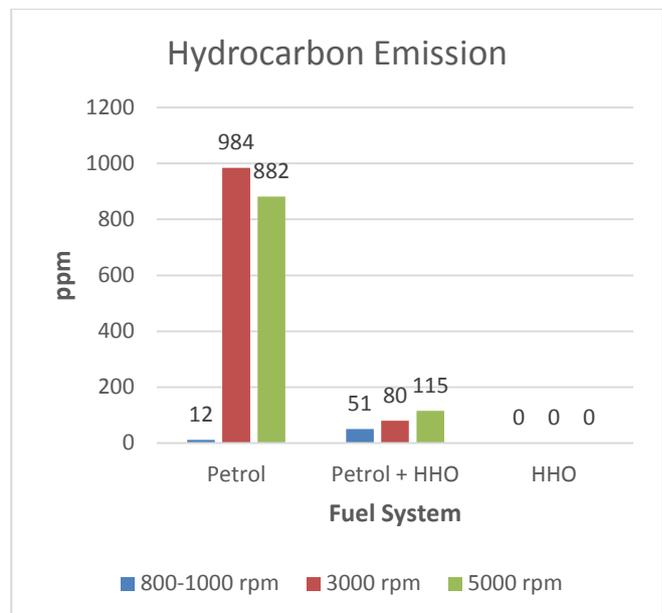
will absorb the heat from the gas and secondly it will condense down the water vapors from the gases. If any moisture traces found it can affect the engine performance and can produce knocking. This gas then enters the carburetor through the hose connecting from the air filter to carburetor.

V. RESULT AND CONCLUSION

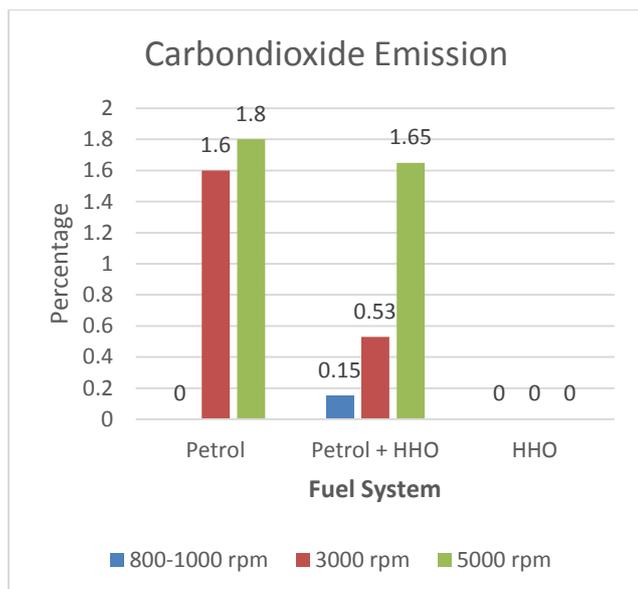
Graph 1. Carbon Monoxide Emission



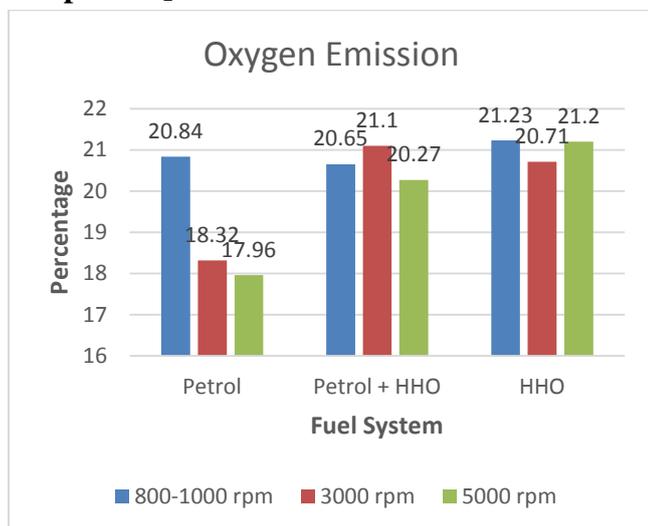
Graph 2. Hydrocarbon Emission



Graph 3. CO₂ Emissions



Graph 4. O₂ Emissions



It's clear by the experimental graphs that when petrol as a sole fuel, on combustion has the highest rate of emission though in comparison of Oxygen is more approximately same in other fuel system which was used for the experiment. On the other hand when petrol + HHO was used, the results of the emission wasn't so appealing in CO & CO₂ but there was a significant decrease in HC. This may be due to the unburnt petrol particle as combustion rate or the ignition rate of hydrogen is much greater than petrol and another important is the phase difference between them hydrogen and oxygen are in gaseous state and petrol is in liquid state. So eventually gas have a higher tendency to ignite much faster than liquid. But in this case the

emission of O₂ was somewhat improved than petrol as a sole fuel. With results by HHO generator was very astounding with all the emission. Due to just two gases hydrogen and oxygen the emission was nil just O₂ on the charts. It had no traces of carbon as petrol wasn't combine with HHO system. Petrol belongs to the paraffin's family in which the bond is between carbon and hydrogen so eventually carbon would be present in the emission.

VI. ADVANTAGES

1. Low cost for production
2. High Combustion properties
3. Maintenance cost is low
4. Easy process and methodology
5. Low emission rate
6. Health hazards would be lowered
7. No storage necessary
8. Improve shell life of engine
9. Easy to install the unit

VII. REFERENCES

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