International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Four Stroke Hydra Engine

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Abstract: ***An attempt has been made in this research to use additive fuel in four stroke petrol engine. Our main aim in selecting this work is to use nonconventional fuel HHO with conventional fuel. We select an engine of Hero Honda Street 100cc, 6.5 hp at maximum speed of 8000 rpm for this research work and working model has been developed to support the idea of the work. In IC engines the combustion of a gasoline fuel produces CO2 and H2O. Some of the fuel is not burnt due to the IC engines are not perfectly efficient, which results in the presence of HC, CO and NOx. The HYDRA generator uses electrolysis process to split water (H_2O) into its base molecules, 2 hydrogen and 1 oxygen molecule. The Oxy-Hydrogen gas is not an alternative to petrol but an additive to increase the efficiency of the engine. This research asses the performance characteristics of a 4S IC engine that is run by petroleum fuel blended with HHO fuel, which is fed through the inlet manifold. It decreases the operating temperature and pressure conditions of the IC engine. Reduction in fuel consumption and reduction in emission is main goal of this research work.***

Keywords: HHO, 4S SI Engine, Fuel consumption, Efficiency, Emission.

1. Introduction

The scope of this work is to introduce some of the hydrogen advantages while maintaining the original specifications of the engine. The Oxy-Hydrogen gas which is also known as the BROWN gas or HHO is a non toxic gas, used as a supplement to any traditional fuels such as Petrol, Diesel, Heavy oil, Acetylene, propane, Kerosene, LPG etc. So the idea is not to compete with petroleum fuels but to increase the life of petroleum fuels to exist longer in this ever demanding automobile industry. So in order to conserve petroleum fuels for future and to eliminate the aforementioned limitations, there is a need of alternative and innovative fuel. The Oxy-Hydrogen gas is obtained by the simple process of electrolysis of water, which can be used in addition to petrol. In this research work, the oxy-hydrogen gas is used in four stroke petrol engine for better performance and lower emission values.

2. Detail Description

2.1 Working Principle

An HHO generator is a device which produces HHO gas. Basically, HHO generator involved in production of hydrogen and oxygen through the process of electrolysis. In this process a DC current passed through water, as a result of which it is divided into its primary constituent's viz. Hydrogen and oxygen. Then the produced HHO gas with the help of electrolysis is added in to the air intake manifold and injects in to the cylinder where HHO mix with the fuel ignites and results complete combustion of the hydrocarbons fuel, lowering emission and increasing fuel efficiency.

2.2 System Installation

(a) Where should be the HHO system installed?

Anywhere in the space around the engine, but preferably in a place that will have a constant flow of air that helps the HHO generator to cool down. HHO systems on which there is no storage of hydrogen because hydrogen is generated through electrolysis system. Use of these systems has an impact on the decrease in emissions from vehicles.

(b) Components require to Install the HHO system?

In short, it requires mounting the HHO generator, pulse modulator, fuses, relays, filters, check valves, switches, installation of hose, and connecting a few cables. Total time required is approximately 30 minutes to 1 hour for the installation of HHO system. The system can be removed without damage to the vehicle.

(c) How much water is used HHO system?

Very little. We can drive a many days without adding water. We advise to add distilled water every week or two to ensure maximum gas production. If we drive an average of about 3,000 miles a month is enough to 1 liter of distilled water.

2.3 Schematic Diagram

HHO is produced with the help of electrolysis process. A 12 V battery is used for the power supply which is connected to the PWM and fuse. The purpose of use is to protect an electric circuit against excessive current. The fuse is connected with the Relay which can prevent equipment damage by detecting electrical abnormalities including over current, undercurrent and reverse current. The relay is connected to the ignition switch which function is to open or close the circuit. The one terminal of PWM is connected to the battery and second

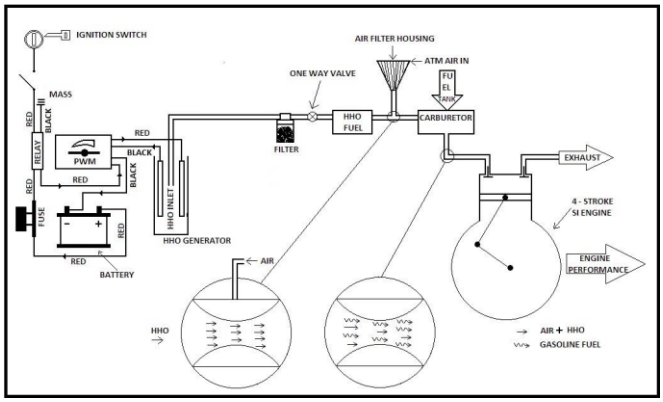

Figure 1: Schematic Diagram of HHO System

terminal is connected to the relay. The other two terminal of PWM is connected to the anode and cathode plate of the electrolysis the PWM control the output of hydrogen generator. It allows regulating the ampere at which we get maximum bubbles. In the electrolysis the bunch of plate immersed into the electrolyte. The volume of gas produces is proportional to the current passing through the water and therefore high current means more gas. Water is the poor conductor of electricity so there is need to increase the conductivity.

In this process the water split into two parts:
(a) Two molecules of Hydrogen
(b) One molecule of oxygen

The gas produce is a highly explosive mixture of hydrogen and oxygen. A large volume of gas exists inside the container which if ignited would explode and destroy the container. The filtered HHO gas then mix with sucked atmospheric air. The mixture of HHO + air further mixes with the fuel in the carburetor. Then this mixture entered into the combustion chamber intake manifold. After applying spark, the complete combustion of this mixture occurs thus engine produce the power and the burned gases in the engine exhaust through the exhaust port to the atmosphere.

The combustion rate is three times faster than the combustion rate of the conventional fuel. That increase the engine power due to complete combustion of the mixture the efficiency of the engine increase and there is no unburned particle in exhaust gas so, there are less proportion of NOx, HC, CO2 etc. in the exhaust gas which results in lower emission and also reduce engine heat up.

2.4 Method Used

There are two methods for using HHO:
(a) Hydrogen produce by the electrolysis
(b) Using readymade HHO cylinder

We are using electrolysis method to producing the HHO. It is safe method as compare to the using the readymade HHO cylinder, because the readymade HHO is difficult to handle and store also it is more explosive. So, it requires more care and attention. There are two method of electrolysis to producing HHO which are follows:

(A) Anode and cathode plates
(B) In method B the cathode plate is replaces the electrolysis container.

Table 1: Difference between Two Electrolysis Method

Anode-cathode plate (A)	Container as a cathode (B)
This method produces the more HHO gas.	This method produces less HHO gas compare to the anode-cathode method.
The erosion of the electrode is less in this method.	The erosion of the electrode is more in this method.

Due to above these two major drawbacks of method B we use the anode-cathode plate electrode method for the electrolysis to produce HHO. Electrolysis remains a standard method of producing high purity hydrogen, though it is much more cost feasible to produce large volumes of hydrogen from fossil fuel. By placing two pieces of metal in distilled water, and applying electricity, the water (H20) can instantly be separated into Hydrogen and Oxygen. The separated gas molecules surface and regroup to form HHO Gas, which is an unbounded mixture of Hydrogen and Oxygen.

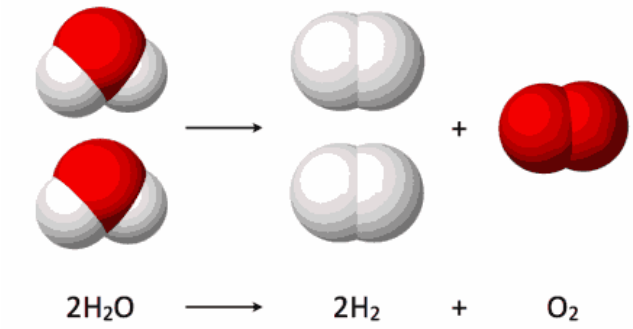

Figure 2: Molecules of HHO

Inside the electrolyser, the electrodes inside the device are made from stainless steel (ss) which is commonly available. Never use aluminum or copper wires, these are great electricity conductors, but they would be destroyed by the electrolysis process. As for the electrolysis distilled water is used and filled up to 3/4th of the height, the electrolyte preferably is KOH (Potassium Hydroxide) for better conduction and it is generally about 2-3% of the total water filled. The amount of hydrogen generated is twice the number of moles of oxygen and both are directly proportional to the total electrical charge conducted by the solution.

Cathode (reduction): $2\ H_2O + 2e^- \rightarrow H_2 + 2\ OH$
Anode (oxidation): $4\ OH^- \rightarrow O_2 + 2\ H_2O + 4\ e^-$
Overall reaction: $2\ H_2O \rightarrow 2\ H_2\ (g) + O_2\ (g)$

The HHO gas generated from the electrolysis is sucked into our engine's air intake system as shown in the diagram. The entire system uses your engine's vacuum pressure to suck in more HHO gas as engine speed increases.

2.5 Engine Specification

Table 2: Engine Specification

Vehicle Name	Hero Honda Street
Type	Four stroke SI Engine
No. of cylinder	One
Maximum power	6.5 bhp/8000 rpm
Start	Kick
No. of gears	Four
Clutch	Automatic
A/F ratio	14.7:1
Engine displacement	100 cc

3. Analysis of Working Model

Figure 3: Working model

3.1 Effect on Fuel Consumption

Table 3: Fuel Consumption

Load	Normal Engine	Hydra Engine
0	5.263×10^{-4} kg/s	4.166×10^{-4} kg/s
12	8.33×10^{-4} kg/s	4.347×10^{-4} kg/s
20	9.0909×10^{-4} kg/s	7.143×10^{-4} kg/s

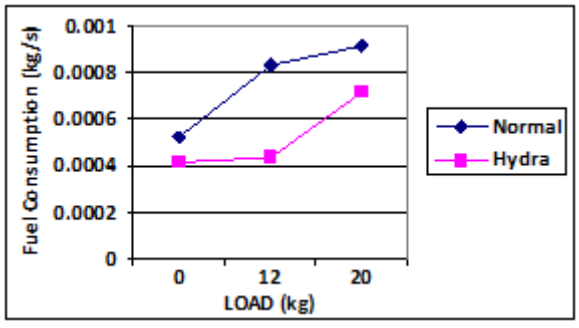

Figure 3: Fuel Consumption

When we added HHO with gasoline fuel, the fuel consumption of engine is decreased, which is shown in chart. We take burette in analysis as fuel tank for easy analysis of the fuel consumption.

3.2 Effect on RPM

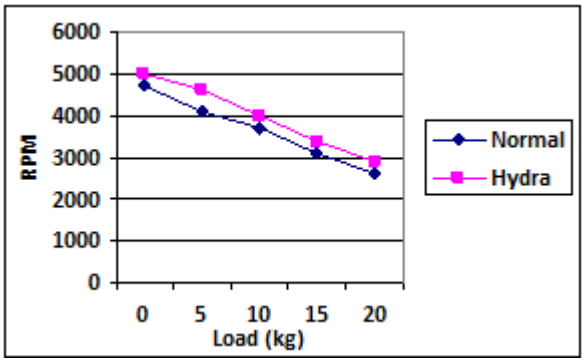

Figure 4: LOAD ⇒ RPM Chart

3.3 Effect on CO%

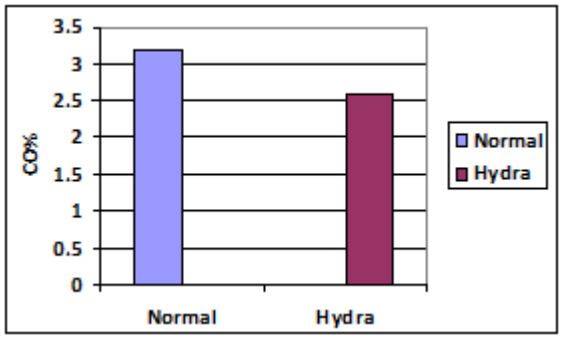

Figure 5: CO%

The CO% was 3.2% when the engine runs on the simple gasoline fuel. The CO% was 2.6% when the engine runs on the HHO + Gasoline fuel. That means there is 23.99% decrease in CO emission. Comparison is shown in the above figure 5.

3.4 Chart of HC Particles

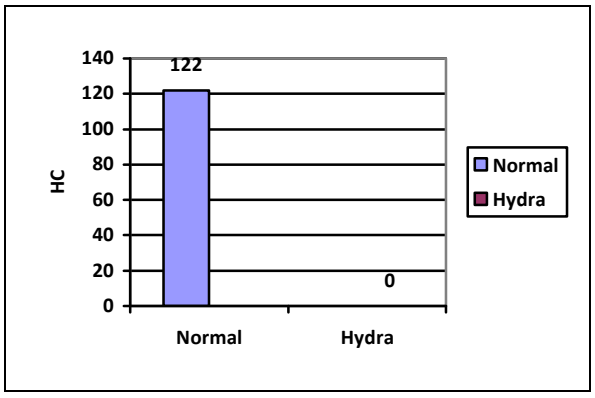

Figure 6: HC Particles

4. Benefits and Safety

4.1 Benefits

- Uses water as source of supplemental alternative fuel.
- Reduces emission.
- Exchange fuel mileage.
- Reductions of carbon build up in cylinder and spark plug.
- Increase spark plug life.
- Long oil changing time.
- Increase vehicle performance.

4.2 Safety Require

- It has been refer as BOOM gas for a reason. If we are collecting the gas, take care that it does not ignite.
- The mixture you will be using can be near the high end of ph scale- highly alkaline .it will react with your skin and potentially cause a skin irritation.
- For establishment of this system in vehicle, skill person is required.

5. Conclusion

In this completed work and mathematical modeling of internal combustion engines as well as analysis of changes of its performance indicators by using HHO and alternative fuel enabled us to formulate following summarized conclusion on the influence of oxy-hydrogen gas.

- The efficiency of oxy-hydrogen gas using in internal combustion engine increases by 18.69%.
- Using HHO with fuel in a spark ignition engine, CO concentration reduces to 18.75%, which reduce the atmospheric solution.
- The use of HHO in gasoline engines consequently reducing the fuel consumption by 23.99%.
- Use of HHO in gasoline engine increases the brake power of engine around 12.20%.

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