

# Experimental Investigation on Hydrogen Powered Petrol Engine

Shubham S. Shirbhate

BE Student

Department of Mechanical Engineering

DRGIT&R Amravati, India

**Abstract**— We gone use HHO cell for the production of HHO gas This HHO cell is design and construct in convenient manner so that the consumption of the space is very less. It help the fossil fuels to exist longer life in turn to help survive this in ever automobile industry. In order to overcome the draw backs of the fossil fuels it is the time to add a supplementary fuel, so a scientist evolve an idea to overcome these problems is to generate the HHO gas. HHO gas is a gas which produced from splitting water into hydrogen and oxygen by the processes of electrolysis and allowing the gas to stay in a premixed state for use on demand without the need of storage. In this project, we are analysing the scope of hydrogen as a supplementary fuel in 4- Stroke internal combustion gasoline engine. A hydrogen generation system for producing hydrogen and injecting the hydrogen as a fuel supplement into the air intake of carburettor, Hydrogen and oxygen is produced with a fuel cell at low temperature and pressure from water in a tank, the device is powered by vehicle battery.

**Key words:** HHO Cell, Petrol Engine

## I. INTRODUCTION

Alternate fuel is important and it should be fossil one. Actually one third of population in world spend their income for our vehicle fuel feeding and the vehicle gives harmful decomposed materials like CO, NO<sub>x</sub>, HC, etc. in the form of smoke. These materials are all affects the engine performance, and pollutes the environment. if we Compare other kinds of fuel with water around the world, water is one of the free recourses and by applying the technique, it can be converted into hydrogen with oxygen, its chemically produce HHO gas and in general "renewable Energy source". It is cheaper, safer, and more explosive and no or very little pollutes the atmosphere.

Gasoline is obtain by fractional distillation of crude oil in fractional towers. It does not have fixed composition the constituent vary depending upon the origin of petroleum. It is clean colorless fuel with good flow ability. Gasoline with octane number 75-85 is used for automobile and with often number 150 it use for aircraft.

### A. Internal Combustion Engine

The internal combustion engine is an engine in which the combustion of a fuel take place inside in a combustion chamber that is an internal combustion engine. In internal combustion engine, due to the high temperature and high pressure gases expansion is take place due to generation combustion apply direct force some component of the engine. The force is applied typically to inlet & exhaust valve, piston ring, pistons, turbine blades, or a nozzle. The force is cause moves the piston from TDC to BDC that will cause conversion of chemical energy into useful mechanical energy. The first commercially internal combustion engine was successful created by "Etienne Lenoir". The IC engine is

different from external combustion engines, such as steam or Stirling engines, in which working fluid burn externally. Working fluids can be air, hot water, pressurized air, heated water in a boiler. IC engine are usually use fuel such as gasoline or diesel, liquids derived from fossil fuels. While there are many applications such as bike, cars, aircraft.

### B. Construction

I.C. engine is an engine in which conversion of the reciprocating motion of piston into rotary motion of the crankshaft with the help of a connecting rod. The piston which reciprocating in the cylinder is very less clearance with the cylinder. Piston rings are inserted in the circumference slot on the piston to prevent leakage of gases from sides of the piston. Which will reduce the losses on cylinder. The combustion is take place at the top of the cylinder head. The connecting rod connects the piston and the crankshaft. A pin called as wrist pin is provided for connecting the piston and the connecting rod at the small end. The other end of the connecting rod connecting the crank shaft is called big end. When piston is reciprocate TDC to BDC, the reciprocating motion is transmitted to the crank shaft by using connecting rod and crank pin due to that the crank shaft makes rotary motion. The crankshaft rotates and main bearings which are fitted the crankcase. A flywheel is use at one end for store the energy and deliver when require as well as to remove vibration. There is an oil sump at the bottom of the engine which work for lubricating the different parts of the engine result reduction in wear and tear and smoother the performance of engine.

### C. Working Principle of I.C. Engine

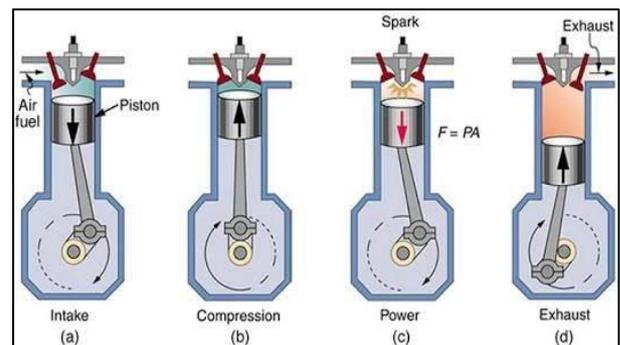


Fig. 1: Working of I.C. Engine

#### 1) Suction Stroke

Suction stroke starts when piston is at top dead centre and about to move downwards. During suction stroke inlet valve is open and exhaust valve is closed. Due to low pressure created by the motion of the piston towards bottom dead centre, the charge consisting of fresh air mixed with the fuel is drawn into cylinder. At the end of suction stroke the inlet valve closes.

Fig. (a) shows suction stroke of engine.

#### D. Compression Stroke

During compression stroke, the compression of charge takes place by return stroke piston, i.e. when piston moves from bottom dead centre to top dead centre. During this stroke both, inlet and exhaust valve remain closed. Charge which is occupied by the whole cylinder volume is compressed up to the clearance volume. Just before "completion of compression stroke, a spark is produced by the spark plug and fuel is ignited. Combustion takes place when the piston is almost at top dead centre.

Thus, combustion of fuel takes place due to production of spark, therefore engine is called as 'spark ignition engine'.

Fig.(b) shows compression stroke

##### 1) Expansion or Power Stroke

Piston gets downward thrust by explosion of charge. Due to high pressure of burnt gases, piston moves downwards to the bottom dead centre. During expansion stroke both inlet and exhaust valves remain closed as shown in Fig. (c)

Thus, 'power is obtained by expansion of products of combustion.

Therefore it is also called as 'power stroke'. Both pressure as well as temperature decreases during expansion stroke.

#### E. Exhaust Stroke

At the end of expansion stroke the exhaust valve opens, the inlet valve remains closed and the piston moves from bottom dead centre to top dead centre as shown in Fig. (d). During exhaust stroke the burnt gases inside the cylinder are expelled out. The exhaust valve closes at the end of the exhaust stroke but still some residual gases remain in cylinder. Each cycle of four stroke engine completes the above four strokes or operations in two crank revolutions.

One revolution of crank shaft occurs during the suction and compression stroke second revolution during the power and exhaust stroke.

Thus, for one complete cycle i.e. for two revolution of crank shaft there is only one power stroke.

Example of four stroke engine is passenger car.

## II. AIM & OBJECTIVES

### A. AIM

Our Project aim is to increase the mileage compared with vehicle running without this equipment and to reduce harmful emission with the help this new technique.

### B. Objectives

- To test the performance of the SI engine in terms of distance covered verses petrol consumption this new technique.
- To test the exhaust emission of various gases from SI engine.

## III. SYSTEM DEVELOPMENT

A. *Experimental Setup Details Our Experimental Setup consist of three parts*

- 1) Bajaj Discover bike
- 2) HHO Kit

### 3) Exhaust Gas Analyzer

### B. Engine Specification

The specifications of bike and detail components of HHO Kit are discussed in details below:

Engine	Discover 100 DTS-i
Cubic Capacity	94.38
Stroke	4 Stroke
Brake Power	7.5 BHP, 7500 RPM
Speed	5000 RPM
No. of Cylinder	Single
Radius of the Brake Drum	-

Table 1: Engine Specification Observation Table

### C. Components of HHO Kit

HHO Kit consist of Electrolyzing chamber, Moisture filter, HHO transfer hoses, Injection nozzle, Plastic bottle, Cam, etc.

### D. Mileage Test

Here in this project we are going to conduct two types of test to ensure the advantage gained on using this innovative technique. Mileage is nothing but the fuel economy of any automobile. It is the total distance travelled by the automobile for specified quantity of fuel. It consist of three steps as follow.

#### 1) First Step

- Before installing the equipment run the vehicle with 100 ml, 150 ml and 200 ml fuel
- Note down the distance (kms) travelled by the vehicle.
- Make minimum three trail runs and note the readings.

#### 2) Second Step

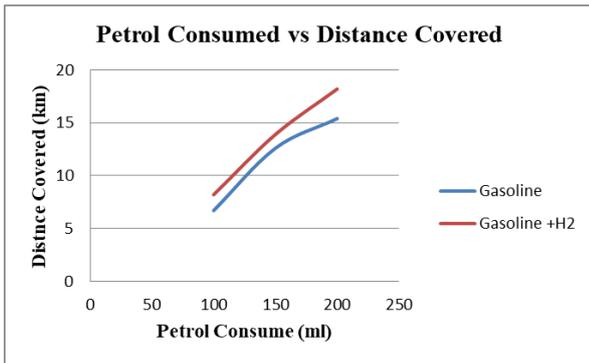
- Now install the equipment to the vehicle and run it with 100 ml, 150 ml and 200 ml fuel (petrol).
- Note down the distance (kms) travelled by the vehicle.
- Make minimum three trail runs and note the readings.

#### 3) Third Step

- Tabulate the readings obtained in the above two steps.
- Take the difference of these readings and note the resulted value.
- This would be extra mileage added to the vehicle on using this technique.

Trial No.	Consumption (ml)	Distance covered (with gasoline) (KM)	Distance covered (with gasoline+HHO gas) (KM)
1	100	6.7	8.2
2	150	12.6	13
3	200	15.4	18.2

Table 2: Mileage Test Observation Table



Graph 1: Petrol Consumed vs. Distance Covered

We conduct performance analysis on petrol engine by supplying gasoline and Gasoline + HHO fuels respectively. After experimental analysis it has been found that the distance covered by the vehicle with HHO kit as compared to pure gasoline is more which is as shown in above fig. 6

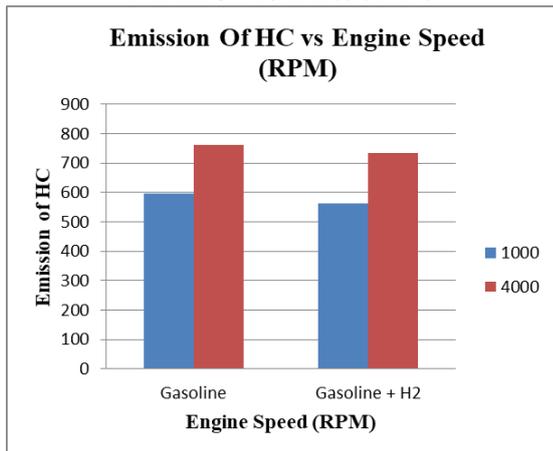
#### IV. EMISSION TEST

Due to the combustion of fuels in the vehicle some gases (exhaust gases) are produced such as hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), etc. This is called emission of gases in automobile. We know that these gases are one of the reasons for global warming. So our project aims to reduce these harmful emission with the help this new technique. The emission test is carried out by Auto Exhaust Multi-gas Analyzer Model no. NPM -NGA-2. Following results were obtained.

##### A. HC Emission Test

HC emission		
RPM	Gasoline	Gasoline+ H <sub>2</sub>
1000	598	562
4000	762	734

TABLE 3: HC Emission Test

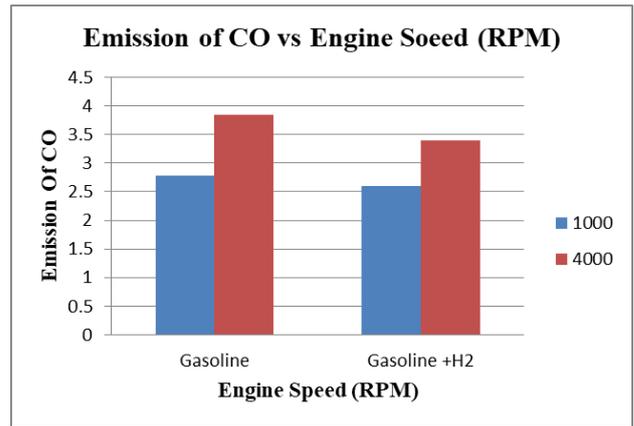


Graph 2: Emission of HC vs Engine Speed (RPM)

##### B. Carbon Mono-Oxide Test

CO Emission		
RPM	Gasoline	Gasoline+ H <sub>2</sub>
1000	2.78	2.6
4000	3.85	3.4

Table 3: Carbon mono-oxide Test

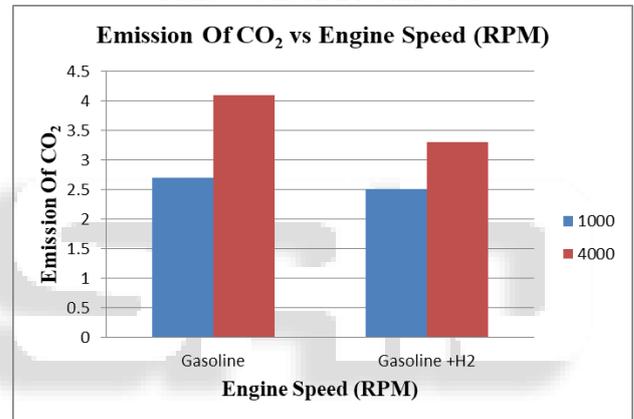


Graph 3: Carbon Mono-Oxide Test

##### C. Carbon Di-Oxide Test

CO <sub>2</sub> Emission		
RPM	Gasoline	Gasoline+ H <sub>2</sub>
1000	2.78	2.6
4000	3.85	3.4

Table 4: Carbon Di-Oxide Test

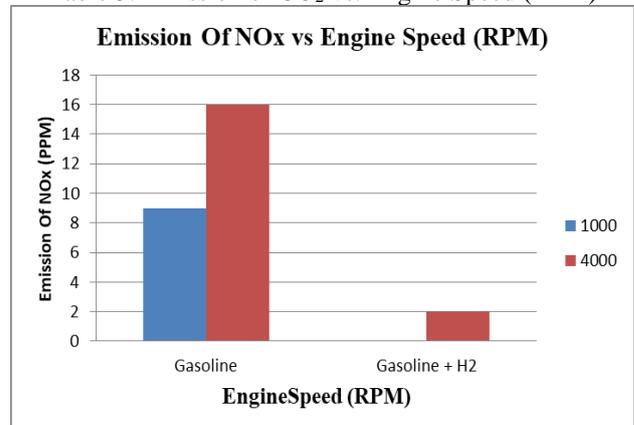


Graph 4: Emission of CO<sub>2</sub> vs. Engine Speed (RPM)

##### D. Nitrogen Oxide Test

Emission of NO <sub>x</sub>		
RPM	Gasoline	Gasoline+ H <sub>2</sub>
1000	9	0
4000	16	2

Table 5: Emission of CO<sub>2</sub> vs. Engine Speed (RPM)



Graph 5: Emission of NO<sub>x</sub> vs. Engine Speed (RPM)

## V. ADVANTAGES, DISADVANTAGES & APPLICATION

### A. Advantages

- Increases mileage upto 20% to 40%. Reduces Emission.
- Increases Pick-up power.
- Complete combustion of fuel up to 98% Reduces Engine noise & vibration.
- No need of R.T.O approval.
- Easy to install.

### B. Disadvantages

- One of the main limitations of HHO based automobile is that it takes about 2 to 3 minutes for the production of HHO gas.
- Another limitation of this type of production of gas is that the water used in this type of production should be very pure without any contaminant.

### C. Applications

- It is used in both S.I. Engines and C.I. Engines.
- It is used in both 2-wheelers and 4-wheelers.
- This kit is one of the pollution control device used to control the pollution in automobiles.
- HHO is used instead of traditional fuels like petrol, diesel etc.

## VI. CONCLUSIONS

- 1) It resulted in the increase of mileage.
- 2) Use of HHO in gasoline engines leads to reduction in the emission of harmful gases.
- 3) Use of HHO in gasoline engine increases the power output of the engine.
- 4) This technique acts as a source to makes us a part in the contribution made in reducing the global warming.

## VII. FUTURE SCOPE

- 1) This experiment can be taken to a higher level of research by finding appropriate ratio of hydrogen to gasoline required to get optimum mileage as well as desired emission levels.
- 2) New technologies can be developed to generate hydrogen from natural resources.
- 3) One can always optimize the hydrogen being obtained from this process of electrolysis and find ways to increase efficiency of this process of hydrogen generation.
- 4) To run the vehicles, hydrogen is a better alternative among all fuel for currently prevalent petroleum fuels.
- 5) The underlying idea is to efficiently consume resources present in nature instead of trying to discover new fuel altogether.

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