

# Hydroxyl Gas Generator or Mileage Booster

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**Abstract:** The overall goal of this project is to demonstrate the potential for commercialization of hydrogen as a fuel enhancer. The major component of this project is conversion of gasoline powered motorcycle to use hydrogen as an additive and increase the fuel combustion. The eventual goal is to supply the vehicle with domestically produced renewable hydrogen. Renewable hydrogen can be obtained from process such as electrolysis process using low cost electricity, hydrogen as a by-product. The produced hydrogen is supplied to the air intake valve. Here it combines with the air fuel mixture and enters the combustion chamber of the engine. The hydrogen assists in complete combustion of the fuel thereby reducing the fuel consumption. The reduced fuel consumption increases the fuel efficiency of the engine. The gases released through the exhaust comprises more of oxygen compared to carbon dioxide. This method also allows as to decrease environmental pollution and to reduce the consumption of fossil fuels.

**Keywords:** Commercialization, Consumption, Environmental, Demonstrate.

## I. INTRODUCTION

The latest snag now paints a disturbing social picture with the growing sense of uncertainty that the prices of fuel will keep rising, and there will be adverse consequences due to higher than normal levels of contamination in the atmosphere. As a result of the intense production of petroleum fuel and the global dwindling non-renewable stored quantities, the world is experiencing an abnormally huge rise in the prices of crude oil. As a result of this, car manufacturers have started producing low-fuel consuming cars as we would want to save both our money and fuel at the same time. We, reportedly, spend one-third of our income on fueling up the vehicle and give harmful degraded materials like CO, NO<sub>2</sub>, HC etc. out in the smokes. The emissions are off shoots of the engine, in case it is a poor running vehicle, the engine emission contaminates the surrounding. The burning of gas very much shows the fact that it gives off toxic gases and pollutes the atmosphere. This makes those working in the field of research and energy begin the search for fuel which can be used in engines that does not require dramatic transformation in automobile design. On one hand, there are some disadvantages linked to its fuel consumption that is low and the cost of operation which is huge; nevertheless, it is crucial to find ways that would increase its efficiency, lower its production expenses and enhance its utility. thus, the fuel switching system has to work perfectly and even more efficient, perhaps including, the regular fuel working as well or even more perfect together. The modern research into secondary engine options of transportway is mainly about electric/battery, hybrid and hydrogen engine, which is the most popular now. While this attention means that the current technology should be abandoned and cannot be redesigned, it also assumes that the target technology will become defunct. But, it can be possible to have interim tech powering us through the struggle that we now face with presence of fossil fuels. Amongst the most topical challenges will be GHG emissions build up which result in global warming and introduction of consequences associated with climate change..

The scientific community is trying to solve these issues with an attempt to switch to cleaner and renewable sources of energy instead of fossil fuels. The studies up to date demonstrate the biomass-based fuel as the best choice, because they do not need the progress to the technologies currently in use. For all purposes, ethanol, which is one of the alcohols, is the best alternative option to petroleum. Hence, the way to anhydrous ethanol expansion in vehicular flow has been paved, which is blended with gasoline (18–25% vol/vol), and as well as with 100% hydrous ethanol (4). e. g. , 0-4. 9% vol/vol of water or any of these combination or Water in contrast to other forms of fuel in the world happen to be a free water resource and this technology can be used to convert it into hydrogen with oxygen, the chemical name of it is HHO and normally it's known as "Free Energy". It is cheaper, easy to mine and have the massive explosive that never pollute the atmosphere. If we are stepping in the gas or diesel moved car we can observe the smell of related fuel, so it is clear that fuel is not burned properly. Here it is mentioned that we burn fuel and see the same places again. To prevent these drawbacks, a small amount of HHO is mixed with the pre-filtered air, which is the air that has already been ejected from the air filter system and is now on the way to the engine in-take system of the car. This mixed HHO ignites releasing the extra electrons into the igniting fuel and thus the added extra energy from the HHO leads cent percent of complete burning of the fuel. The HHO has Polymorphism that is it acts differently - before burning, while burning, and after

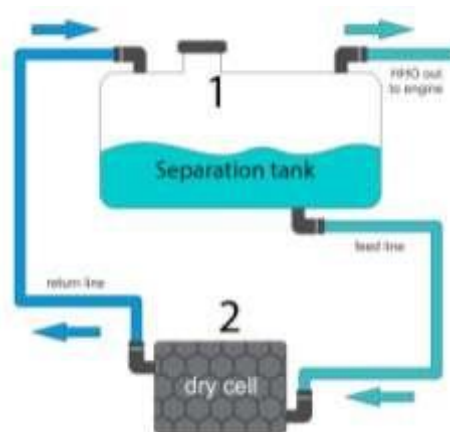
burning. Before burning of Hydrogen, which is a lightest gas with one proton and one electron and more efficient fuel three times of the explosive power when compared to fuel gas and five times than petrol. Actually, the Hydrogen requires little bit of energy of ignition to produce wide level of tremendous flammable temperature in the speed of lighting and there is no chance to compare with other fuel in this world. As a result of fact, it increases the engine performance, torque, and mileage and minimums fuel consumption. During burning the HHO into the engine with a tremendous explosion on that area and gives off high power of energy and automatically reverts to water vapor at once. Due to this action the engine not only getting higher torque but also gets easily cooled from 10 to 20 times faster than other fuels. For example, after combustion of fuel in the engine the level of temperature is approximately 250°F, but on the other hand mixing of HHO with same fuel means the engine temperature reduces approximately from 150°F to 200°F only because of vapors formations after combustion. Thus, the engine life period gets wider, and reduces lubricating oil degradation beyond the limit of Km. Then oil changing period also gets lengthened. It leads in decrease of the maintenance cost and increase of interval of maintenance. After burning the HHO, the engine gives steam and some percentage of oxygen on the exhaust side and the steam is automatically converted into water form in the atmosphere. Thus, the exhausts emission also controls from 10% to 50%. The pollution also reduces, and remaining Oxygen comes out from the exhausts. In this study one of the goals was to test if the addition of HHO gas as source of active intermediate substances would result with measurable effects on engine operation and fuel consumption.

**II. EXPERIMENTAL SETUP AND TEST PROCEDURE**

**2.1. HHO Generator**

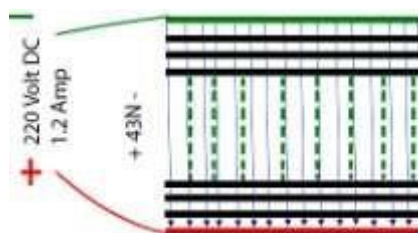
**2.1.1. System Description**

Illustrated generator of HHO used in our study is presented in the Fig. 1. Coordination tank (1) is responsible for supplying to HHO module (2) with the continuous water flow for preventing overheating and, thus, ensuring stable and continuous hydrogen generation

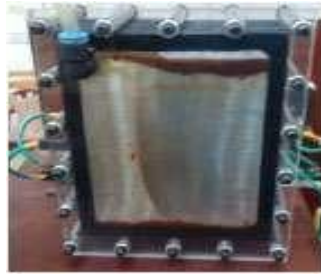


**Fig. 1** Schematic diagram of the HHO gas generation system.

Oxygen–hydrogen mixture generated from the dry cell will be back to the top of the tank with some water droplets. Water droplets will separate and fall to the bottom of the tank with the rest of the water, while hydrogen and oxygen gases are directed to the engine intake manifold.



**Fig 2:** HHO fuel cell. (a) Plates’ arrangement (using 43 neutral plates).



(b) HHO dry cell with Water inlet and gas outlet ports.

The stainless steel plates acting as the cathode were as well employed as the cathode. It is applicable to 45 electrodes 100\*100\*1 which are used. 2 mm thickness with the configuration as is demonstrated in Fig. 2 in the alternate version that might have been marked as (+,43N,-), where the positive electrode is designated as (+), neutral electrode is (N), and the negative electrode can be labeled as (-). The amperages from the negative bridge rectifier terminal flows on the neutral plates to the positive plate, into the positive terminal. The polarity of the plates lowers the plate voltage, the cathodes and anodes work the same power and the surplus of the area of electrodes for forming HHO gas.

The gap between counter plates was 2 mm maximum, this was reached using rubber gaskets. Along with the 100\*100\*2 mm size of the acrylic plate for the visual detection of electrolyte level. The DC power coming from the Wall 220volt is supplied to the HHO cell. 2 Ampere. Cell current production efficiency within the absence of the gas engine helps us find the best electrode configurations. The low resistance and severe temperature, the efficiency of the electrode is tested experimentally.

**2.1.2. HHO separation tank**

The set-up fig. 1, shows the components of the HHO separation tank. It was designed to be made from a PVC tank with a capacity 5 L. and a. This allowed us to fill our fish tank with the 5-gallon water from the store easily with Distilled water without any dissolved catalyst. Hoses were used for water inlet and HHO gas outlet from the cell, the condensed water carried to the cell through outlet and HHO gas outlet to the engine. It is equipped by a Pressure gauge with vacuum range 0–1 bar and a spring-loaded vacuum breaker.

**2.2. Engine and test bed description**

It consists of HHO dry cell which is supplied with the electric current through the vehicle battery. The gas produced from this cell by electrolysis process is conveyed though a hose pipe after the air filter and before the carburettor. The mixture of air and HHO gas is mixed with the conventional fuel in the carburettor according to the stoichiometric ratio and sucked into the IC engine through the intake manifold as per the throttle requirement.

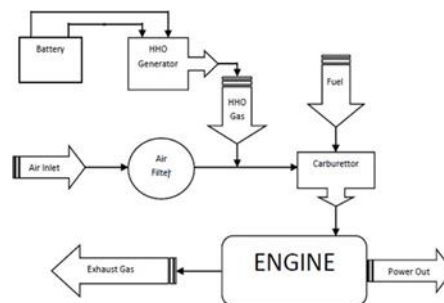
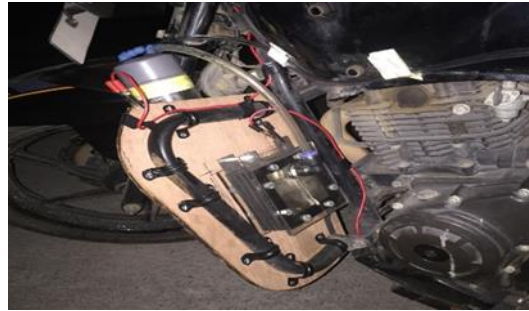


Fig. 3: Schematic layout of installed HHO generation system on a vehicle or IC engine system.

**2.2.1 Construction:**

The actual assembly is similar to the schematic layout of the system. It consist of a backing plate, dry cell assembly and reservoir cum bubbler assembly. The dry cell is initially assembled on the backing plate at its centre as shown in Fig.

The backing plate and dry cell unit is fitted on the bumper using pipe U clips. The reservoir is connected at the top of the backing plate on the front side close to the shock absorber. The reservoir is at an elevated height than the dry cell to provide manometric head for better flow of electrolyte to the dry cell. Bottom outlet of reservoir is connected to inlet port of dry cell with transparent hose. The outlet of dry cell is connected with transparent hose to reservoir top port connected to dip tube. The other port at reservoir top end is the gas outlet port. It is connected using transparent hose before the carburettor. A hole is to be drilled in the throttle tube which is before the carburettor for connecting the gas carrying hose.



**Fig. 4:** Actual assembly of dry cell on the vehicle.

### 2.2.2. Working:

"Electrolysis is the process by which ionic substances are decomposed (broken down) into simpler substances when an electric current is passed through them." As we switch on the starter, the electrical circuit is completed and current starts to flow from the battery to the dry cell and electrolysis process is triggered. Current flows from negative terminal to the electrolyte.  $K^+$  ions are attracted towards anode (negative electrode) and  $OH^-$  ions are attracted towards cathode (positive electrode). This causes the electric current to flow from negative to positive electrode due to flow of ions. All cathode, anode and net cell reactions are mentioned above in chapter 1 methodology. As output of this electrolysis process, HHO gas is obtained from the cell.

#### Overall Cell reaction



This  $2H_2 + O_2$  is called as HHO gas or technical name for it is Brown's gas. This HHO gas produced from dry cell contains some water particles in it. So it cannot be given directly to engine. This output of dry cell is given to the reservoir, where reservoir acts as bubbler and the output HHO gas with water particles is fed to the electrolyte through dip tube. Water particles from HHO mix with electrolyte in reservoir and the HHO gas is liberated in the form of bubbles. This HHO gas in pure and dry form will be collected in reservoir free space at top and then discharged through outlet at top end of reservoir. This pure and dry HHO gas is being supplied in between carburetor and air filter to the hole made in throttle tube through transparent hose connected to it.

While engine operation this HHO gas is also sucked in carburetor as secondary fuel with atmospheric air and conventional primary fuel that is petrol. This mixture of petrol, atmospheric air and HHO gas is sucked during suction stroke.

This is the detailed working of HHO generator.

## III. RESULTS AND DISCUSSION

### 2.3.1. Testing Of Exhaust Emissions:-

The testing of exhaust emissions was done on a modern exhaust gas analyser machine. Two operating conditions were tested for the engine. The first operating condition was before putting on dry cell to the vehicle and the engine was powered only by primary conventional fuel that is petrol. The second mode of operation was after the installation of the HHO dry cell kit on the vehicle, and engine functioned on HHO gas as secondary fuel and petrol as primary conventional fuel. The specification of carbon monoxide and hydrocarbon test procedures and measurement methodologies for in-service vehicles fitted with SI engines at idling conditions..

Table.(4.1)- Engine specifications for tested vehicle

Engine model	TVS Apache RTR 160
Engine type	4 stroke single cylinder SI engine
Displacement	159.7cc
Bore	62 mm
Stroke	52.9 mm
Compression ratio	9.5:1
Maximum Power	15.2 bhp @8500rpm
Maximum Torque	13.1 Nm @4000rpm

Fig.5. Variation of engine power versus engine speed at different loads with/without HHO.

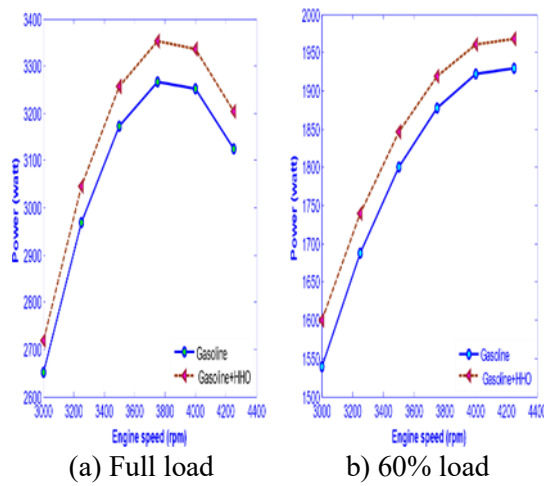
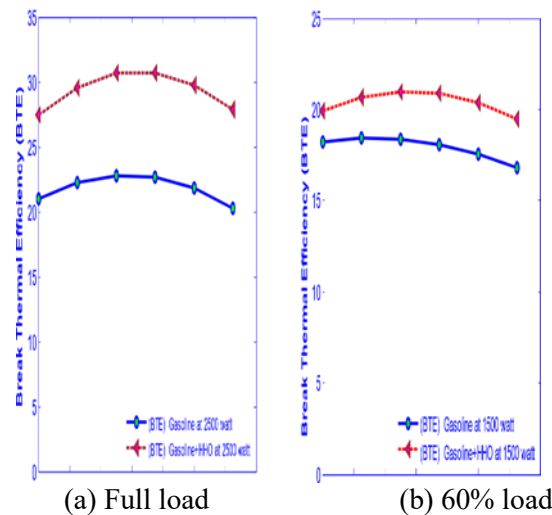
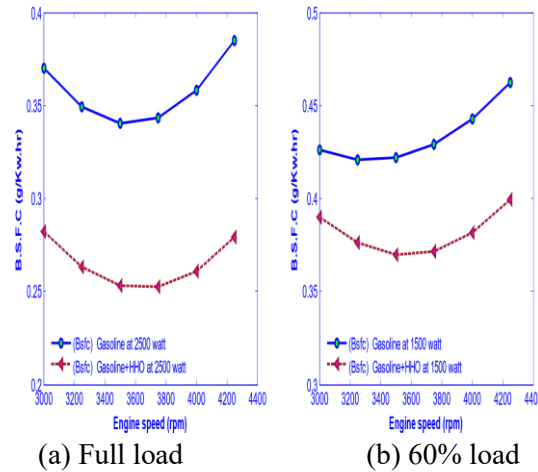


Fig.6. Variation of brake thermal efficiency versus engine speed at different loads with/without HHO.



**Fig.7.** Variation of brake specific fuel consumption versus engine speed at different loads with/without HHO



3000 3200 3400 3600 3800 4000 4200 4400 3000  
**Engine speed (rpm)**

3200 3400 3600 3800 4000 4200 4400  
**Engine speed (rpm)**

**IV. CONCLUSION**

An experiment was done and the after effect was to have a look of the effect of HHO gas on TVS Apache RTR160 engine. Being developed is a fuel cell that constitutes an HHO gas generation unit to be used as engine fuel. The mixture of the products of combustion and fresh air are being fed to the intake manifold. The concentrations of exhaust gas have been analysed and measured through a suitable instrument as a gas analyzer. The following can be the summed up.

1. Water which is used in gasoline engine burning very quickly and fully diminishes fuel consumption which in turn there is decrease in pollution. The HHO cell is a simple add-on that can be easily fitted into engine-compartment without the need for any structural changes.
2. It has resulted asthma's exposure level of this gas to be less than 15-30% of average.
3. H2C gas level has been enhanced as a result, where there is a concentrations level between 5 to 15%.
4. The mileage of the of the engine was seen to be improved by about 21.22%.
5. The proposed design for reservoir cum bubbler takes into consideration the safety precautions needed when dealing with hydrogen fuel.

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