PERFORMANCE STUDY OF HYDROGEN POWERED PETROL ENGINE

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Abstract

Hydrogen powered vehicles have been in development for the past decade. While hydrogen fuel cells have been receiving the majority of the attention, they will not be ready for mass production for fifteen to twenty-five years. Hydrogen internal combustion engines may prove to be the most effective solution for the immediate future. This project explores the feasibility of making hydrogen internal combustion engines in mass produced vehicles. We researched the different methods for producing hydrogen, storing it in vehicles and converting traditional internal combustion to burn hydrogen instead of gasoline. Through this research, we investigated the advantages of hydrogen internal combustion engines over hydrogen fuel cells.

INTRODUCTION

Hydrogen powered bikes are those in which “HYDROGEN CELL” is used to produce a fraction of power for driving the bike. This results in decrease the fuel(petrol) thus increasing the mileage of the bikes. hydrogen gas kit is latest innovation to increase mileage and power of vehicle.HHO kit.Combustion of fossil fuels has caused serious problems to the environent and the geopolitical climate of the world. The main negative effects on the environment by

Fossil fuel combustion are emissions of NOx, CO, CO2, and unburned hydrocarbons. The main negative effect of burning fossil fuel on the geopolitical climate is the lack in supply of these fuels and the effect pollution has on politics.Hydrogen is a cleanfuel which on combustion produces water vapor as the only product. The use of hydrogen in IC engines not only help increase the efficiency of it but also it helps to reduce pollution and reduce the poisonous gases like carbon monoxide, nitrous oxide etc. The use of hydrogen helps to reduce their use and hence prevent the depletion of these precious natural resources.Through a process of electrolysis water that is in a sealed container under your hood is converting to HO gas. This gas is than introduce to airflow in the intake manifold using your engine vacuum. This gas is than mixed with the fuel providing better mileage.

. PROBLEM STATEMENT

In recent years, the usage of The hazardous effect of pollutants from conventional fuel vehicles have caused the scientific world to move towards environmentally friendly energy sources. Though we have various renewable energy sources, the perfect one to use as an energy source for vehicles is hydrogen. Like electricity, hydrogen is an energy carrier that has the ability to deliver incredible amounts of energy. Onboard hydrogen storage in vehicles is an important factor that should be considered when designing fuel cell vehicles.

OBJECTIVES

At the completion of this module, the technician will understand:

- The combustive properties of hydrogen that relate to its use as a combustive fuel
- The air/fuel ratio of hydrogen fuel mixtures and how it compares to other fuels • the types of pre-ignition problems encountered in a hydrogen internal combustion engine and their solutions
- The type of ignition systems that may be used with hydrogen internal combustion engines
- Crankcase ventilation issues that pertain to hydrogen use in an internal combustion engine
- The thermal efficiency of hydrogen internal combustion engines
- The type of emissions associated with hydrogen internal combustion engines
- The power output of hydrogen internal combustion engines
- The effect of mixing hydrogen with other hydrocarbon fuels

COMPONENTS

- BATTERY
- ANODE
- CATHODE
- ELECTROLYTE
- CONNECTING PIPE
- CYLINDRICAL SETUP
- ENGINE

Battery

A battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high- energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to include devices composed of a single cell.

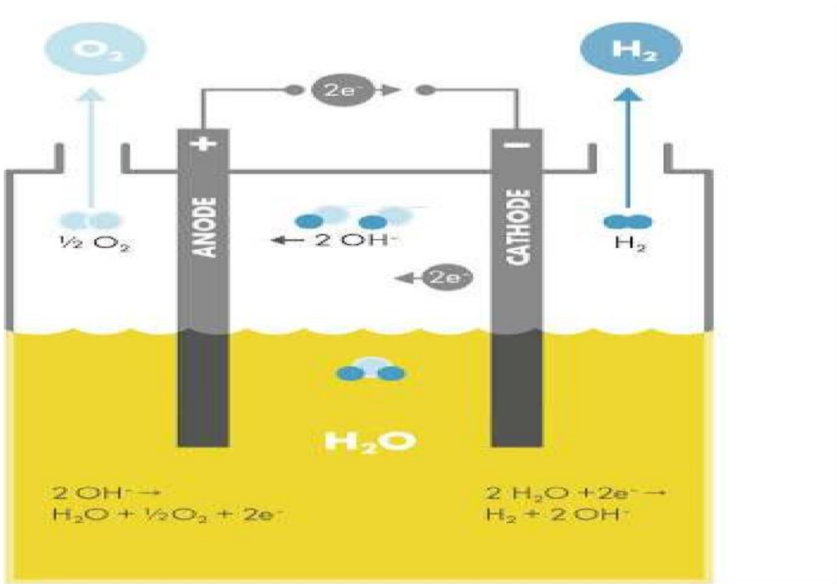
Primary batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and smart phones.

Battery	LI ion Battery
Voltage	12.4 V
Ampere	7.5 ah
Numbers	1

Solid works drawing of battery

Anode & Cathode

The terms anode and cathode are not defined by the voltage polarity of electrodes but the direction of current through the electrode. An anode is an electrode through which conventional current (positive charge) flows into the device from an external circuit, while a cathode is an electrode through which conventional current flows out of the device



Electrolyte

An electrolyte is a component which is added to water to increase its conductivity . Here we are using Potassium hydroxide as electrolyte. When this electrolyte is added to water the water become concentrated and when electricity is passed through anode and cathode the water molecules will brake down into hydrogen and oxygen

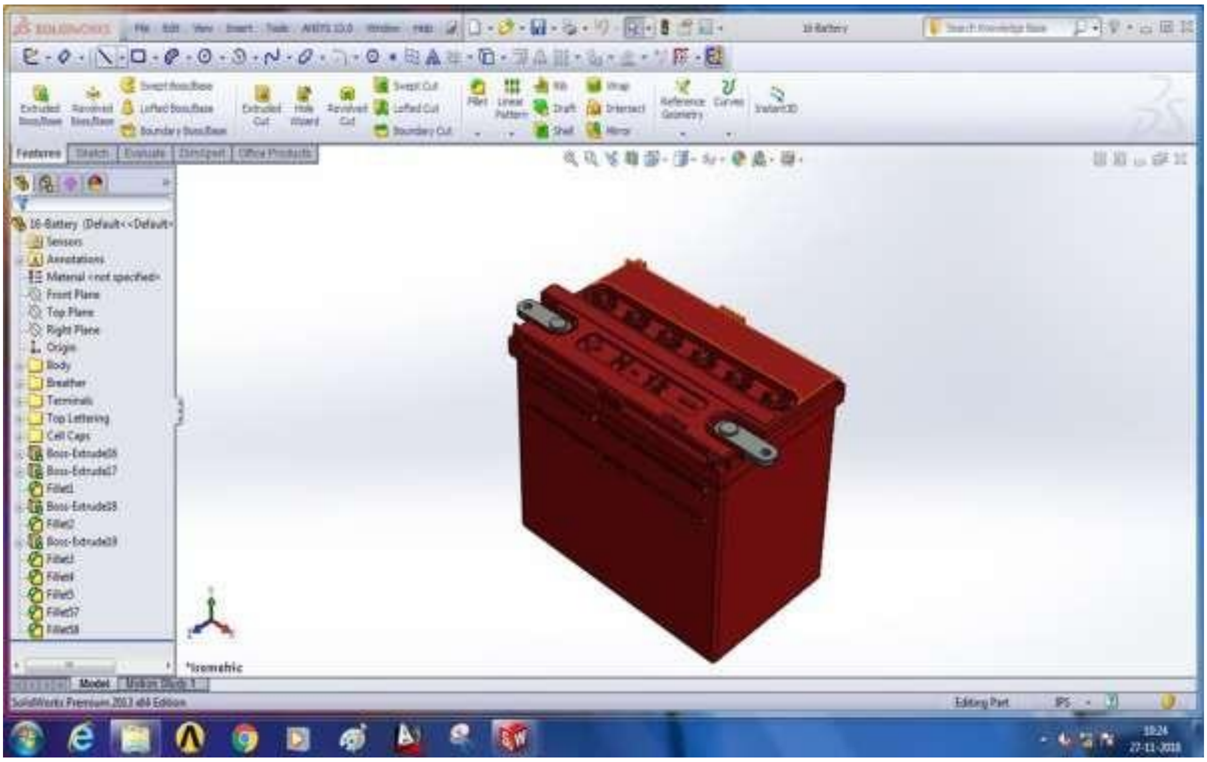
Engine

Here we are using 100cc bike engine (splender).

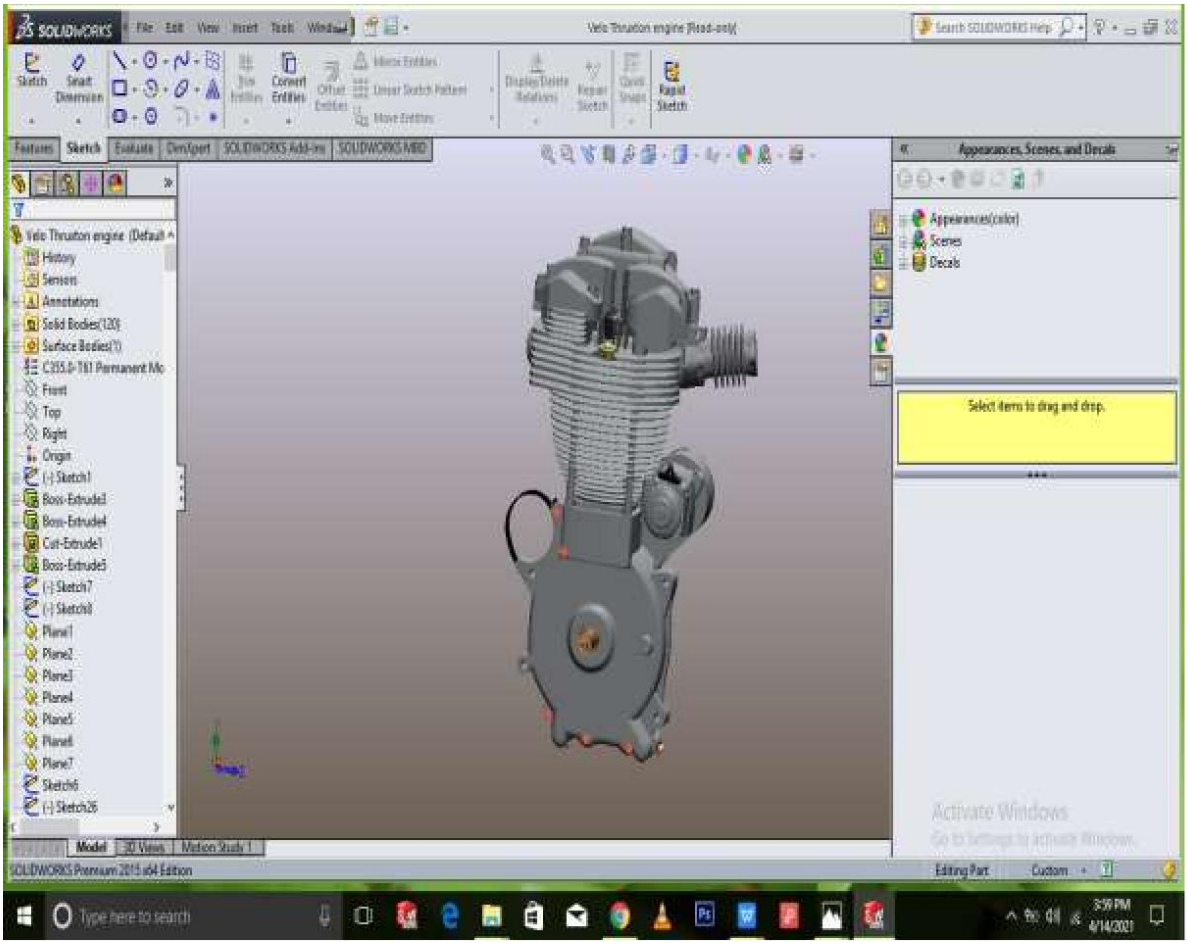
SOLID WORK DRAWINGS

BATTERY

[12V 7.5Ah]



ENGINE



CALCULATION

Air/Fuel Ratio

The theoretical or stoichiometric combustion of hydrogen and oxygen is given as:

$2H_2 + O_2 = 2H_2O$

Moles of H_2 for complete combustion = 2 moles

Moles of O_2 for complete combustion = 1 mole

Because air is used as the oxidizer instead oxygen, the nitrogen in the air needs to be included in the calculation:

Moles of N_2 in air = Moles of O_2 x (79% N_2 in air / 21% O_2 in air)

= 1 mole of O_2 x (79% N_2 in air / 21% O_2 in air)

= 3.762 moles N_2

Number of moles of air = Moles of O_2 + moles of N_2

= 1 + 3.762

= 4.762 moles of

air Weight of O_2 = 1 mole of O_2 x 32 g/mole

= 32 g

Weight of N_2 = 3.762 moles of N_2 x 28 g/mole

= 105.33 g

Weight of air = weight of O_2 + weight of N

= 32g + 105.33 g

= 137.33 g

Weight of H_2 = 2 moles of H_2 x 2 g/mole

= 4 g

Stoichiometric air/fuel (A/F) ratio for hydrogen and air is: A/F

based on mass: = mass of air/mass of fuel

= 137.33 g / 4 g

= 34.33:1

A/F based on volume: = volume (moles) of air/volume (moles) of fuel

= 4.762 / 2

= 2.4:1

The percent of the combustion chamber occupied by hydrogen for a stoichiometric mixture:

% H_2 = volume (moles) of H_2/total volume

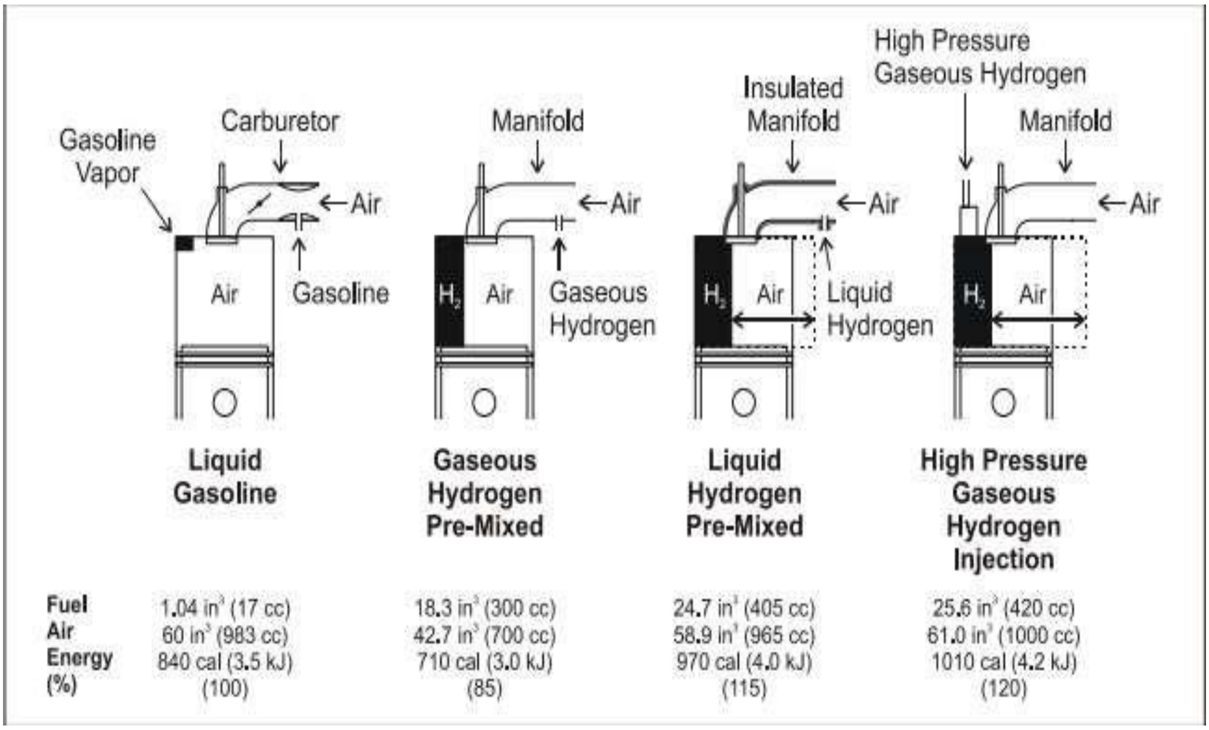
= volume H_2/(volume air + volume of H_2)

= 2 / (4.762 + 2)

= 29.6%

As these calculations show, the stoichiometric or chemically correct A/F ratio for the complete combustion of hydrogen in air is about 34:1 by mass. This means that for complete combustion, 34 pounds of air are required for every pound of hydrogen. This is much higher than the 14.7:1 A/F ratio required for gasoline. Since hydrogen is a gaseous fuel at ambient conditions it displaces more of the combustion chamber than a liquid fuel. Consequently less of the combustion chamber can be occupied by air. At stoichiometric conditions, hydrogen displaces about 30% of the combustion chamber, compared to about 1 to 2% for gasoline. Figure 3-3 compares combustion chamber volumes and energy content for gasoline and hydrogen fueled engines. Depending the method used to meter the hydrogen to the engine, the power output compared to a gasoline engine can be anywhere from 85% (intake manifold injection) to 120% (high pressure injection).

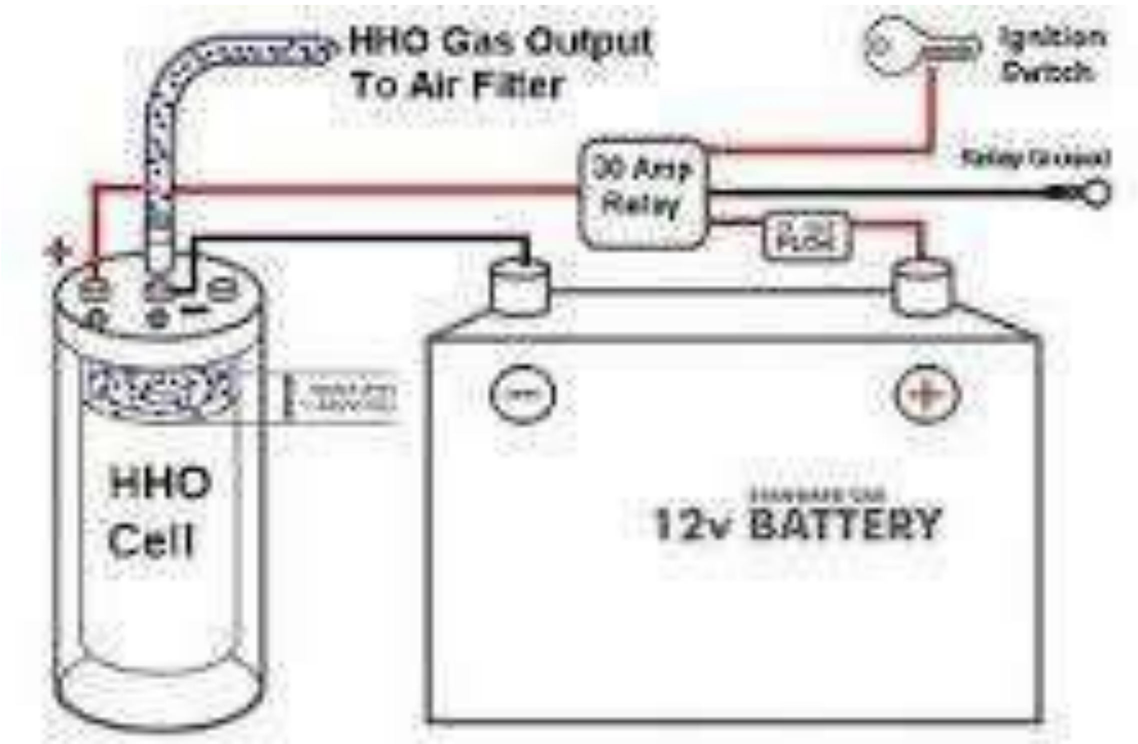
Combustion Chamber Volumetric and Energy Comparison for Gasoline and Hydrogen Fueled Engines



WORKING PRINCIPAL

This works on the principal of electrolysis process.Electrolysis is the process that converts water to gas. The electrical supply for the process is used from your Vehicles battery and alternator.An electrical power source is connected to the two electrode materials which are placed in the water. Hydrogen will appear at the cathode (the negatively charged electrode, where electrons enter the water), and oxygen will appear at the anode material (the positively charged electrode).ie reduction at cathode and oxidation at anode occurs According to ideal faradaic efficiency. The amount of hydrogen generated is twice the number of moles of oxygen and both are proportional to the total electrical charge conducted by the electrodes solution.

ELECTRICAL CONNECTION



WORKING PROCESS

The hydrogen generated at cathode is fed to the inlet manifold that is in air hose pipe of the carburetor, then this gas mix with the coming air from the air filter when the vacuum is created by the piston movement from TDC to BDC. As the ho hydrogen or HO gas mixed with air then it goes to engine cylinder with gasoline during suction stroke of the engine. At the end of compression stroke the spark is generated from the cold rated spark plug the combustion of gasoline and HO gas occurs.HHO itself contains 1/3 oxygen by volume and 2/3 hydrogen (which has an octane rating of 130). The hydrogen explosion is so fast that it fills the combustion cylinder at least 3 times faster then the gasoline explosion and subsequent ignites the gasoline from all directions. Hence more power is generated consequently the milage of our bike gets increased.Some basics the burn speed of hydrogen is 0.098 to 0.197 ft/min (3 to 6 cm/min) compared gasoline´s 0.00656 to 0.0295 ft/min (0.2 to 0.9 cm/min).

DESIGN MODIFICATION

Spark plugs

Use cold rated spark plugs to avoid spark plug electrode temperatures exceeding the auto-ignition limit and causing backfire.

Use RTD (Resistance temperature detector)

RTD provide safety us because when the temperature of the engine of the bike exceed a particular limit then it cut off the gas supply consequently the bike will only on gasoline. Therefore, chances of blasting are reduced to zero.

Ignition system

Avoid uncontrolled ignition, the spark plug gap can be decreased to lower the ignition voltage; this is no problem for hydrogen engines as there will be almost no deposit formation. Spark plug gaps as small as 0.25mm has been used.

Carburetor setting

After having installed the Cell and electrical connections made properly, we set the carburetor correctly to achieve better mileage.

1) Adjust the Fuel Control Valve so that the fuel supply is decreased to minimal and engine runs in idle condition smoothly. Finer setting of fuel supply will result in increased mileage of the vehicle.

2) Make sure to Fine Tune the Air Control Valve and Fuel Control Valve after

running the vehicle for every 200 - 300 Kms until better mileage is achieved. As the carbon deposits on the inside wall of the engine is removed, the vehicle performance will increase gradually.

3) Trick is to find Fine setting by "Allow Maximum Air" at maximum RPM and

"Reduce Fuel Supply.

CONCLUSION

It is advantageous to use Brown's gas enriched air as a fuel in internal combustion engines. Significant impact on brake thermal efficiency and brake power is observed upon the addition of Brown's gas enriched air. Fuel consumption and other emissions viz: NOx and smoke emissions are reduced to considerable amount. Hydrogen fuel enhancement from electrolysis (utilizing automotive alternators) has been promoted for use with gasoline powered and diesel trucks, although electrolysis-based designs have repeatedly failed efficiency tests and contradict widely accepted laws of thermodynamics. This project will help our country to be energy independence if it is used in a proper way. It will make India free from pollution that is going to be a major problem of the world.

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