

Improving Fuel Efficiency through Hydrolysis for Two Wheeler

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Abstract— Faced With the ever-increasing cost of gasoline, automakers worldwide are working overtime to cost-effectively improve vehicle fuel economy while still meeting today's strict emissions requirements. One promising way to boost fuel economy is to add hydrogen to the fuel/air mixture in a conventional gasoline engine. It's called a hydrogen-boosted gas engine. However, since hydrogen isn't readily available at your local filling station, selling a hydrogen-boosted gas engine hasn't been on any automakers' short list. In this project, we have worked on a new technology that utilizes a fast-response onboard reformer to generate a small amount of hydrogen from gasoline. This hydrogen is added to the engine's normal air/fuel mixture. Engines designed to run on a mix of hydrogen gasoline can see a fuel-economy gain of 20 to 30 percent with no requirement for control of harmful NOx emissions (oxides of nitrogen). With ever-increasing rise in inflation, fuel costs and taxation, we endeavour to design and friendly and highly efficient.

1 INTRODUCTION

This Project is based on a process called hydrolysis that is when water is supplied with a electric current through a battery and the atoms in the water are splitting up to two parts. The anode separates oxygen, and the cathode separates hydrogen. After this separating process we use the split up hydrogen and store it in a tank. Then that hydrogen is forced to combine with the air to the carburetor where the hydrogen mixture is sent to the engine, where as even hydrogen is a flammable liquid it reduces the amount of fuel that is taken into the engine causing a raise in the economy of fuel consumption and also reducing the emissions to a good extent.

2 PROCEDURE

2.1 Working principle

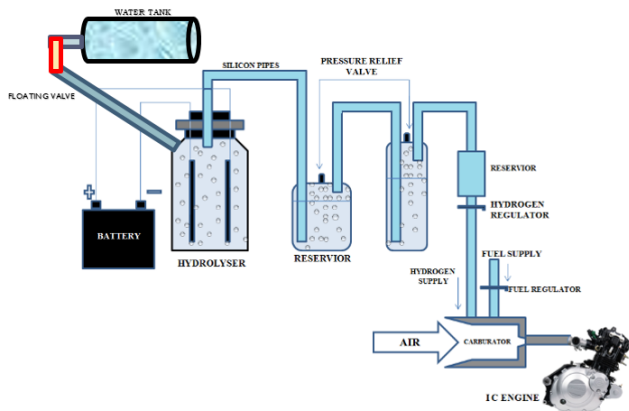
An electrical power source is connected to two electrodes, or two plates (typically made horn some inert metal such as platinum, stainless steel or iridium) which are placed in the water. Hydrogen will appear at the cathode (the negatively charged electrode, where electrons enter the water), and oxygen will appear at the anode (the positively charged electrode). Assuming 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 solution. However, in many cells competing side reactions dominate, resulting in different products and less than

ideal faradaic efficiency.

Electrolysis of pure water requires excess energy in the form of over potential to overcome various activation barriers. Without the excess energy the electrolysis of pure water occurs very slowly at not at all. This is in part due to the limited self-ionization of water. Pure water has an electrical conductivity about one millionth that of seawater. Many electrolytic cells may also lack the requisite electro catalysts. The efficiency of electrolysis is increased through the addition of an electrolyte (such as a salt, an acid or a base) and the use of electro catalysts.

2.2 Working process

The hydrogen generated at cathode is fed to the inlet manifold that is in air hose pipe of the carburettor, 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 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. Reservoir 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 than the gasoline explosion and subsequent ignites the gasoline from all directions. Hence more power is generated consequently the mileage of our bike gets increased



3 Combustive properties of hydrogen (brown gas):-

3.1 Low Ignition Energy:-Hydrogen has very low ignition energy.

3.2 High Auto ignition Temperature:-The high auto ignition temperature of hydrogen Allows larger compression ratios to be used in a hydrogen engine than in a hydrocarbon engine.

3.3 High Flame Speed:- Hydrogen has high flame speed at stoichiometric ratios. 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).

3.4 High Diffusivity:- Hydrogen has very high diffusivity. Firstly, it facilitates the formation of a uniform mixture of fuel and air. Secondly, if a hydrogen leak develops, the hydrogen disperses rapidly. Thus, unsafe conditions can either be avoided or minimized.

3.5 Low Freezing point:- Thus this creates no starting problem in the cold environment.

3.6 Wide Range of Flammability:- As can be seen the flammability limits (= possible mixture compositions for ignition and flame propagation) are very wide for hydrogen (between 4 and 75 percentage hydrogen in the mixture) to gasoline (Between 1 and 7.6percentage).

4 FEASIBILITY, NEED AND FUTURE SCOPE OF THE TOPIC:-

This project have a reliability in itself being an automobile. This project is also very economical since the major factor of high level of fuel (petrol) prices in the country, would be reduced. All the components used in the project are real and available easily. Such type of bikes or automobiles are needed more in India because these reduces the air pollution and the amount of money involved in the fuel consumption. Currently, in India, air pollution is widespread in urban areas where vehicles are the major contributors and in a few other areas with a high concentration of industries and thermal power plants.

Hydrogen is a fuel with heat content nearly three times that of gasoline. From our work we experimentally found out that the efficiency of an IC engine can be rapidly increased by mixing hydrogen with gasoline. Hydrogen is the Key to a Clean Energy

5 TESTING AND ANALYSIS

The setup was then arranged and assembled in a four stroke pulsar 150 dts-I which is a 150 cc 4-stroke single cylinder engine

5.1 Mileage test:-

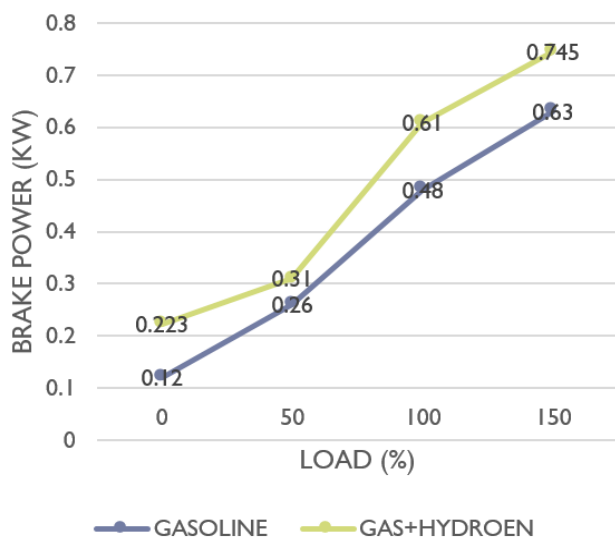
5.1.1 WITHOUT HYDROGEN:-

TEST NO	GASOLINE CONSUMTION	MILEAGE (SUMMER)	MILEAGE (WINTER)
TEST 1	100ml	4.4km	4.3km
TEST 2	150ml	6.7km	6.2km
TEST 3	200ml	8.9km	8.5km

5.1.2 WITH HYDROGEN:-

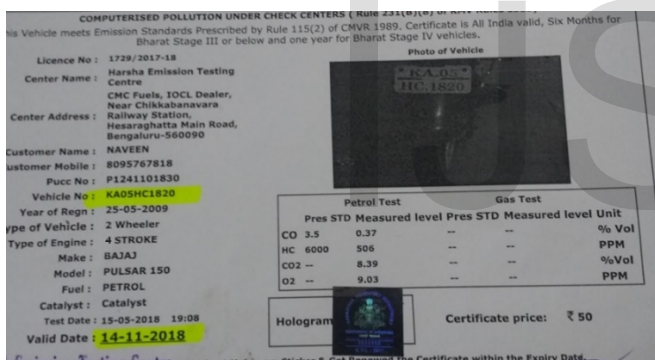
TEST NO	GASOLINE CONSUMTION	MILEAGE (SUMMER)	MILEAGE (WINTER)
TEST 1	100ml	7.1km	6.8km
TEST 2	150ml	8.9km	8.2km
TEST 3	200ml	12.9km	12.1km

5.2 Power TEST:-

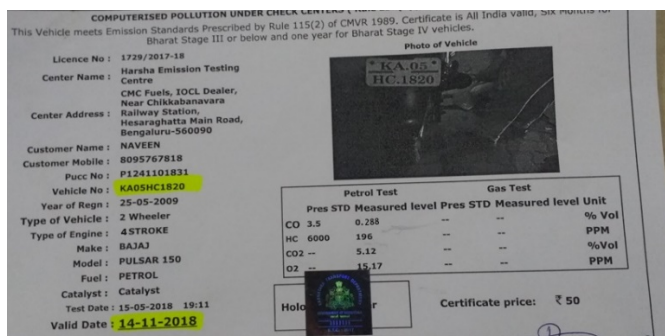


5.3 Emission test:-

WITHOUT HYDROGEN:-



WITH HYDROGEN:-



6. Safety precautions

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

6.2 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. Carburettor setting-after having installed the cell and electrical connections made properly, we set the carburettor 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.

6.3 Pressure relief valve:- when there is a backfire of there hydrogen flame the pressure relief valve opens so that the pressure escapes through it causing no harmful damages, and also so that the hydrogen inlet pipe is immersed in water the hydrogen does not get burned all the way back to the chamber.

7. 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.

8 . ACKNOWLEDGMENT

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9 REFERENCES

1. NASA Technical Note, May 1977, "Emissions and Total Energy Consumption of a Multicylinder Piston Engine Running on Gasoline and a Hydrogen-Gasoline Mixture" (Accessed 2008-08-08)
2. Hydrogen Internal Combustion Engine Vehicles Idaho National Laboratory
3. G. Fontana, E. Galloni, E. Jannelli and M. Minutillo (January 2002). "Performance and Fuel Consumption Estimation of a Hydrogen Enriched Gasoline Engine at Part-Load Operation". *SAE Technical Paper Series* (2002-01-2196): 4-5.
4. Mathur H.B., Das L.M.(1991). "Performance characteristics of a Hydrogen Fueled SI Engine using Timed Manifold Injection". *Int. J. Hydrogen Energy* (vol 16, pp. 115-117, 1991).
5. Per Tunestal, Magnus Christensen, Patrik Einewall, Tobias Andersson, and Bengt Johansson (January 2002). "Hydrogen Addition for Improved Lean Burn Capability of Slow and Fast Natural Gas Combustion Chambers". *SAE Technical Paper Series* (2002-01-2686): 7-8.
6. Tsolakis A, Megacities A, Wyszynski ML, "Application of exhaust gas fuel reforming in compression ignition engines fuelled by diesel and biodiesel fuel mixtures" *Energy & Fuels* 17 (6):1464-1473 NOV-DEC 2003.
7. Yougen Kong, Sam Crane, Palak Patel and Bill Taylor (January 2004). "NOx Trap Regeneration with an On-Board Hydrogen Generation Device". *SAE Technical Paper Series* (2004-01-0582): 6-7.
8. Thorsten Allgeier, Martin Klenk and Tilo Landefeld (January 2004). "Advanced Emissions and Fuel Economy Control Using Combined Injection of Gasoline and Hydrogen in SI-Engines". *SAE Technical Paper Series* (2004-01-1270): 11-12.
9. Water-Powered Cars: Hydrogen Electrolyzer Mod Can't Up MPG's, Mike Allen, August 7, 2008, Popularmechnics.com
10. US Environmental Protection Agency, "Devices and Additives to Improve Fuel Economy and Reduce Pollution - Do They Really Work?"
11. Barton, P.J. 2004. Study of Heavy Duty Vehicle Exhaust Emissions and Fuel Consumption with the use of a JetStar™ Hydrogen Gas Generator.