

Development and Performance Analysis of 4-Stroke Engine using Oxy-Hydrogen Gas as a Fuel

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ABSTRACT

Due to the more use of conventional fuel in the vehicles, a pollution level is increasing day by day. Hydrogen is a potential alternative fuel for the IC engine. Fuel optimization plays a vital role all over the world, Water is the most readily obtainable and affordable source and hydrogen energy has been proven to be more effective compared to electric and gasoline cars. Prices of petroleum oil are increasing day-by-day affecting the life style of common people as well as national economy. That's why we need an alternative for petroleum. In recent days, all country is spending a huge amount of money on research and development of non-conventional energy resources. In the world, the conventional energy sources are limited, and their usage is very high; so alternative sources of energy have tremendous potential in future. Thus world is in crisis to find an alternative fuel for petroleum oils. To fulfill the aim stated before, non-conventional energy systems like solar, battery are developed. Nobody will think for a moment but it's the reality that water can be used as a fuel and hence an energy resource.

Keywords : Oxy-hydrogen gas Kit; Hydrogen; Performance of vehicle; rope brake dynamometer; emission performance; alternative fuel

I. INTRODUCTION

Fossil fuels (i.e., petroleum, natural gas and coal), which meet most of the world's energy demand today, are being depleted rapidly. Their combustion products are causing global problems, such as the greenhouse effect, ozone layer depletion, acid rains and pollution, which are posing great danger for our environment, and eventually, for the total life on our planet. fossil fuels are not renewable. In addition, the pollutants emitted by fossil energy systems (e.g. CO, CO₂, CnHm, SO_x, NO_x, radioactivity, heavy metals ashes, etc.) are greater and more damaging than those that might be produced by a renewable based hydrogen energy system. Many engineers and scientists agree that the solution to all of these global problems would be to replace the existing fossil fuel system with the clean hydrogen energy system.

A. Difference Between Oxy-hydrogen gas and Hydrogen

The Oxy-hydrogen Gas contains one part oxygen (such as hydrogen and two parts of course), as opposed to pure hydrogen. Oxy-hydrogen is significantly more combustible than hydrogen, thanks to the presence of oxygen in perfect proportion. Pure hydrogen is much more expensive to exploit. The advantage of the Oxy-hydrogen gas because it is easy and economical to make. So, Oxy-hydrogen is a powerful combustion enhancer.

Some researchers are even looking for ways to produce a car that runs 100% on its own Oxy-hydrogen, generated from water on-board the vehicle. This is very good for the environment, but very bad for oil companies. It would represent a HUGE shift in global economic power, if nearly free and clean energy became available to anyone/everyone.

One KWh of electricity produces approximately 340 liters of gas. Virtually any amount of Brown's Gas can be produced in any volume through cells in series, cells miniaturized, or cells enlarged. One unit of water yields 1,860 units of gas. The inverse applies as well. Upon ignition, Brown's Gas implodes. When implosion of the gas mixture occurs, the result is a 1,859 unit vacuum with one unit of water.

1 Litre of Water = 1866.6 Litters of Brown Gas

1 Litre of Water = 933.3 Litters of H₂:O₂ Gas

Brown Gas is simplest and highest atomic form and therefore less energy are required to burn than H₂:O₂ Gas. Thus, Brown gas burns at low temperature. This increases the efficiency of vehicles.

II. AIM

To design a Oxy-Hydrogen Gas kit which produce hydrogen-hydrogen oxygen gas. This will increase the performance of the engine and decrease the pollution emitted from the engine. Mechanical efficiency will be increased.

III. WORKING

We have battery, hydrogen generator, burette, bubbler, air filter, carburettor, engine and dynamometer. Positive of battery connect with one plate and negative phase connect with another plate.

There are two stainless steel plates that both are connected with battery terminal. Hydrogen will be formed in between two plates and will go to the bubbler. We will see the bubble in the bubblers that shows the hydrogen gas. Now this produced hydrogen gas deliver to the main fuel line.

It will supply in the hose which is in between air filter and carburettor. In carburettor hydrogen and gasoline will mix and delivered to the engine.

IV. ENGINE MODIFICATION

A. Ignition System

Avoid uncontrolled ignition due to residual ignition energy by properly grounding the ignition system or changing the ignition cable's electrical resistance.

Alternatively, 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.

B. Spark Plug

Use cold rated spark plugs to avoid spark plug electrode temperatures exceeding the auto-ignition limit and causing backfire. Cold rated spark plugs can be used since there are hardly any spark plug deposits to burn off. Do not use spark plugs with platinum electrodes as this can be a catalyst to hydrogen oxidation.

C. Injection System

Provide a timed injection, either using port injection and programming the injection timing such that an initial air cooling period is created in the initial phase of the intake stroke and the end of injection is such that all hydrogen is inducted, leaving no hydrogen in the manifold when the intake valve closes; or using direct injection during the compression stroke.

D. Hot Spots

Avoid hot spots in the combustion chamber that could initiate pre-ignition or backfire.

E. Compression Ratio

The choice of the optimal compression ratio is similar to that for any fuel, it should be chosen as high as possible to increase engine efficiency, with the limit given by increased heat losses or appearance of abnormal combustion (in the case of hydrogen primarily pre-ignition).

V. LITERATURE REVIEW

A. Development of Hydrogen By Using Reformer by P. Sreenivas, Venkata Ramesh Mamilla, K. Chandra Sekhar[1]

Author proposed the use of neat alcohols gives greater benefits than fuels containing lower levels of alcohols but neat alcohol Vehicles exhibits poor cold ignition performance below 11° Celsius. To overcome this cold

starting problem they used hydrogen to start the vehicle and then engine runs on pure alcohol.

Result : With the use of hydrogen, they can reduce the cold starting of the engine and reduce the fuel consumption.

B. Efficiency Analysis of a Copper Coated SI Engine using Normal and HHO blended Gasoline under Various Loads by P.T. Aravindhana, P.T. Anandhan[2]

Author discussed HHO gas production kit and did experiment on the 4- stroke engine having 550 cc capacity.

Result : Author found that mechanical efficiency and brake thermal efficiency increased using this HHO gas.

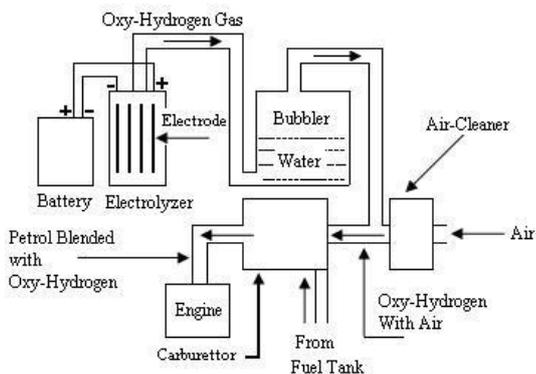


Figure 1. hho generator with engine

C. C. Hydrogen As a Spark Ignition Engine Fuel Technical Review by C.B. Srinivasana, Dr. R. subramanianb[3]

Author has worked on the alternative fuel to achieve the need of human over the conventional fuel. They increase the performance of the vehicle and at the same time reduce the exhaust gas emissions. They compare the property of Hydrogen with Methane and Gasoline.

Result: Authors found that Hydrogen is superior alternative fuel in IC engine. Property of Hydrogen is more suitable to the SI and CI.

D. D.Implications of Combustion Parameters on the Performance of a Hydrogen-Fuelled Research Engine by G.N. Kumar, G.P. Subash, L.M. Das[4]

Authors have use Several engine configurations have been built up and widely tested to generate optimum performance and low-emission characteristics without any symptoms of undesirable combustion phenomena such as backfire and rapid rate of pressure rise.

They conduct the experiment on the research engine setup to study the effect of some critical operating parameters such as air-fuel ratio, ignition timing on the cylinder pressure and heat release rate using neat hydrogen gas.

Result: An appropriately designed timed manifold injection system can ensure neat hydrogen SI engine without any undesirable combustion phenomenon such as backfire.

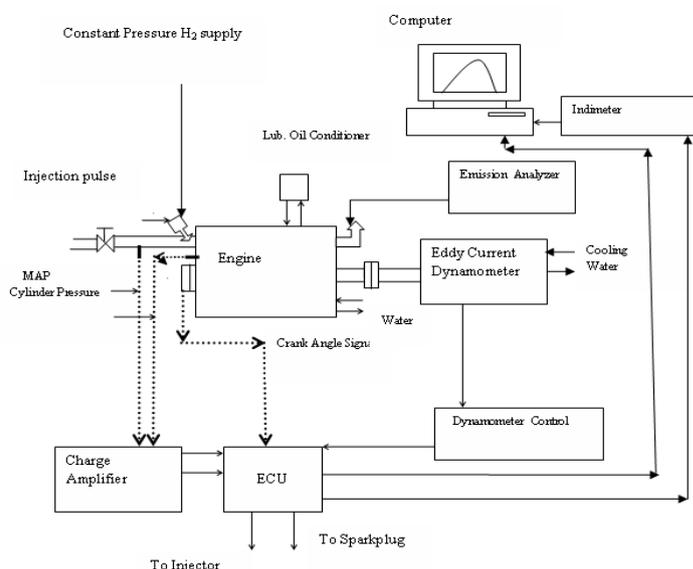


Figure 2. modified hydrogen fuelled engine[4]

E. E.Hydrogen Petrol Mixture SI Engine by Baiju B, Gokul S, Sachin Sunny, Ranjith C. M, Sathyamoorthy U[5]

Authors have designed a mixed fuel two wheeler engine in order to minimize the consumption of gasoline as well as to increase the power of vehicle. Here in addition, a hydrogen generating unit is made to produce hydrogen .It is actually an electrolysis unit having high grade stainless steel/graphite/semiconductors as electrodes in a closed container and mixture of distilled water & suitable ionic solution(KOH or NaOH) as electrolyte. Power for electrolysis is taken from an additional battery provided (12V).

Result: Hydrogen is a fuel with heat content nearly three times that of gasoline. Authors experimentally found out that the efficiency of an IC engine can be rapidly increased by mixing hydrogen with gasoline.

F. F.Hydrogen Fueled I.C. Engine by chetan patel[6]

The author performed tests at the Engines Laboratory of Dokuz Eylul University at Izmir. The laboratory consists of test benches involving an eddy current-type dynamometer, exhaust emission analyzer, fuel metering device and auxiliary equipment shows the basic set up of the test bench. The engine was Fiat licensed one produced by the Tofas Company. Besides the engine itself, flywheel.

Result: Hydrogen fuel has higher brake thermal efficiency and even can operate at lower engine loads with better efficiency. It can be noticed that brake thermal efficiency is improved to about 31 percentage with hydrogen fuelled engine compared to gasoline fuelled engine.

VI. CONCLUSION

- ✓ We have limited amount of conventional fuel quantity and these conventional fuels makes more pollution which is harmful for the environment as well as for human.
- ✓ To overcome this we have to find an alternative fuels. Hydrogen is a superior fuel for an IC engine. We can use this hydrogen in the SI engine with some engine modification.
- ✓ Storage of hydrogen is quite difficult.
- ✓ Results show that Hydrogen emits less pollution and gives more power. In this way we can say hydrogen is a good substitute of gasoline or any conventional fuel.

VII. ACKNOWLEDMENT

I am grateful to prof. Imran Molvi for his valuable suggestions and guidance given by them. I would like to thank the teaching & non-teaching staff of Department of Mechanical Engineering for sharing their knowledge with me.

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