Review of Hydrogen Powered 4-Stroke S.I. Engine (HHO Engine)

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***Abstract*—Considering the current scenario of petroleum fuels, it has been observed that, they will last for few years from now. On other hand, the ever increasing cost of a gasoline fuels and their related adverse effect on environment caught the attention of researchers to find a supplementary source. For commercial fuels, supplementary source is not about replacing the entire fuel, instead enhancing efficiency by simply making use of it in lesser amount. Form the recent research that has been carried out, focus on the use of Hydrogen rich gas as a supplementary source of fuel has increased. But the problem related to the storage of hydrogen gas confines the application of pure hydrogen in petrol engine.**

Electrolysis of water can give us hydrogen in form of Brown's gas (HHO gas) or oxy-hydrogen gas, which can be used as an alternative fuel for any internal combustion engine. An attempt has been made in this work to use alternative fuel in two stroke petrol engine. Our fore most aim in selecting this project to research for find solution is to use non-conventional fuel against conventional fuel which is becoming scarce and costly now days

Keywords : hydrogen , SI engine, electrolysis of water, HHO generator.

I. INTRODUCTION

A worldwide temperature alteration is viewed as one of the real issues the academic group needs to face. Air pollution in India is a serious issue. Air pollution contributes to the premature deaths of two million Indian every year[1]. Fuel consumptions is an important factor regarding economy. HHO also reduces the fuel consumption rate [6].

Hydrogen powered engine are those in which "HYDROGEN CELL" is used to produce a fraction of power for driving the engine. This results is decrease the hydrocarbon fuel thus increasing the mileage of the engine. Hydrogen gas kit is latest innovation to increase mileage and power of vehicle .Combustion of fossil fuels has caused serious problems to the environment and the geopolitical climate of the world. The main negative effects on the environment by Fossil fuel combustion are emissions of NOx, CO, CO_2, and unburned hydrocarbons. Such type of bikes or automobiles is needed more in India because this reduces the air pollution and the amount of money involved in the fuel consumption. Hydrogen is a fuel with heat content nearly three times that of gasoline.

HHO gas is renewable and clean burning fuel that does not generate carbon dioxide[1-2].

The concentration of the exhaust gases are corresponding to the measure of hydrocarbons in the fumes. HC's are generally the most exceedingly awful issue for the engines of vehicle [3]. Fuel

LITERATURE REVIEW

The valuable and fast exhausting non-sustainable power source asset "petroleum" can be spare by substituting "hydroxyl gas" in oil motor [7]. Looked with the regularly expanding expense of tradition non-renewable energy sources, inquires about worldwide are working additional time to cost viably enhance interior ignition motor (ICE) efficiency and execution attributes [8]. The Brown's gas (HHO) has been as of late acquainted with the automobile business as another wellspring of vitality [11]. The execution and discharge qualities of a pilot infusion diesel motor with the backups of alternative fuel like unadulterated hydrogen, HHO and biodiesel. Fumes emanation esteems (NOx, CO2, CO) were examined in motor speed. Impact of H2 and HHO to execution and outflows of an oil motors are inspected. Motor execution esteems ware expanded [12].

The producers assert that their framework indicated different level of mileage change. This paper is for green transportation centers in building up the institutionalized framework with appropriate control over fuel utilization and discharge. A more green-cognizant society can be accomplished through the demand of green innovation to open transportation [13]. The expanding industrialization of the world has driven the need of fuel. Petroleum derivatives are gotten form restricted stores [14]. Electrolysis is the procedure that change over water to gas the electrical supply for the procedure is utilized from your vehicles battery and alternator [16].

The hydroxyl gas production rate is increased by 30% to 40% with a reduction of electrical energy consumption about 35% (at ambient temperature and pressure). The production rate is also increased 10% to 15% more when temperature and alkaline solution increased from 25 ^{O}C to 40 ^{O}C with same parameters [18].

HHO gas was obtained by water electrolysis process. The test ware carried out on four stroke, four cylinder petrol engine. Different performance parameters along with emissions where investigated verses load. From the results it was concluded that, indicated thermal efficiency increased with the enrichment of HHO gas. Tendency to knock was reduced with increased octane number. Also it

was observed that, levels of CO, CO2 and HC were reduced with increased HHO% but NO_x was found to be increased because of increased temperature inside the combustion chamber.

II. PREPARE YOUR PAPER BEFORE STYLING

HHO gas was generated by electrolysis process and the generator integrated to the petrol engine. The experiment was done on single cylinder 180cc SI engine at a constant speed . load was varied along with HHO gas. HHO gas was varied by varying the current supplied to the generator. Amperes Used were 1, 2 and 3 amperes with DC supply of 12 volts. HHO gas was supplied along with air through intake manifold. From the results it was observed that, at full load and at 3 ampere current total reduction in fuel consumption was about 18.87% compared with normal petrol engine. This was due to better combustion. After hydrogen enrichment at full load and at 3 ampere , brake thermal/efficiency was increased by 3.72%. Also HC was decrease by 28.33% at full load CO was reduced to 1.42% from 1.7% by volume at 3 ampere current supply. The main reason was presence of oxygen which came along with hydrogen fuel enhances complete combustion.

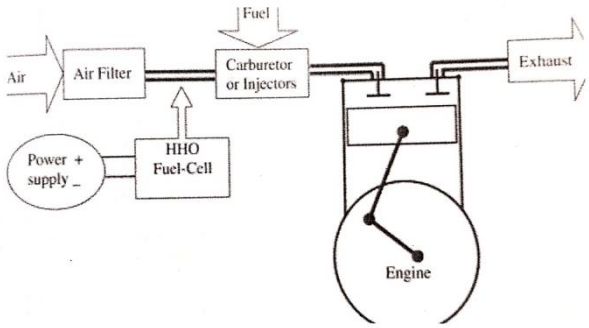
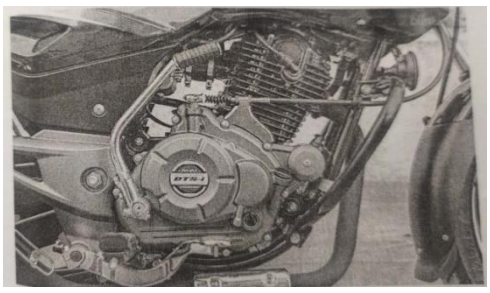


Figure 1.1 working process for feeding HHO



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Oxy- Hydrogen gas is produced in common ducted electrolyser & then sent to the intake manifold to introduce into combustion chamber of the engine. Oxy- Hydrogen gases will combust in the combustion chamber when brought to its auto-ignition or self ignition temperature.
For a stoichiometric mixture at normal atmospheric pressure, auto-ignition of oxy-hydrogen gas occurs at about 570° C (1065°f) . the minimum energy required to ignite such a mixture with a spark is about 20 micro joules. At normal temperature and pressure, Oxy-Hydrogen gas can burn when it is between about 4% and 94% hydrogen by volume. When ignited, the gas mixture converts to water vapour and releases energy. The amount of heat released in independent of the mode of combustion, but the temperature of the flame varies. The maximum temperature of about 2800°C is achieved with a pure stoichiometric mixture, about 700°C hotter than hydrogen flame in air. Oxy-hydrogen gas has very diffusivity. This ability to disperse in air is considerably greater than gasoline and it is advantageous in mainly two reasons. Firstly it facilitates the formation of homogeneous air fuel mixture and secondly if any leak occurs it can disperse at rapid rate. Oxy hydrogen gas is very low in density. The engine selected for the experiment was duel twin spark plug, carburetor type Pulsar 180cc with specifications of bore and stroke as 63.5x56.4 having a max. power of 17.02HP @ 8500 rpm and max. torque of 14.22 Nm @ 6500 rpm.
HHO Generator:-

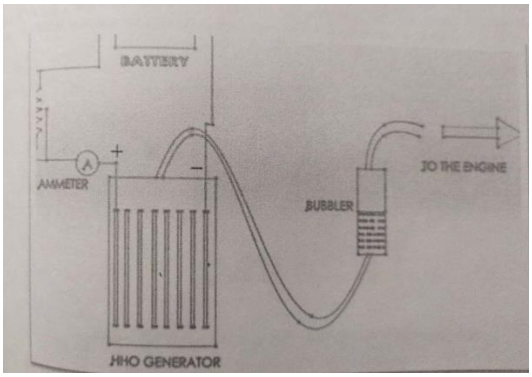

Figure 2. Schematic diagram off HHO gas generation system

- Component requirements for the Generator are Hydrogen cell, connection pipes, Cold rated spark plug, Bubbler, Water tank, KOH, Battery (12 V, 32 A). A typical dry cell generator is shown. As shown each plate in the generator comes with a gasket to prevent leakage of water. Hear, electrolyte was stored in a tank connected to the generator. The HHO gas generated here is served back into the same tank. In this process the electrolyte circulate through the system due to its gravity.

RESULTRESULTS:-

A. Effect of applied voltage

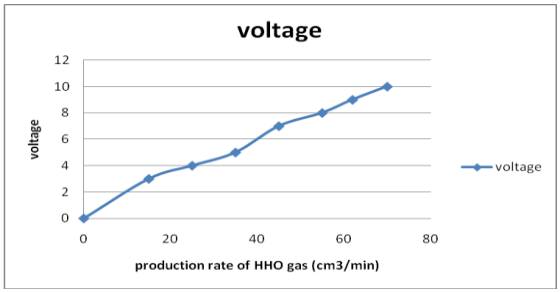

Figure 3.1 Effect of production rate of hydrogen gas with variation of applied voltage in 0.1 mole electrolyte concentration of solution (at ambient temperature and pressure).

B. Effect of time on production of gas

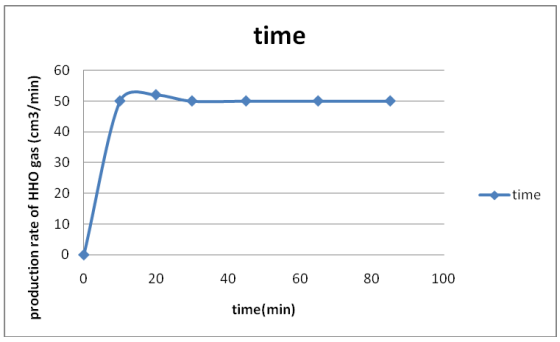

Figure 3.2 Effect of production rate of hydrogen gas w.r.t time, with 0.1 mole concentration of electrolyte at constant voltage and constant current.

C. Effect of electrolyte concentration

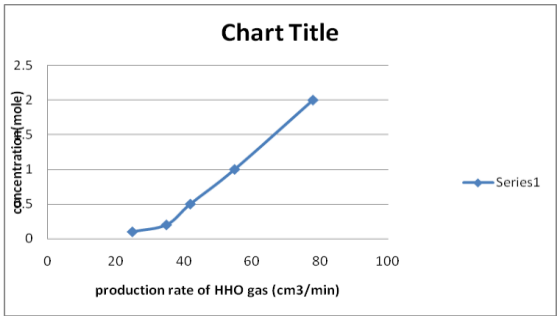

Figure 3.3 Effect of production rate of hydroxyl gas with variation of electrolyte concentration at constant voltage and constant current.

D. Effect of temperature

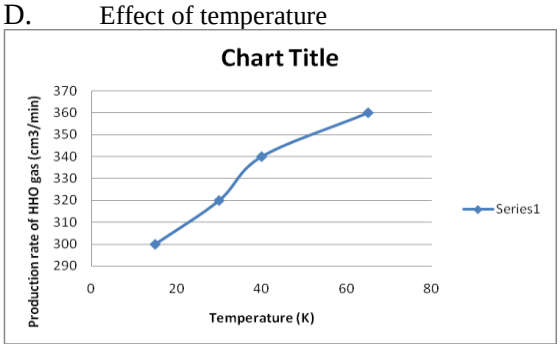

Figure 3.4 Effect of variation of temperature on production of gas at constant voltage and current with 0.1 mole concentration (KOH).

CONCLUSION

Laboratory experiments have been carried out to investigate the effect of HHO gas on the emission and performance of a Pulsar DTSI 180. A new design of HHO fuel cell has been performed to generate HHO gas required for engine operation. The generated gas is mixed with a fresh air in the intake manifold. The exhaust gas concentrations have been sampled and measured using a gas analyzer.

The following conclusions can be drown.

- HHO cell can be integrated easily with existing with engine systems.
- The engines thermal efficiency has been increased up to 10% when HHO gas has been introduce into the air/fuel mixture, consequently reducing fuel consumption up to 34%.
- The concentration of NOx, CO and HC gases has been reduced to almost 15% to 18% and 14% respectively on average when HHO is introduced into the system.
- The best available catalyst was found to be KOH, with concentration 6 g/L.

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