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Design of a Petrol - HHO Hybrid Fuel System for 110cc, 4-Stroke IC Engine

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Abstract:-- **In this paper we have designed a hybrid fuel injection system that uses petrol-HHO mixture instead of pure petrol as fuel in a 3-valve, 4-stroke, 11o cc IC engine. We have designed a 120 cc electrolysis chamber consisting of copper electrodes and tested KOH, NaCl and their mixture for the optimal production of HHO and using taguchi method, we have estimated optimal molarity of KOH and NaCl. We have also used a pwm charge controller to regulate 5 volt 1 amp supply from a 12 volt battery. We have also processed the produced HHO using a silica gel based dryer and designed a safety bubbler to prevent unnecessary injection of HHO in case of blockage. We have measured the amount of produced gas and its calorific value from combustion. We also estimated the enhancement of engine performance by using this assembling. Furthermore we have compared the results by using normal tap water and medical grade distinct water and found that HHO production rate decreases rapidly with time if tap water is used instead of medical grade distinct water.**

Keywords:— **HHO gas, pwm charge controller, IC engine, KOH solution**

I. INTRODUCTION

The HHO gas is a mixture of hydrogen and oxygen, where the ratio of hydrogen and oxygen 2:1 which is a stoichiometric ratio. This mixture also called as oxyhydrogen or knall gas. Now a days energy crisis is a main issue for the Govt as well as normal people. To overcome this problems many researchers are work on different types of energy efficient resources. Among all the energy efficient resources HHO gas is most promising eco-friendly fuel which don't have any emission of carbon or sulphur contents.HHO gas have some properties like high flammable velocity, low spark ignition power and highly combustable with any fuel. For these properties, there is no backfire can happen in the IC engine and make the engine very much thermal efficient. As the HHO gas has wide flammable velocity and low ignition energy, so this HHO gas can be used by mixing with the petrol for enhance engine performance. Comparing with the traditional fossil fuels, HHO gas is a carbon less fuel whose combustion does not emit any HC, CO, CO2. The high flame temperature of HHO gas-petrol mixture fuel, resulting in the increased NOx emission can be a negative issue for the wide application of hybrid fuel engines.

II. EXPERIMENTAL SET UP

The oxyhydrogen or HHO gas was directly added to the combustion chamber without any modification or manufacturing. These HHO gas was produced in a production chamber of plexiglass with two similar types of electrode, connected as anode and cathode with the battery. Here we were used Aluminium as an electrode by giving positive and negative charge from an external electrical source. After giving external charge the electrolysis reaction was starting and for the anode and cathode reaction the hydrogen and oxygen are generated respectively. At the first few minutes the generation of HHO gas was healthy but after few minute the generation become slow which happened because the current was become constant for the high current. To overcome this problem we used a dc-dc charge controller to control the charge. In this experiment we set the maximum limit of voltage 5v and current 1amp and a membrane was set at the middle of two electrodes to separate them to prevent short circuit. A flow meter was used to measure the flow rate of HHO gas and a multimeter was used to measure the voltage and current. For better electrolytic solution for electrolysis we used KOH as electrolyte with the water in the amount of 6 gm/L is the best amount for better HHO production which we investigated. The technical specification of the HHO generation system is shown in below,

Table-1

In this setup we used a battery for external source of energy, a flashback arrestor for prevent HHO flashback from intake manifold, an intake manifold for

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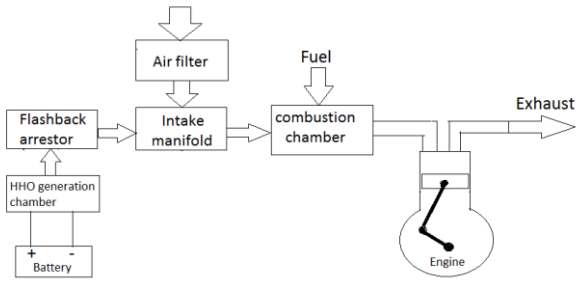
mix up the air and fuel, an air filter for filter the air , a combustion chamber for combust the mixed air-fuel-HHO gas. After combustion of mixed fuel it was directly fed to the engine and observed the speed and torque in different gears.

Maximum gas supply	150 ml/minute
Electrodes(anode-cathode)	Aluminium
Maximum electrolysis voltage and current	5volt – 1amp
Electrolyte	KOH aqueous solution 6 gm/L
Electrolysis container volume	120 ml
Water level control	Float system
Water temperature	40 – 45 degree centigrade
Dimension	6cm * 6cm * 18cm
Weight	700 gm

The whole system shown as schematic diagram in figure-1.



III. RESULT AND DISCUSSION:

It is investigated that, among the different concentration of KOH with water, 6 gm/L of water concentration gives better efficiency at different engine speeds with compared to NaOH and maximum voltage of 5volt and maximum current of 1amp gives better HHO production.

It is found that after using the petrol-HHO gas mixture instead of only petrol, the performance of the engine was improved and fuel consumption decreased. We investigated the improvement of performance characteristics of torque- speed with different gears.

During the experiment, it is also noted that while using the HHO gas and air-petrol mixture the HC, CO and NOx emission less in amount with compare to while using only air-petrol in the engine. As we are using the HHO gas and fuel mixture, there is obviously carbon particles are less in amount. So using mixture of HHO gas ,reduces the CO which was observed by a gas analyzer as the fuel consumption is less . For these less fuel consumption it is obvious that the HC and NOx emission also less. . The emission of HC, CO and NOx has been reduced to 12%, 6%, and 13% respectively on average while using HHO gas with petrol.

IV. CONCLUSION:

In this experimental work, it is investigated that, using of HHO gas mixed with the fuel effected the engine torque-speed performance characteristics and fuel consumption by the engine itself. Here, a new HHO generator has been set up for the HHO generation to mixed with the fresh air and fed to the intake manifold. Although the exhaust gas or emitted gas concentration have been sampled and measured using a gas analyzer. From this experiment it is concluded that, HHO cell can be setup and integrated easily with existing engine system and its also justified that KOH with concentration of 6 gm/L is best for efficient HHO generation. The engine thermal efficiency has been increased by using this technology upto 15% and fuel consumption reduced upto 40% . The emission of HC, CO and NOx has been reduced to 14%, 8%, and 12% respectively on average while using HHO gas with petrol.

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