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Research Article

GENERATION AND ANALYSIS OF OXYHYDROGEN (HHO) GAS

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A R T I C L E I N F O

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A B S T R A C T

The process of electrolysis of water is an electrochemical process wherein hydrogen and oxygen are derived. The resulting mixture of oxygen and hydrogen is called oxyhydrogen or Brown's gas. This paper present an experimental study of the regime of operation of an oxyhydrogen (HHO) generator depending on the parameters of the electrolyte - concentration and temperature we produce the HHO gas and analyse this gas to check its efficiency.

INTRODUCTION

The rising demand and the limited supplies of non renewable energy sources leads to significantly higher prices of these resources. For these reasons, even more relevant stands the problem for increasing the efficiency of energy conversion.

One of the main consumers of non-renewable energy sources are the internal combustion engines, which are characterized by relatively low efficiency. Lately more and more widely used is the oxyhydrogen known as Brown's gas. It is used as a supplement to the air mixture of an internal combustion engine. Thus is achieved a reduction of fuel consumption.

There is something of great importance to the world that is being suppressed and hidden from us: That abundant, clean energy can and is being derived from water. Sea water, well water, tap water; good old H2O.Water can be cheaply disassociated into Brown's Gas / HHO gas (monatomic and diatomic Hydrogen and Oxygen) using efficient electrolyzing techniques which require very little power to operate, or sophistication to build. This is directly contrary to current scientific dogma; which teaches that the creation of useful amounts of Hydrogen requires tens of thousands of watts of power, creating high amounts of heat in the process. This is simply not true: Many people all over the world have home-built working devices that create HHO gas using very little power. The terms "Brown Gas" and "HHO" are used in this article as synonymous, although there is some minor technical debate as to the ratios of monatomic and diatomic gas within each, and "HHO" was once a trade name for Brown's Gas (it has now become a generic term like "Kleenex", as is written here for this purpose).

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Brown's Gas got the name from Yull Brown, a gifted Bulgarian professor and inventor living in Australia. He was one of the first to note the extraordinary properties of HHO, and to disassociate it cheaply from water. He was also one of the first to use it to power an automobile's internal combustion engine, and to also market it as a welding gas (and one of the first to experience the aura of suppression surrounding this alternative energy). Professor Brown discovered that using relatively small amounts of carefully tuned pulsed electricity across submersed plate electrodes acting as Capacitors can break the atomic bonds of water into HHO thousands of times more efficiently than the old methods of "brute force" high-Amperage systems. This does not break any existing scientific principles: When the "capacitance" of the electrodes are exceeded, there is a large release of energy similar to an over-voltage electrolytic "cap" in a circuit exploding much like a firecracker.

The generator of oxyhydrogen (HHO) represents an electrolyser, which is placed in an aqueous solution of an electrolyte (e.g., sodium or potassium hydroxide) and metal electrodes are immersed.Upon application of a voltage on the electrodes through the electrolyte passes electrical current, which leads to a directed motion of the positive H^+ and negative OH^- ions, respectively, to the cathode and anode On the electrodes flow redox reactions leading the release of hydrogen and oxygen – Figure 1, respectively, on the cathode and the anode.

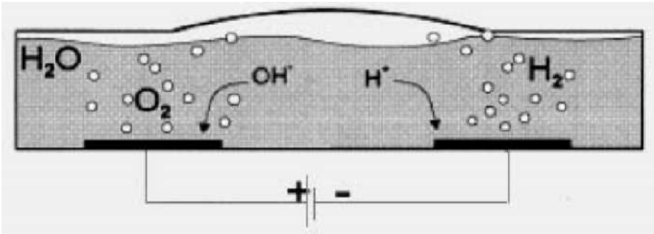

Fig 1 Schematic explanation of the process of electrolysis

Oxyhydrogen is a mixture of hydrogen (H_2) and oxygen (O_2) gases. Theoretically, a ratio of 2:1 hydrogen: oxygen is to achieve maximum efficiency in practice a ratio 4:1 or 5:1 is needed to avoid an oxidizing flame. This mixture also be referred to as Knallgas (Knallgas: "bang-gas"), to be a generic term for the mixture of fuel with the precise amount of oxygen required for complete combustion, thus 2:1 oxyhydrogen would be called "hydrogen-knallgas". A pure stoichiometric mixture may be obtained by water electrolysis, which uses an electric current to dissociate the water molecules:

Electrolysis: $2 H_2O \rightarrow 2 H_2 + O_2$

Combustion: $2 H_2 + O_2 \rightarrow 2 H_2O$

The purpose of this paper is to produce the HHO gas and analyse this gas to check its efficiency.

Experimental Study

The study was conducted by an oxyhydrogen generator working with solution of Potassium hydroxide (KOH). A photo of the tested electrolyser with accompanying additional elements is presented in Figure 2.

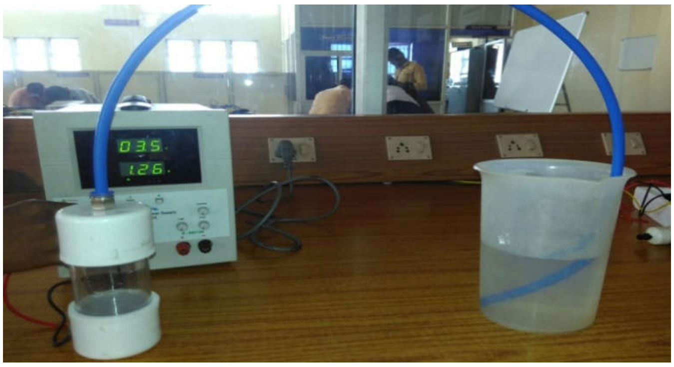

Fig 2 *A photo of the tested HHO generator*

In the existing method the HHO gas has been produced with the help of an electrolysis method and the gas has been sensed and controlled with the help of an flashback arrester and has been send to an two wheeler. After the gas in the bike is over it should be refilled but there is no indication of refillment in this open loop process.

Fig 3 *HHO Generation Setup*

To overcome the process of open loop system here in our project we are using the closed loop system by connecting the engine to the electrolysis kit and after the gas is over it is again filled and the process is continued.

The hydroxy gas (HHO) is a flammable gas and it has been produced by the electrolysis process of different electrolytes with various electrode designs in a leak proof plexi glass reactor (hydrogen generator). Here, in this project the hho gas has been produced by electrolysis cell and then it is sensed by the smoke sensor. The smoke sensor here give the absolute prediction of the gas produced and it is connected to the adruino board and the range of that gas has been sensed purely. The gas which has been set to a normal range can be used for the purpose of any application. When the gas range reaches an abnormal range it is considered as a poisonous gas and cannot be used anymore. Hydroxy gas was used as a supplementary fuel in a four cylinder, four strokes, compression ignition (CI) engine without any modification and without need for storage tanks. At mid and higher engine speeds; the HHO system with diesel fuel yields higher engine torque output compared to pure diesel fuelled engine operation unless HECU is added to the system. The main objective of this project is to acquire pure HHO gas for various applications example for the use in vehicles.

Majority of these works as reviewed focused more on the effective production of the HHO gas through Electrolysis technique. This Project work focuses on the Generation and analyzes of the HHO gas been produced that can perform optimally used for many applications.

Fig 4 *HHO Application Setup*

RESULTS

The experiment has been developed with the help of LabVIEW software.

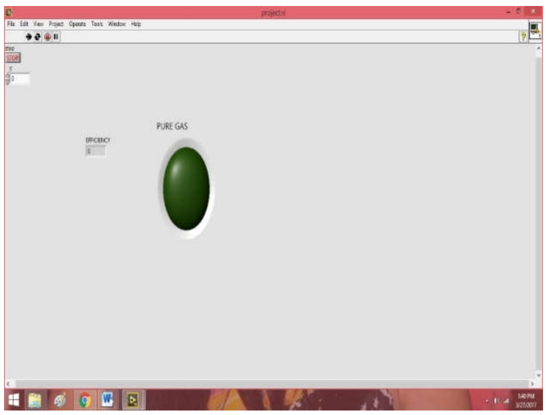

Fig 5 *Front Panel Output*

The gas which has been produced is sensed through the smoke sensor and the MQ2 sensor has been connected to Ardiuno UNO and through the software. For gas the efficiency range varies from 0 to 1.5 and the smoke the efficiency range varies from 0 to 2.5 and in this production of HHO the efficiency range varies from 2 to 3. This efficiency is checked using the LabVIEW.

In the front panel there is a design to check the efficiency and the LED glows according to the variation in the efficiency during execution.

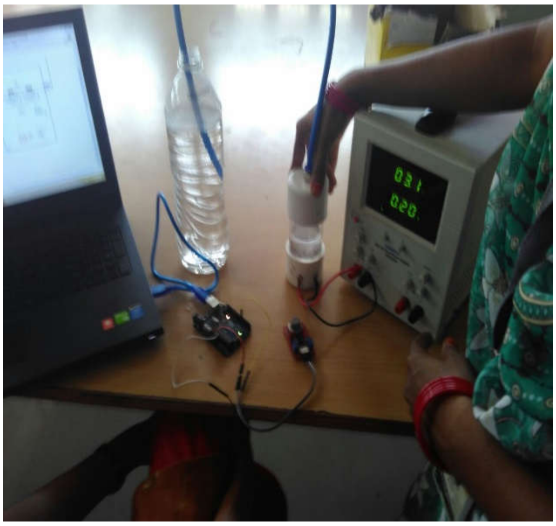

Fig 6 *Experimental Setup of HHO gas*

This is the experimental setup where the HHO gas has been produced with the help of drycell method and the gas which has been produced is sensed through MQ2 Sensor which is connected to Arduino UNO and the execution done in Lab VIEW.

CONCLUSIONS

At mid and higher engine speeds the HHO system with diesel fuel yields higher engine torque output compared to pure diesel fueled engine operation unless HECU is added to the system. High burning velocity and low ignition energy of hydroxyl air mixture minimize the effect of the weakened in cylinder charge flow and increased residual gas fraction which block the fuel to be fast and completely burnt at high speeds. However, increased CR may cause pre-ignition and this can be minimized by direct HHO injection into the cylinder. At low engine speeds, low lean-flammability limits of hydroxyl causes challenges at higher equivalence ratios. Due to the long opening time of intake manifold at low speeds, high volume occupation (reduced volumetric efficiency) of HHO becomes inevitable. Since minimum ignition energy of hydroxyl air mixture is a decreasing function of equivalence ratio till stoichiometric (richer) conditions, torque is reduced after HHO gas addition. A control unit has to be used to obtain appropriate electrolysis voltage and current (gas flow rate) to terminate the impairments of hydroxy gas at low speeds.

- Uniform and improved mixing of hydroxyl air and oxygen content of HHO stimulate combustion which has a major effect on SFC by using an adequate capacity system. Wide flammability range, high flame speed and short quenching distance of hydroxy yield diesel fuel to be combusted completely under high speed conditions without HECU and low speed conditions with HECU.
- High burning velocity, wide flammability range, oxygen content and absence of carbon make HHO gas an appropriate fuel addition to obtain adequate combustion which yield reputable reduction of HC and CO emissions when a sufficient hydroxy system is used at mid and higher speeds of engine without HECU and low speed conditions with HECU.
- A control unit, which decreases electrolysis voltage and current automatically when the engine speed decreases under 1750 rpm (critical speed for this experiment), has to be designed and manufactured to eliminate the impairments of hydroxy enriched diesel fuel combustion at low speeds and to provide energy economy.

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