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A Review Study of Use of Oxy Hydrogen Gas in Four Stroke S.I. Engine

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Abstract:
In order to reduce carbon emission performance and conservation of petroleum fuel there is required an alternative fuel. In many alternatives HHO is one of the best option. HHO can be produced by the simple electrolysis process of different electrolytes like KOH, NaCl, NaOH with various electrodes designs in leak proof HHO generator
It is very economical and easily available it cannot store. But its
production does not take much time and as compare to other resources like electric car solar car, it is very reliable source of fuel. Another advantage of HHO is very diffusible gas so in case of leakage it will diffuse in air. It can be reducing carbon emission and helping to reduce hazards of global warming

Keywords: *electrolysis, emission, HHO, hydrogen gas, petrol engine*

1. Introduction

Hydroxy gas known as brown's gas, green gas and oxy hydrogen gas etc. it was introduced by former Bulgarian engineer Yull brown (march 28,1978) but Mr. brown was not first who invent this gas, William Rhodes (march21, 1961) also achieve this gas by the special electrolysis process. This is brief summary of related to invention of HHO gas now we discuss about how make and experimentalize HHO gas in four stroke spark ignition internal combustion engine HHO gas produce by various types of HHOgenerator which made by stainless steel because stainless steel having good electrical conductivity with high corrosion resistivity.

2. Formation of HHO

HHO formed by the simple electrolysis process of distilled water but for the increasing the rate of reaction we use catalyst like sodium bicarbonate, sodium chloride or sodium hydroxide etc.
Distilled water +sodium bicarbonate +electricity=cheap and clean HHO
Ultimately water can be break into its constituent's elements hydrogen and oxygen. It can be said fourth form of water which is made up of magnicules of hydrogen gas (HH) attached to loan oxygen atom (O) by magniculer bond.
Formation of HHO is very simple but it cannot store HHO generate in a device which known as HHO generator as shown in fig.1

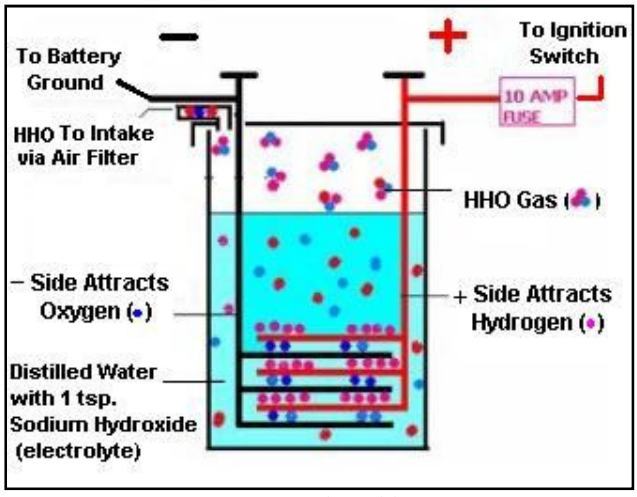

Figure 1: Basic principle of hho generator [9]

When we start the ignition switch, current flowing in HHO generator and start the formation of HHO now this HHO gas output we use in combustion chamber as fuel constituent.

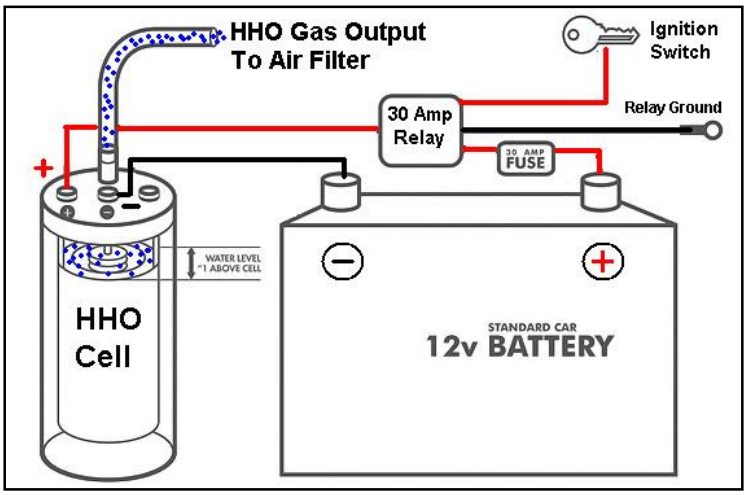

Figure 2: HHO construction [9]

3. Characteristics of Hydroxyl Gas

Hydroxyl gas is new generation fuel which different from petroleum fuel and hydrogen gas it is in form of bubble. For a stoic metric mixture at normal atmospheric pressure, auto ignition of hydrogen gas occurs at about 570^0C (1065^0F) the minimum energy required to ignite such a mixture with a spark is about 20 micro joule at normal temperature and pressure [1]. Basically HHO diatomic structure so we can say that it is not hydrogen plus oxygen because they are not separated after electrolysis their bond known as magnicular bond

Properties	Diesel	Unleaded gasoline	Hydrogen
Autoignition temperature (K)	530	533-733	858
minimum ignition energy(ml)	-	0.24	0.02
Flammability limits (volume % in air)	0.7-5	1.4-7.6	4-75
Stoichiometric air-fuel ratio on mass basis	14.5	14.6	34.3
Limits of flammability (equivalence ratio)	-	0.7-3.8	0.1-7.1
Density at 16 _C and 1.01 bar (kg/m3)	833-881	721-785	0.0838
Net heating value (MJ/kg)	42.5	43.9	119.93
Flame velocity (cm/s)	30	37-43	265-325
Quenching gap in NTP air (cm)	-	0.2	0.064
Diffusivity in air (cm2/s)	-	0.08	0.63
Research octane number	30	92-98	130
Motor octane number	-	80-90	-

Table 1: the properties of hydrogen

If you want to check the rate of hydroxy gas generated with respect to rate of current rise, a loss of weight of electrolyser is noted for given period of time and current. Current passing through electrodes is increased from 1 ampere to 3 ampere in step of 1 ampere. Graph shows that with increase in the time for which the current is flowing through electrolyser, weight of electrolyser decreases [2] shown in graph.1

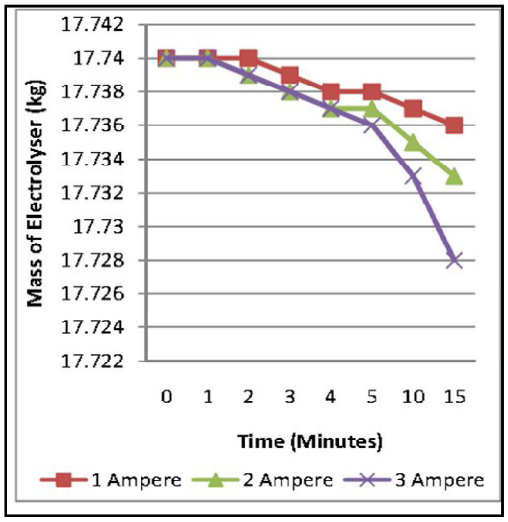

Figure 3: Time rate of gas generation with decreased weight of electrolyser [2]

When oxy hydrogen gas is mix in charge (air + fuel mixture), increase the octane ratting of fuel so the fuel is ignite before top dead centre in combustion chamber.

4. Emission Performance

as we know it consist hydrogen and oxygen only so when it mix with petrol and fresh air in form of charge it reduced remarkable percentage of HC and CO. many of researchers investigate it. At normal charge (air + fuel), when we increase rpm the percentage of HC and CO increase rapidly but when added HHO it reduces the percentage of HC and CO

5. Conclusion

Our review based on to check the usability of HHO in four stroke spark ignition engine without any modification. Main conclusions are as below: -

1. HHO generator can be installed easily in small vehicle.
2. With the help of HHO gas, we can reduce HC, NA_x and CO 40-50%
3. HHO gas increase the engine efficiency about 20-30%
4. HHO gas reduced fuel consumption at least 20% .it also depend on design of HHO generator.

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