A Review Paper on Experimental Investigation on performance and emission analysis of single cylinder S.I engine with different mass flow rate of Hydroxgen(HHO) gas as an additive with gasoline fuel

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Abstract: Petroleum based fuels are more in ultimatum in the world. Fossil fuels are available in restricted reserves. Nowadays, more investigators focus on protecting the environment and sustain the greenhouse effect or global warming effect on the earth. The use of hydrogen in spark ignition engines as a supplementary fuel can enhance combustion and reduce toxic emissions .So, in this study,we use the hydroxygengas(HHO) or brown gas with gasoline fuel in four stroke SI engine. Several processes and approaches of hydrogen production are found by researchers. Some processes are not cost-effective so, in this paper by using the cheaper method of HHO production which is electrolysis process. The HHO gas or brown gas was produced by the process of water electrolysis. HHO gas was produced by the electrolysis process of different electrolytes with many electrode designs in a HHO generator. In this experiment HHO use at a different mass flow rate in SI engine. This paper presents the concern with the HHO gas addition on performance and combustion characteristics of four stroke SI engine with variable load. The effect can be shown on the graphs of SI engine for the brake thermal efficiency, indicated thermal efficiency, mechanical efficiency fuel consumption and emission analysis (nitrogen oxides, carbon monoxide, and total unburned hydrocarbons were measured) with the use of HHO.

Keywords:- HHO, brown gas, electrolysis, emission, SI engine etc.

I. INTRODUCTION

The internal combustion engine (ICE) is a heat engine that converts chemical energy in a fuel into mechanical energy, usually made available on a rotating output shaft. Chemical energy of the fuel is first converted to thermal energy by means of combustion or oxidation with air inside the engine. This thermal energy raises the temperature and pressure of the gases within the engine and the high-pressure gas then expands against the mechanical mechanisms of the engine. This expansion is converted by the mechanical linkages of the engine to a rotating crankshaft, which is the output of the engine. The crankshaft, in turn, is connected to a transmission and/or power train to transmit the rotating mechanical energy to the desired final use. For engines this will often be the propulsion of a vehicle (i.e., automobile, truck, locomotive, marine vessel, or airplane). Other applications include stationary engines to drive generators or pumps, and portable engines for things like chain saws and lawn mowers.

Internal engine are classified many ways. Mainly there are two types:-

a. **Spark Ignition (SI).** An SI engine starts the combustion process in each cycle by use of a spark plug. The spark plug gives a high-voltage electrical discharge between two electrodes which ignites the air-fuel mixture in the combustion chamber surrounding the plug. **In** early engine development, before the invention of the electric spark plug, many forms of torch holes were used to initiate combustion from an external flame.

b. **Compression Ignition (CI).** The combustion process in a CI engine starts when the air-fuel mixture self-ignites due to high temperature in the combustion chamber caused by high compression.

Spark Ignition engine

Gasoline or petrol engines are also known as spark-ignition (S.I.) engines. Petrol engines take in a flammable mixture of air and petrol which is ignited by a timed spark when the charge is compressed. The first four stroke spark-ignition (S.I.) engine was built in 1876 by Nicolaus August Otto, a self-taught German engineer at the Gas-motoreufabrik Deutz factory near Cologne, for many years the largest manufacturer of internal-combustion engines in the world. It was one of Otto's associates - Gottlieb Daimler - who later developed an engine to run on petrol which was described in patent number 4315 of 1885. He also pioneered its application to the motor vehicle.

Figure 1 shows in a diagrammatic manner a four-stroke engine cylinder provided with two valves of the 'mushroom' or 'poppet' type.The inlet valve (IV) communicates through a throttle valve with the carburettor or vaporiser, from which a combustible mixture of fuel and air is drawn. The exhaust valve (EV) communicates with the silencer through which the burnt gases are discharged to the atmosphere. These valves are opened and closed at suitable intervals by mechanisms, which will be described later.

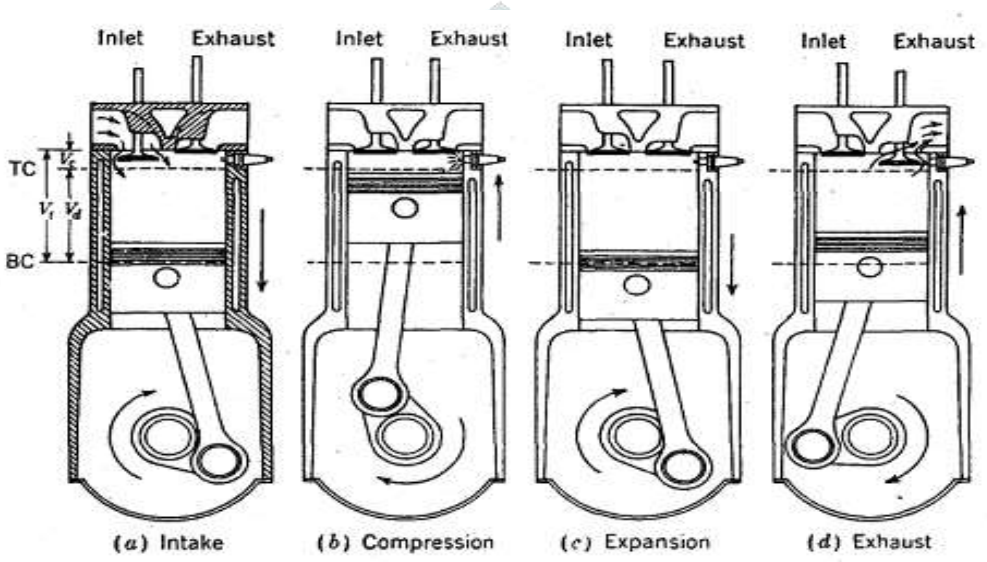

Figure 1:- Four Stroke SI engine

II. REALIZING THE PART LOAD CONTROL OF A HYDROGEN-BLENDED GASOLINE ENGINE AT THE WIDE OPEN THROTTLE CONDITION

Shuofeng Wang, Changwei Ji*, Bo Zhang, Xiaolong Liu(2014) experimentally investigated the effect of varying the hydrogen volume fraction in the hydroxygen on burning and emissions performance of an SI gasoline engine at an engine speed of 1400 rpm. The main outcomes are summarized as follows:increase thermal efficiency after adding 3% hydroxygen in the total intake gas.When the hydrogen volume fraction in the hydroxygen is lesser than 70%, the fuel energy flow rate of the 3% hydroxygen-blended gasoline engine is higher than that of the original gasoline engine.[1]

III. REDUCTION OF FUEL CONSUMPTION IN GASOLINE ENGINES BY INTRODUCING HHO GAS INTO INTAKE MANIFOLD

Ammar A. Al-Rousan(2010) lead Test experiments were conducted on a 197cc (Honda G 200) single-cylinder engine the aims of the mixing are: a 20 to30% reduction in fuel consumption, lower exhaust temperature, and consequently a decrease in pollution. The ideal size of the FC is when the surface area of an electrolyte needed to generate sufficient amount of HHO is twenty times that of the piston surface area. Also, the volume of water wanted in the cell is about one and half times the engine capacity.[2]

IV. EXPERIMENTAL INVESTIGATION OF THE EFFECT OF HYDROGEN ADDITION ON COMBUSTION PERFORMANCE AND EMISSION CHARACTERISTICS OF A SPARK IGNITION HIGH SPEED GASOLINE ENGINE

Shivaprasad K Va, Raviteja Sa, ParashuramChitragara Kumar G Nb(2014) experimentally investigated the performance and emission characteristics of a high speed single cylinder SI engine operating with different hydrogen gasoline blends.For this purpose the conventional carbureted high speed SI engine was modified .The addition of hydrogen is effective on improving engine brake thermal efficiency. An increase of brake thermal efficiency was observed till a hydrogen fraction of 20%.Overall the test results revealed that the blends up to 20% hydrogen are suitable as an engine fuel without much compromise in the performance and emission characteristics.[3]

V. THE ADDITION OF HYDROGEN TO A GASOLINE-FUELLED SI ENGINE

T. D'Andreaa, P.F. Henshawa , D.S.-K. Tingb:Andrea(2004) investigated the effect of various engine speeds and equivalence ratios on combustion of a hydrogen blended gasoline engine. The experiment results showed that the combustion duration decreases and the nitrogen emission increases with the increase of hydrogen blending fraction.[4]

VI. EFFECT OF HHO GAS ON COMBUSTION EMISSIONS IN GASOLINE ENGINES

Sa'ed A. Musmar ,Ammar A. Al- Rousan(2011) generate HHO gas has been built and integrated with Honda G 200 (197 cc single cylinder engine). The results show that a mixture of HHO, air, and gasoline cause a reduction in the concentration of emission pollutant constituents and an enhancement in engine efficiency. The emission tests have been done with varying the engine speed. The results show that nitrogen monoxide (NO) and nitrogen oxides (NOX) have been reduced to about 50% when a mixture of HHO, air, and fuel was used. Moreover, the carbon monoxide concentration has been reduced to about 20%. Also a reduction in fuel consumption has been noticed and it ranges between 20% and 30%.[5]

VII. CONCLUSIONS

- Reduction in Specific Fuel Consumption.
- HHO found best alternative for the current IC engines.
- HHO Can Be used without any modification in Gasoline engine as an additive.
- BY using HHO in Bi-fuel engine thermal efficiency is increases emission and BSFC is decreases. but Volumetric efficiency decrease and hence power output also decreases.
- Lean burn is an effective way to improve fuel efficiency and may or may not reduce NOx emissions.
- The ignition and burning characteristics of HHO are considerably different from that of gasoline.
- By emission analysis UBHC reduces and CO ,HC particles reduces.

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