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EFFECT OF HYDROGEN USE ON PETROL ENGINE

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ABSTRACT: *The high fuel conception and climatic change due to the effect of petroleum products are one of the major threat that are faced by researches and meteorologist. In different country's governments are initiating several steps in order to reduce the usage of fossil fuels, also try to implement different innovative ideas. In India government has banned usage of diesel engine due to the high level emission of carbon monoxide (CO), hydro carbon (HC), particulate matter-PM & Nitrogen oxide (NOx). This crisis where overcome by introducing of Hydrogen fuel which is a zero emission fuel when combust with oxygen.*

A Hydrogen vehicle is an alternative fuel vehicle that uses hydrogen as it's on board fuel for motive power. This work deals with the fabrication of hydrogen fuel engine, effect of hydrogen addition on petrol fuel engine were carried out to identify the effect of hydrogen use in internal combustion engine. In this work the Hydrogen production is carryout by electrolysis process and mixed with petroleum fuel. At the end of study it is observed that the fuel consumption rate is found to be less for hydrogen petrol engine, Brake Horse Power (BHP) and efficiency get increased also the exhaust gas analysis shows the reduction on the harm full emission of NOx, CO and HC

Key words: **HYDROGEN, PETROL ENGINE, ELECTROLYSIS, CONSUMPTION RATE, BRAKE POWER, POLLUTION RATE**

1. INTRODUCTION

The use of fossil fuel has been increased in a large amount since the evaluation of it due to its striking behavior such as high calorific value, cheap source of energy, complete stability, and massive economic benefits. The consumption rate of fossil fuel is increasing day by day that's why it is consider as "man's best friend" After several research and study conducted in different parts of country it is found that the use of fossil fuel producing high level of emission which causing global pollution & environment problems such as ozone layer depletion, acid rain, greenhouse effect. Therefore because of these side effects International Organization takes different steps to minimize the production and usage of fossil fuels. To reduce current pollution level researchers and scientists are trying to develop renewable source of energy like solar, wind, geothermal and fuel burning techniques. Government are increasingly accepting renewable energy source even though fossil fuel are still the world supreme energy source because of their high energy density. The emission of NOx, CO, CO2 and unburned hydrocarbon are the main negative effects on the environment by the combustion of fossil fuel.

There are various possible solutions to diminish the problem of using fossil fuel. One method involves burning of hydrogen gas along with hydrocarbon fuels in engine. Hydrogen been accept as a fuel having some unique and beneficial properties like high flame speed, minimum ignition energy, higher calorific value, high auto ignition temperature and it may be consider as the best alternative to be used as fuel in IC engine. The hydrogen engine results in the reduction of CO,HC,CO2&O2 which are clamp to climatic change and global warming, Due to the hydrogen burning results higher burning temperature occur inside the engine a small scale of Nitrogen Oxide are still exist in exhaust gases.

2. METHODOLOGY

2.1 PREPARATION OF HYDROGEN

The hydrogen production which is needed for the work is done by electrolysis process, KOH solution along with the help of cathode and anode terminal is used. A 12volt battery is connected to the electrode, by the chemical reaction hydrogen comes from the negative terminal tank. The output hydrogen gas get dunked into a water tank (in order to avoid backfire) and gas is collected via a nylon tube and provide to the engine where hydrogen is mixed with petrol.

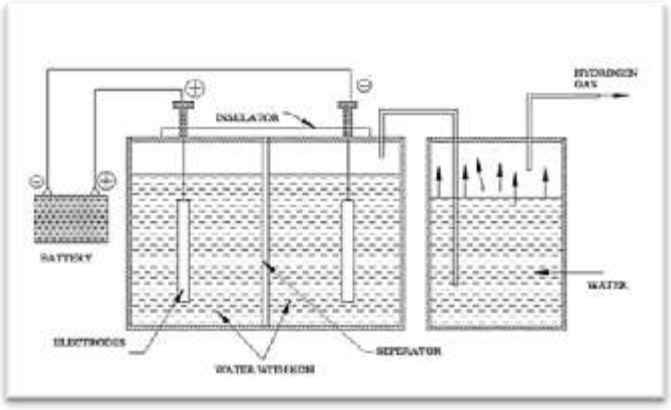

Fig-1: Electrolysis Process

The chemical reaction occurs is.

KOH + H2O = KOOH + H2

The balanced equation is

2KOH + 2H2O = 2KOOH + 2H

Fig-2: Hydrogen Production Assembly

1) PROPERTIES OF HYDROGEN

Table -1: Properties of Hydrogen

Atomic mass	1.0079 u
Density	0.09 g/cm^3
Melting Point	13.81°K
Boiling Point	20.28°K
Auto-Ignition Temp	536°C

2) PROPERTIES OF PETROL

Density	737.22 kg/m^3
Melting point	216°k
Boiling point	368°k
Auto-Ignition Temp	280°C

Table -2: Properties of Petrol

2.2 COMPONENTS AND DESCRIPTION

1) PETROL ENGINE

Fig -3: Four Strokes Engine

Table -3: Engine Specification

Type	Four strokes
Cooling system	Air cooled
Bore/stroke	50 x 50 mm
Piston displacement	98.2cc
Maximum torque	0.98 kg-m at 5,500RPM

2) FRAME

It is made of mild steel. This frame is mounted on the structure with the appropriate arrangement of the entire parts. Bearing sizes and open bores were made in an arrangement to properly align the bearings when

assembled. The bearings are conditioned to cover with grease.

3) CHAIN

Chain drives contain endless chain links that match tooth strokes. Chain sprockets are locked to the chains of driver and running machines. Chain drives represent a type of flexible gearing. The chain works like an infinite gear rack, while the sprockets are similar to pinion gears.

Chain drives give a good look of the power transmission. The chain machine links with the teeth of the sprockets and this function maintains a positive speed ratio between the driver and the driven strokes.

4) SPROCKET SPECIFICATIONS

Table -4: Engine Sprocket Specification

No. of teeth	178
Inner diameter	166mm
Outer diameter	178mm
Material	Mild steel

Table -5: Wheel Sprocket Specification

No. of teeth	17
Inner diameter	48mm
Outer diameter	50mm
Material	Mild steel

2.3 FABRICATION

1) FABRICATION OF FARME

A frame of length 35inch width 15inch and height 46inch is fabricated by using L angled mild steel through different mechanical process such as Metal Cutting, Welding and Drilling

2) FABRICATION OF HYDROGEN PRODUCTION UNIT

A 3L capacity tank is made by using PVC pipe of length 1feet and 5" diameter. Stainless steel of thickness 1mm is used as electrode and they are placed by maintaining a gap of 30mm. 2litre of additional water is used to detect hydrogen and also to avoid back fire. A nylon pipe with 12mm outer diameter and 8mm inner diameter is used to transfer the hydrogen produced.

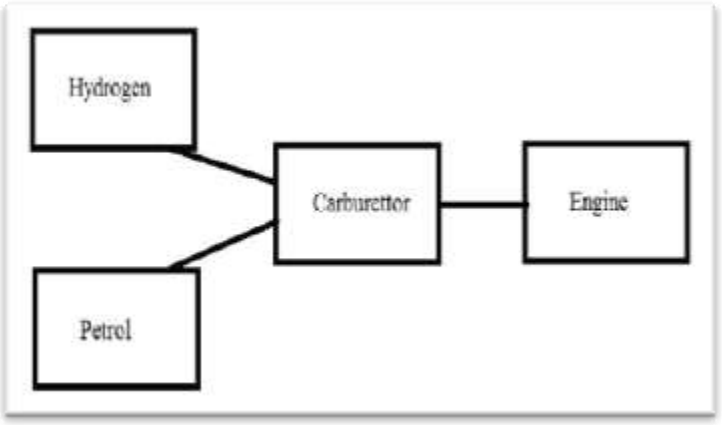

Fig -4: Working Principle

3) ASSEMBLY

After the fabrication of frame, the engine is mounted on it. A 2L tank is mounted on the top of the frame in order to store petrol. 12 volt lead acid battery is used for the production of hydrogen.

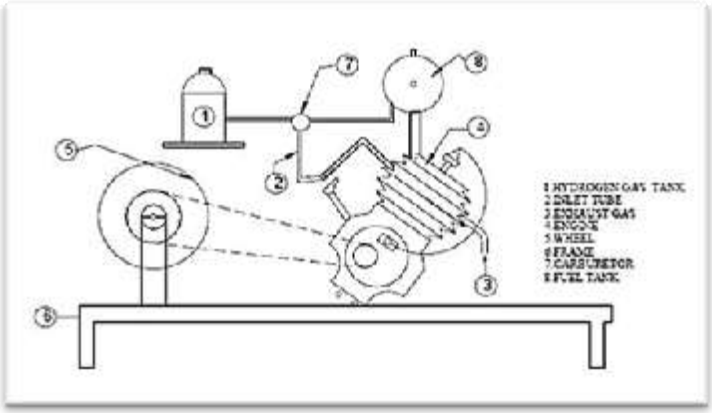

Fig -5: 2D Drawing Of Assembly

Fig -6: After Assembly

3. RESULT AND CALCULATION

3.1 FLOW RATE CALCULATION

Power = V x I

Voltage, V = 12 v , Current, I = 1.4 A

Power = 12 x 1.4 = 16.8 watt

Also, Power = F x V = 16.8 watt

That is, P x A x V = 16.8 watt

Observed pressure, P = 1.8 kg/cm2 = 176520 n/m2

A = x d2

Diameter of tube, d = 8mm

A = x 0.008 x 0.008 = 5.02 x 10-5 m3/s

PAV = 16.8

Substituting all values

176520 x 5.02 x 10-5 x V = 16.

Therefore V = 1.89 m/ s

Flow rate = A x V

= 5.02 x 10-5 x 1.89

= 9.48 x 10-5 m3/s

3.2 FUEL CONSUMPTION RATE

For 10 ml fuel fall, speed v/s time graph is plotted for naturally operating engines and petrol hydrogen mixed fuel engine, it is found that from graph the value of hydrogen mixed petrol engine is above the naturally operating engines. Speed is calculated in RPM and time in seconds. Fuel consumption rate is found to be lower for hydrogen-petrol engine

Table -6: Fuel Consumption Rate Table

Si No	Volume Of Petrol	RPM	Time (Seconds)	
			Petrol Only	Hydrogen & Petrol
1	10 ml	450	14.65	57
2	10 ml	800	13.26	54

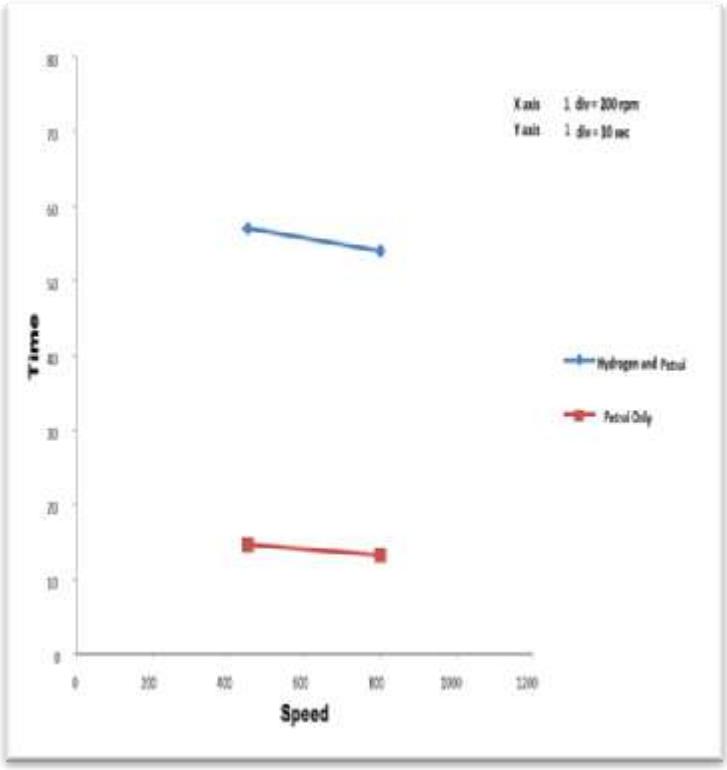

Chart -1: Speed v/s Time Graph

3.3 BRAKE POWER

Table -7: Brake Power Table

Si No	Volume Of Petrol (ml)	Brake Power	Time (Seconds)	
			Petrol Only	Hydrogen & Petrol
1	10 ml	0	110	130
2	10 ml	0.52	105	126
3	10 ml	0.87	101	123
4	10 ml	1.22	96	118
5	10 ml	1.93	90	112
6	10 ml	2.63	84	107

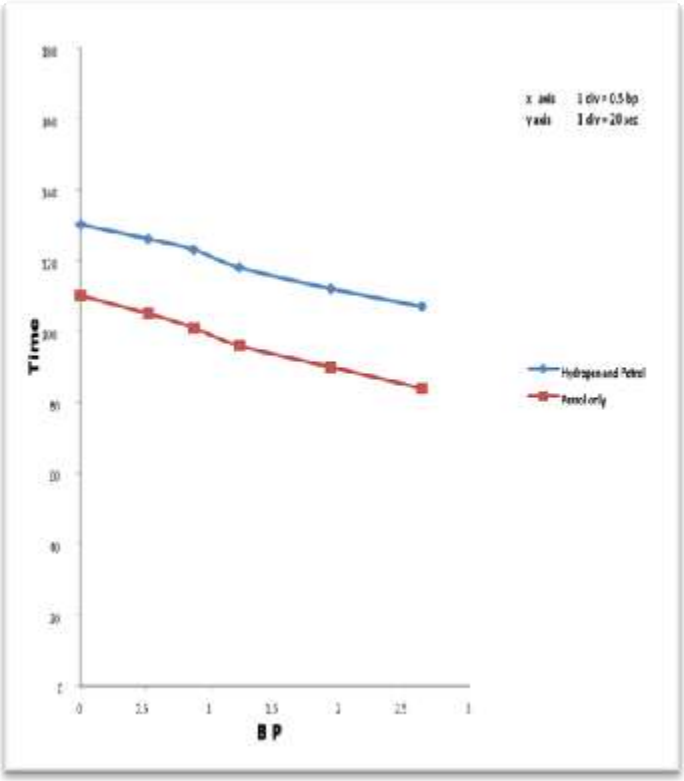

Chart -2: BP v/s Time Graph

The above graph shows Brake Power of engine while using of petrol only and by using of hydrogen and petrol. It is clear that the BP is very much higher for the engine while the using of hydrogen & petroleum fuel mixture, on other hand the BP will reduce while using of petroleum fuel only.

3.4 POLLUTION RATE

Table -6: Pollution Test Result

	TEST RESULTS		
	REGULATION	ACTUAL	UNIT
CO	0.3	1.85	%
HC	200	181	PPM
CO2	-	2.11	%
O2	-	15.9	%

The Hydrogen fuel engine undergo for the pollution control test and certified that the engines Hartridge Smoke Unit (HSU) emission level conforms to the standard prescribed under rule 115(2) of CMV Rule 1989

4. CONCLUSIONS

The usage of fossil fuel will results some adverse effect in environment so in future it is essential to replace this usage and consumption of fossil fuel to a renewable energy sources or by the usage of hydrogen fuel for engine combustion processes which will not affect to environment. It is sure that the hydrogen fuel will rule the market in future and in next coming days can be act as best alternative to the conventional fossil fuels as it is cleanest and renewable fuel

From the above research we can conclude that the effect of hydrogen will bring a diverse effect in internal combustion engine.

The flow rate observed on hydrogen engine after the study is 9.48 x 10-5 m3/s

Hydrogen with petrol fuel in the combustion process of the petrol engine resulted in, drop the fuel consumption and reduction of all engine-out pollutants such as CO, HC.CO2&O2.

Also smoke emitted by the hydrogen engine is less than 65 Hartridge Smoke Unit (HSU), so pollution board certified engine as non-polluting.

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