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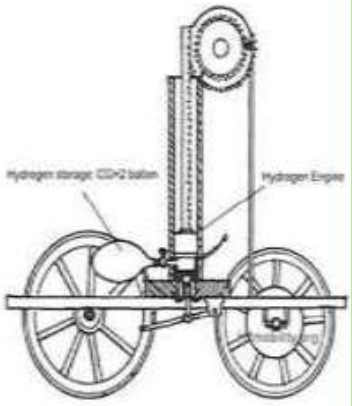
Hydrogen Powered Vehicle

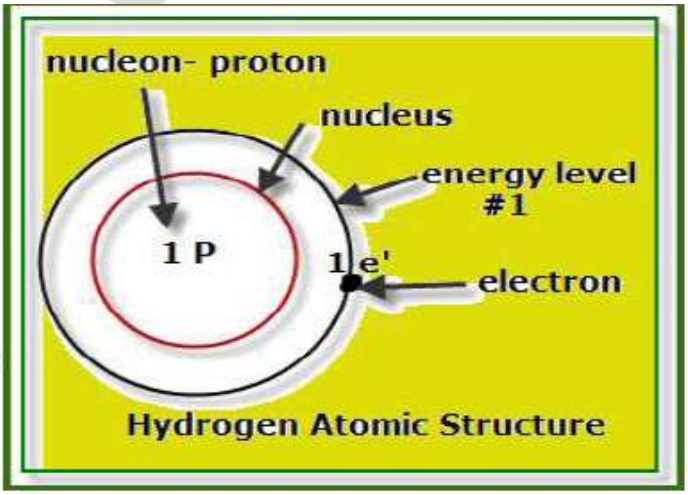
Shethna Ronnie K1, Patel Dhrumik K2, Thanki Aditya A3
UG Student1, Mechanical Department, rooneyshethna@yahoo.in , +91-9067113511
UG Student2, Mechanical Department, dhrumikpatel56@gmail.com , +91-9662520250
UG Student3, Mechanical Department, aditya.thanki@gmail.com , +91-9783559909

Abstract-Nowadays, availability of fossil fuel is being very critical and due to this the cost of these fuels are increasing. The use of these conventional fossil fuel increases the pollution of atmosphere due to higher carbon emission rate. To overcome from these drawbacks of nonconventional fuel such as hydrogen can be used as fuel because hydrogen is most commonly found on the earth and it can be obtained from water (H2O). The purpose to use hydrogen as a fuel in automobile vehicle is to reduce the emission of carbon monoxide and carbon dioxide and this hydrogen fuel can be produce by widely and readily available water. Thus, hydrogen is an environmental friendly fuel that has the potential to dramatically reduce our dependence on imported oil. Currently, the technology of hydrogen fuel vehicle is in developing phase, therefore several significant challenges must be overcome before it can be widely used. In this project we have used hydrogen along with the petrol as the fuel which has considerably increased the efficiency of engine

Keywords-Hydrogen Energy1, Hydrogen Engine2, Hydrogen Kit3, Chemical Process4, Equipment Cost5, Inexpensive6, High Mileage7

Introduction- In a compound state, hydrogen is most commonly found on the earth in the form of water, or H2O. Potentially, as a motor fuel, the main source of hydrogen is natural gas and methanol. Hydrogen fuel may contain low levels of carbon monoxide and carbon dioxide, depending on the source. In order to be useful as a motor fuel, hydrogen must be manufactured from other sources. Pure hydrogen can be extracted from virtually any hydrogencontaining compound. A hydrogen atom is an atom of the chemical element hydrogen The electrically neutral atom contains a single positively charged proton and a single negatively charged electron bound to the nucleus by the Coulomb force. Atomic hydrogen constitutes about 75% of the elemental (baryonic) mass of the universe In everyday life on Earth, isolated hydrogen atoms (usually called "atomic hydrogen" or, more precisely, "monatomic hydrogen") are extremely rare. Instead, hydrogen tends to combine with other atoms in compounds, or with itself to form ordinary (diatomic) hydrogen gas, H2. "Atomic hydrogen" and "hydrogen atom" in ordinary English use have overlapping, yet distinct, meanings. For example, a water molecule contains two hydrogen atoms, but does not contain atomic hydrogen (which would refer to isolated hydrogen atoms). Hydrogen was the first element ever discovered and put on the periodic table (the periodic symbol H). The hydrogen atom has only one electron circling the nucleus. Hydrogen is the simplest element as it has only one nucleus, one shell and one electron. The trouble with today's cars is that they still put out a lot of pollution, and use up fossil fuels. One day, we have to run out of fossil fuels. People have been talking about running cars on water for ages. Unfortunately, most of the time, these people are crackpots. But there is a certain amount of truth in what they say.



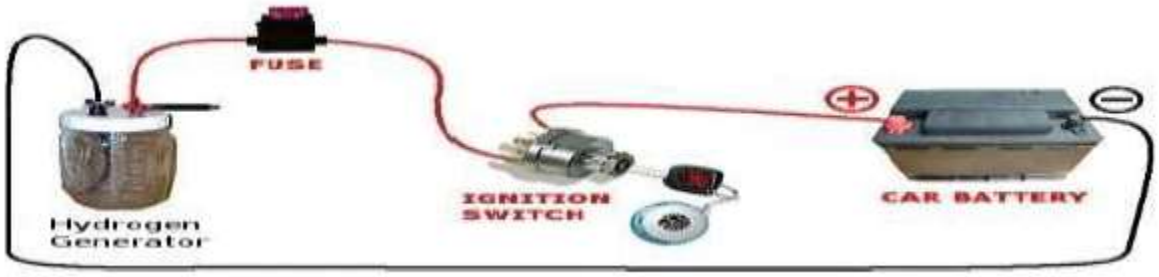


Hydrogen Energy-Hydrogen energy is an important part of developed nation's clean energy plan. Like most sources of clean energy, it is relatively new, and as such there is much more to discover about it. Let's look at and answer a few questions about hydrogen energy with our focus being a survey of its positives and negatives. Hydrogen is the most basic of all Earth elements. The hydrogen atom is made up of a single proton and a single electron. As such, it is very abundant, but it doesn't really exist as a separate with no emissions of either CO2, toxic chemicals or form of matter. Instead it is usually combined with other elements. To separate hydrogen gas from its companion substances takes a lot of work but it produces a powerful, nearly clean source of energy. As a gas, it can be used in fuel cells to power engines. There are following reaction processes take place between various metal electrodes and electrolyte to generate hydrogen as a product of reaction process.

(1) $CH4 + H2O \rightarrow CO + 3H2$

$CO + H2O \rightarrow CO2 + H2$

(2) Al + 3H2O + NaOH→ NaAl(OH)4 + 1.5H2
(3) Al + 3H2O → Al(OH)3 + 1.5H



Components and their Energy

1. Battery: It is a source of energy through which power is supply to hydrogen kit.
2. Hydrogen kit: It comprises mainly three elements anode, cathode & electrolyte. Copper plates are used as anode & cathode.
3. Carburetor: Produced hydrogen is then supplied to carburetor, where it mixes with air.
4. Electrolyte: is a composition of potassium hydroxide and distilled water. Generation of hydrogen take place by reaction between KOH, H2O & Cu.
5. Hydrogen Engine: from carburetor Hydrogen air mixture is supplied to the engine cylinder, where ignition takes place through spark plug

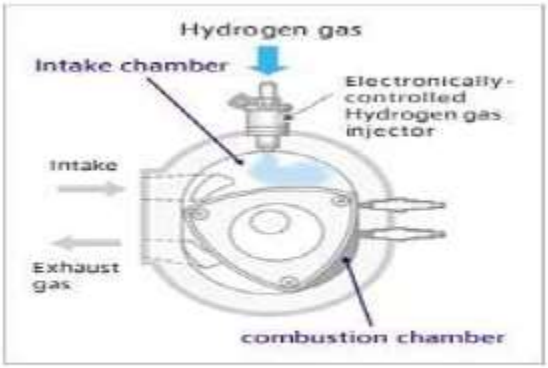


Fig. Combustion process

Hydrogen Kit- Hydrogen kit mainly consist of following elements:

- Copper or high grade steel plate electrode
- Electrolyte solution.
- Container.
- Hose pipe.
- Conduction wire.
- We use many combination of hydrogen kit to get the best result from our experiment. The combinations that we use in our experiment in order to get best result are as follows.

1. Single container kit having plain water as electrolyte and high grade steel plates as electrode.
2. Single container kit having distilled water with 5 gm of KOH as electrolyte and copper plates as electrodes.
3. Single container kit having distilled water with 10 gm of KOH as electrolyte and copper plates as electrodes.
4. Single container kit having plain water with 20 gm of NaOH as electrolyte and copper plates as electrodes.
5. Double container kit having distilled water with 20 gm of KOH as electrolyte and copper plates as electrodes.






Fig. Components of Hydrogen Kit

Technical Specifications of Car

Dimensions and weights

- Overall length: 3,340 mm (131.5 in)
- Overall width: 1,440 mm (56.7 in)
- Overall height: 1,405 mm (55.3 in)
- Wheelbase: 2,175 mm (85.6 in)
- Ground clearance: 160 mm (6.3 in)
- Curb weight: 650 kg (1,433 lb)
- Gross vehicle weight: 2,000 kg (4,409 lb)

Capacities

- Seating capacity: 5person maximum
- Fuel tank capacity: 28 L (7.4 US gal)
- Engine oil: ~2.7 Lt including oil filter
- Transmission oil: ~2 Lt
- Coolant: 3.6 Lt

Performance

- Maximum speed: 120 km/h (75 mph)
- 0–100 km/h (0–62 mph): 18.8 seconds
- 1/4-mile: 28.5 seconds

Fuel economy

- Mileage highway: 20 km/l (5.0 l/100 km;
- 47 mpg-US)
- Mileage city: 18 km/l (5.6 l/100 km;
- 42 mpg-US)
- Mileage overall: 19 km/l (5.3 l/100 km;
- 45 mpg-US)

Engine

- Engine model: F8
- Displacement: 796 cc (49 cu in)
- Valves per cylinder: 2
- Number of cylinders: 3 inline
- Power: 37 HP at 5000 rpm
- Rpm limiter: ~7000 rpm
- Torque: 57 Nm at 2500 Rpm

Suspension

- Front suspension: McPherson strut and coil
- spring
- Rear suspension: Coil spring with gas-filled
- shock absorbers

Steering

- Steering type: Rack and pinion
- Minimum turning radius: 4.4 m (14.4 ft)

Brakes

- Front Brakes: Drum, disk
- Rear Brakes: Drum

Wheels and tyres

- Tyres (radial optional): 145/70 R12, 145/80
- R12

Features of a Hydrogen Car

- Use of technically advanced technique
- Qualitative, and clear light display
- Light secured by high quality glass
- Superior strain gauge load cells
- Durable design with strong structure
- Compact and light in weight
- Easy to carry and clean
- Battery level indication
- Large backlit LCD display
- High resolution and luminosity light
- Precise results in nano second speed

Discussion- To reach up to the desired results discussion is necessary with competent people which can make execution regarding to the project. We have taken guidance from many experienced people which also helped us in making decision for execution of project.

We have discussed with many expert mechanic regarding to the car before buying it which is to be modified according to the requirement of the project.

We have also discussed with our project guide related to the required modification in the car for execution of the project.

Result- We have conduct the experiment with various combination of electrolyte solution and metal electrodes to get the best result. We used following combination of apparatus to obtain maximum amount of hydrogen that can be supplied to the engine with minimum drawbacks.

 Catalyst used: 1. NaOH

2. KOH

 Electrode Materials:

1. High grade stainless steel electrode

2. Copper electrode

 Constituents of electrolyte:

1. Distilled water with NaOH

2. Distilled water with KOH

 Electrode Materials:

1. High grade stainless steel electrode

2. Copper electrode

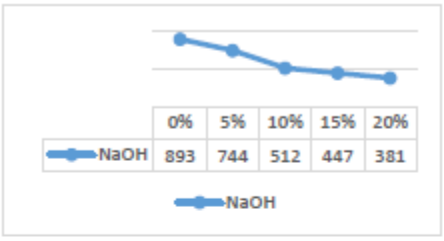


Fig. Percentage of NaOH increases

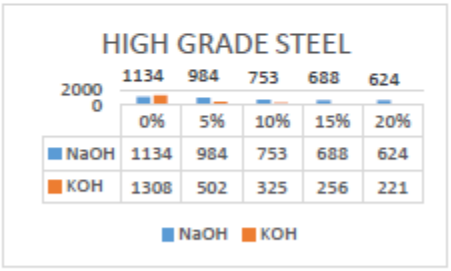


Fig. Percentage of catalyst increases

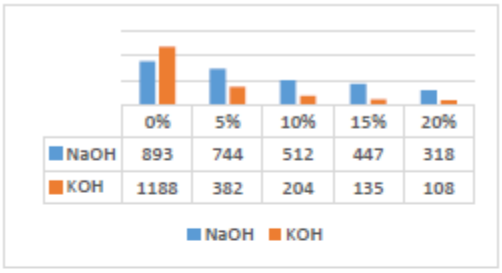


Fig. Production rate with copper electrode

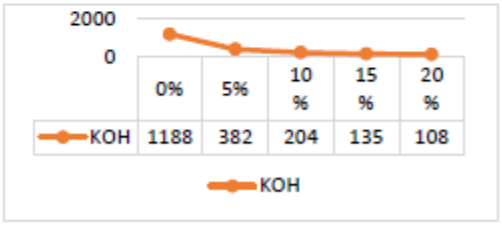


Fig. Percentage of KOH increases

Conclusion- From the result and whole literature review, we observe that to run an automobile vehicle only on hydrogen gas, we required the hydrogen supply to the engine at very high pressure and that need to be stored in high pressure tank at approximately 200 bar. Tis requires high strength storage which increases the cost of vehicle considerably. So, we used hydrogen along with petrol as the fuel in the engine which increased the efficiency of the vehicle to a large extent as shown in result. Thus, from this experimental project we can say that hydrogen can be used as a fuel to increase the efficiency of automobile vehicle which also reduce the carbon emission to very large extent. Due to these advantages, we can say that, the scope of hydrogen fueled automobile vehicle is too bright in the future.

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