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Hydrogen fuel as Renewable energy source for Hybrid motorized vehicle

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Abstract

Hybrid Powered Bike with Energy Saver is a hybrid bike concept where bike will be run based on of water and battery powered. The oxygen and hydrogen gases generated through electrolysis will be used to power the bike piston engine. Another option is to use electric motor to power the bike. The proposed solution emphasizes on the use of environment friendly fuel. Implementing this system will enable us to reduce the cost of fuel and also make it less polluting.

Impact:

- It will help us to overcome from the uses of Non-Renewable energy sources as they are limited.
- It will help us to overcome the pollution problem up to certain level.
- It will save our money as well the time.

Keywords: *Electrolysis of water, fuel cell, SI engine, Electric drive, Injector.*

INTRODUCTION:

Hybrid bike will run based on water through electrolysis and battery powered. For electrolysis direct current electrical power source is connected to two electrodes, two metals or two plates like platinum, stainless steel, graphite, aluminum etc, which are dipped in to the water. Hydrogen will be generated from the cathode and oxygen will be generated from the anode (the positive electrode). The amount of hydrogen gas generated is twice the amount of oxygen and both are corresponding to the total electrical charge conducted by the solution. Electrolysis of sea water requires excess energy in the form of over potential to overcome various activation barriers. Without the excess energy the electrolysis of sea water occurs very slowly. This is in part due to the limited self-ionization of water. Sea water has an good conductor of electricity. The electrolysis cell may also lack the requisite electro-catalysts. The efficiency of electrolysis is increased through a addition of additives (such as syngas or

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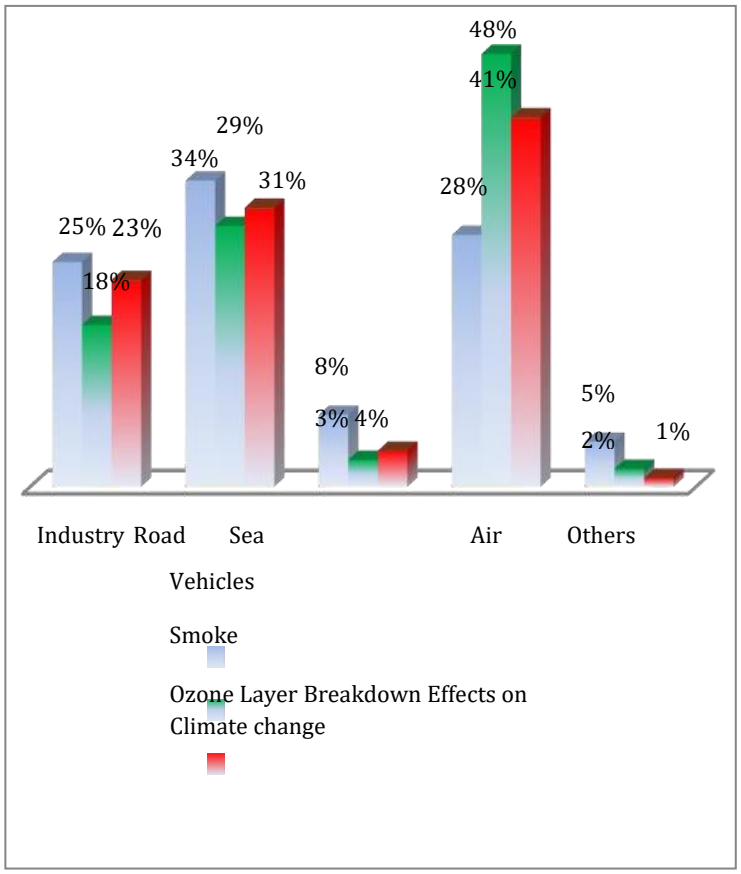
titanium powder) and its used as a catalyst. Currently the electrolysis process it is used industries since hydrogen can be produced more that can be afforded from fossil fuels Electric drive is designed to convert electrical energy to mechanical energy. There are four 12-volt batteries and it is connected in series. The maximum speed of electric drive is 50km/hr and RPM can be controlled by speed controller circuit.

DESCRIPTION OF THE PROBLEM

The major adverse effects of bikes on the environment are air pollution and noise. The exhaust of a bike engine consists of harmful gases like Sulphur and nitrogen oxides and also carcinogenic substances like benzene and formaldehyde. These gases lead to several other environmental problems and also have an adverse effect on the human health. Fossil fuels are getting more and more scarce and expensive. A less expensive and environment friendly fuel is the solution to this problem.



power continuously

POTENTIAL BENEFITS OF THE HYBRID BIKE

Implementing this system will enable us to reduce the cost of bike and fuel & hence, there will be a simultaneous fall in the price of fuel. By this solution the bike will become more efficient and less polluting over time.

DESCRIPTION OF THE DESIGN PROCESS

In this design process, the bike engines are powered by two methods, they are:

1. ELECTROLYSIS METHOD

Electrolysis of water will be carried out in a water tank with separate tank for the anode and the

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cathode. Aluminum electrode is used as anode and stainless-steel electrode is used as a cathode. These electrodes are connected to a battery using copper wires. To boost up the rate of hydrogen generation, catalysts like syngas and titanium powder are added. When current flows through the circuit, hydrogen gas will evolve at the anode and oxygen gas will evolve at the cathode. These gases will be collected and stored in separate tanks that will be fitted with Zigbee sensors to monitor the rate of generation, consumption and level in the storage tank. These oxygen and hydrogen gases will be supplied to the Hybrid Bike, where they will be mixed and burnt to produce driving force. Water consists of hydrogen and oxygen in the following proportions:

Hydrogen = 66.67 % of volume

Oxygen = 33.33 % of volume

EQUATIONS

Cathode (reduction): $2\ H2O(l) + 2e^- \rightarrow H2(g) + 2\ OH^-(aq)$

Anode (oxidation): $4\ OH^-(aq) \rightarrow O2(g) + 2\ H2O(l) + 4\ e^-$

Combining either half reaction pair yields the same overall decomposition of water into oxygen and hydrogen:

Overall reaction: $2\ H2O(l) \rightarrow 2\ H2(g) + O2(g)$

2. ELECTRIC POWERED METHOD

Another option is to use electric motors as a mechanism which will be powered by electric power. Lead Acid with a potential of 48 V each will be used for this purpose. These cells will power the electric motor for generation of thrust. A dynamo can be connected along with the engine shaft which will save some energy in a separate cell for emergency operation.

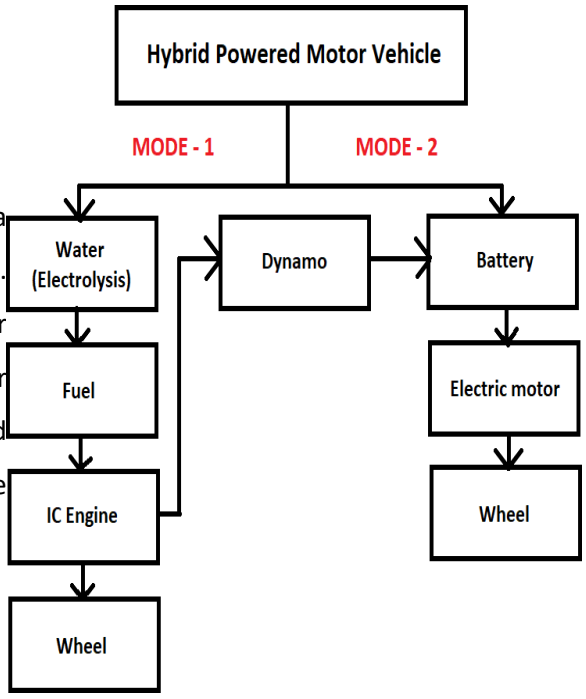

Figure – 1: Flow Chart

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MATERIALS FOR ELECTRODES OR CELL

PLATINUM

It is corrosion resistant and it does not dissolve in the electrolytic solution. It is a very good choice for anode but its cost is very high and also it produces toxic substances. The reaction products are dangerous for the personal health environment

GRAPHITE

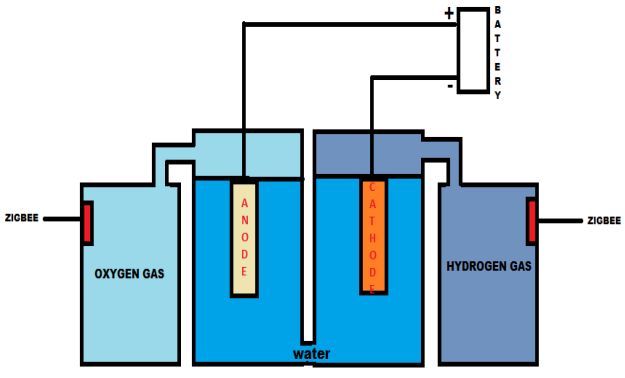
It is an electrically conductive mineral and it cost less compared to all metals.

STAINLESS STEEL

Stainless steel is also corrosion resistant and will be able to withstand the corrosive process of electrolysis. Environmental and health effects are lesser compared to other materials.

WORK PLAN

Two materials will be chosen for electrodes. (Platinum, graphite, stainless steel, Aluminum, etc). One plate will act as anode and the other as cathode. These electrodes will be dipped into a container filled with water. These plates will be connected to a DC power supply.



ELECTROLYSIS OF WATER

DC supply has good voltage control and current limiting characteristics. Alternative current will be inappropriate for electrolysis since it may lead to an explosive mixture of oxygen and hydrogen. When connected to battery, electrolysis will take place and water will be split up into hydrogen and oxygen molecules. These gases will be stored in separate tanks. These gases will then be injected into the engine intake which will be burnt and required driving force will be obtained.

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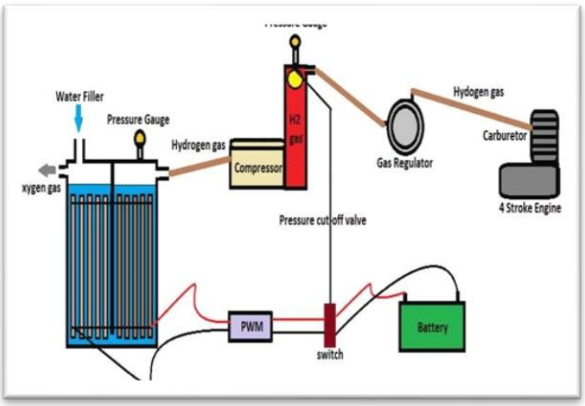
HYDROGEN FUEL GENERATION AND STORAGE

One end of the 12-volt Battery is connected to PWM (pulse with modulation) and the other end is connected to electrolysis tank. When switched ON the electrolysis process gets started in the electrolysis tank and hydrogen gas will get generated and is stored in a tank by using a compressor. The hydrogen gas is supplied to the IC engine via the gas regulator under an optimum pressure. The toggle switch shuts down the hydrogen supply by the use of pressure cut off valve when the pressure exceeds in the hydrogen storage tank.



Zigbee

It is placed in the hydrogen and oxygen gas storage container. It will show the percentage of oxygen and hydrogen stored in the container and the percentage of gas that is supplied to the IC engine.

Some additives are added to water to increase the percentage of hydrogen generated

It is placed in the hydrogen and oxygen gas storage container. It will show the percentage of oxygen and hydrogen stored in the container and the percentage of gas that is supplied to the IC engine.

Some additives are added to water to increase the percentage of hydrogen generated.

ADDITIVES

1. Syngas or synthesis gas
2. Titanium

When these particles are added to water, hydrogen will be generated 150 times faster compared to the normal water and which makes our hydrogen generation 50 times more than that of the normal case.

For 1 litre water = 1,235 L (or) 1.235 m^3

Rate of hydrogen generation for 1-liter normal water = 0.1177 ml per second

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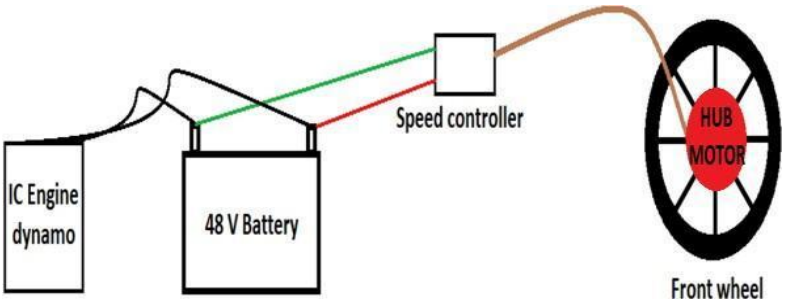
Density of Hydrogen = 0.0899g/L

BATTERY POWERED ELECTRIC BIKE



Four 12-volt lead acid batteries are used in this concept. All the batteries are connected in series. The speed of electric drive can be controlled using a speed controller.

NOMENCLATURE OF SET-UP IN BIKE

Figure (A) Electrolysis kit will split the hydrogen gas and sends it to the water chamber so as to control the back fire.

Figure (B) This figure depicts the generation of hydrogen

Figure (C) Maruti Suzuki car fuel injector is used because it can inject the fuel at a pressure of 52 bar. It is also used for engine cooling because the combustion of hydrogen gas produces excessive

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temperature.

Figure (D) This pipe indicates the water level

Figure (E) The injection of water decreases the temperature, increases the mileage. The water when evaporated converts into steam which increases the torque produced.

UNIQUENESS OF SOLUTION

- Environmentally friendly as it is able to use sea water to generate hydrogen (instead of fresh water) as input and zero carbon emission is possible
- Fuel economy and low cost will enable more people to use hybrid motorcycle
- Reduce Knocking of the bike engine

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RESULT

PETROL TEST READINGS

S:no	Amount of Petrol used	Distance covered (winter)	Distance covered (summer)
1	100 ml	4.8 km	5 km
2	150 ml	6.7 km	7 km
3	200 ml	9.6 km	10 km

HYDROGEN GAS FROM WATER TEST READINGS

S:no	Amount of Water used	Distance covered (winter)	Distance covered (summer)
1	100 ml	7.8 km	9.3 km
2	150 ml	12.1 km	17.8 km
3	200 ml	18.5 km	21.6 km

S:no	Amount of Water used	Distance covered (winter)	Distance covered (summer)
1	100 ml	7.8 km	9.3 km
2	150 ml	12.1 km	17.8 km
3	200 ml	18.5 km	21.6 km

FUTURE HYBRID BIKE:

Front View

Side View

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CONCLUSIONS

It is advantageous to use hydrogen gas as a fuel in bike IC Engine. Hydrogen gas through electrolysis can reduce the percentage of Nitroxide, Sulphur oxide, Unburned Hydro Carbons and Carbon emissions. The energy independence can be achieved once this concept works in an optimum level. This project is pollution friendly and hence the level of air pollution can be reduced considerably in a day-by-day basis.

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