

Reduction of Emission In SI-Engine By Using Fuel cell and Aqua silencer

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Abstract— The continuous increase in global temperature will have spread impact on worldwide. The article deals with the issue of reducing exhaust emission the ecological nature of two wheeler vehicle. It is established that features in silencer and carburetor .To reduce the amount of specific emissions of harmful substances with exhaust gases of two wheeler's when using the "fuel cell & aqua silencer" Emission test was carried out at various conditions such as normal, with aqua silencer and with fuel cell and the result was discussed. By implementing this system in BS-III vehicle can be more or less equal to BS-VI norms. This modification with HHO System will help to improve the mileage

KEY WORDS: Aqua silencer, HHO kit, Emission.

INTRODUCTION

The study to find gasoline and diesel difference due to price[1].The customers should concentrate more on fuel efficiency rather than giving importance to the product quality, utility or innovation alone. High fuel efficiency, Good quality, Innovation , Durability and Sensible cost price this factors is prefer to purchase a two wheeler[2].

Alternatively, Hydrogen-Hydrogen Oxygen (HHO) cells are newly developed innovative solution to store energy with no harm effects for any of the beings on earth. HHO generation cells are introduced to be a green alternative energy storage source because of its advantages, which have overcome the environment pollution and global warming issues. HHO generation cell is environmentally friendly because the hydrogen burns completely without creating pollutants, toxic fumes, or public nuisance. The HHO cells itself mainly in its simplest form stainless steel material that uses water (Saltwater increase the reaction more than the regular water) as an in product. The waste of the system is pure distilled water that can be used as drinking water after mixed with tap water. The output of HHO system is oxygen and hydrogen gases, where hydrogen gas can be stored and used efficiently as power source. The use of Hydrogen gas as a power/supplementary source is not a new idea where it has been targeted by several researches and experiments to enhance, reduce and eliminate certain features of certain systems. For instance, in 1920s, a researcher has designed practical hydrogen-fueled engine and has converted over 1,000 engines to be hydrogen-fueled [3].

The investigation results have demonstrated that a small addition of hydrogen to the fuel, very low oxides of nitrogen (NOx) and CO emissions were achieved for hydrogen-isooctane

mixtures leaner than equivalence ratio of 0.55 and there was significant thermal efficiency improvement yields from the extension further than isooctane lean limit operation[4]

LITERATURE SURVEY

The following literature is based on the research papers published in various national and international journals, books and review articles :

1.T.Tsujimura,Y.Suzuki; "The utilization of hydrogen in hydrogen/diesel dual fuel engine" ;Elsevier (2017); International journal of hydrogen energy (2017) ;1-9 This paper explains study on DDF (diesel dual fuel) where hydrogen is secondary fuel. Also this paper gives explanation about hydrogen DDF working and evaluation of performance of DDF engine. [5]

2.A. F. Ambrose a,A.Quasem Al-Amin , R.Rasiaha,R. Saidur c, N.Amind; "Prospects for introducing hydrogen fuel cell vehicles in Malaysia";Elsevier(2016); international journal of hydrogen energy;1-10 This paper gives introduction of hydrogen fuel cell vehicles (FCVs). The main message of this article is that hydrogen FCV in Malaysia can be expected and is possible when there is a thorough understanding of energy security issues, where energy policy integration for economic development and environmental objectives are achieved at the same time. [6]

3. S.Raffek et.al (March 2017) that they determine the amount of exhaust gases relives from the automobile vehicles and they also determined the amount of hydrocarbons, nitrogen present in the gases. They testes the exhaust gases in their silencer (without lime water) and later they tested in their aqua silencer (with lime water) and they taken their readings. They also proved that their silencer is better than the conventional silencer. They tested their project using with charcoal and without charcoal. Smoke analysis also taken in that project.[7]

3.Rahul.S.Padval et.al (March 2016) they concluded this project had an effective emission control than the present conventional silencer and reduced the exhausted gases toxic like unburned hydrocarbons, nitrogen using lime water and charcoal. They said that fuel requirements for the conventional silencer are same as to the aqua silencer. Due to the medium of water it will also reduce the smoke and noise. They also said that contamination of water is very less in aqua silencer. They also showed that how chemically react to that lime water and

to charcoal. They also added an extra chemical reagent as chlorine which will coagulation power of the process. In this project they also showed the comparison between conventional silencer and to this aqua silencer.[8]

AQUA SILENCER

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FIG-1 Aqua Silencer

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EXPERIMENTAL SET UP AND METHODS

Fuel cell

An HHO kit or Brown gas generator is an interesting technology. It uses electrolysis process to split water (H₂O) into its base molecules, two hydrogen and one oxygen molecule". The product of fuel cell system is oxygen and hydrogen gases, where hydrogen gas can be deposit and utilized efficiently as power source.

Fuel cell is a fuel supply device containing several parts that demonstrate the real possibilities of how hydrogen can be used as a 100% clean fuel for two wheeler in the future. Research on

Fuel cell is currently going on all around the world. Open literature [11-17] and numerous web sites (too many to be listed here) have discussed the Fuel cell in detail and in all aspects

Describe the parts of fuel cell

Fuel cell:

The fuel cell utilized in our trials is an electrolyte cell where refined water converts to HHO. The created gas can be effectively infused into the ignition chambers, at that point started and consumed. at that point started and consumed . The HHO gas comes from the partition of water particles H-O-H. It has high calorific worth and 1 kg of HHO is multiple times as strong as fuel. The cell plates have an anode and a cathode. The electric flow enters the anode and afterward passes to the cathode through the electrolyte. The anode and cathode are made of similar materials

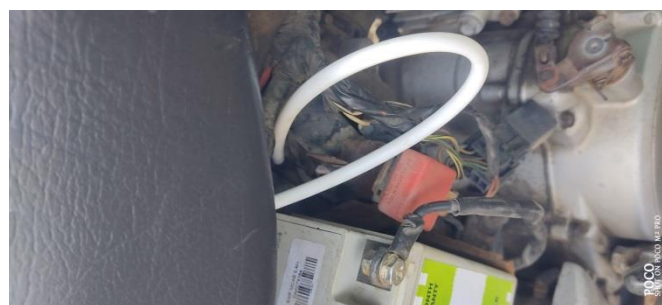


FIG-2 HHO System in Pulsar 150cc

Dryer

HHO dryer eliminates every single undesirable molecule and moisture from HHO before it enters the engine. This outcomes in a better performing engine with less upkeep

Pulse Width Modulation

Pulse width modulation (PWM) is utilized for controlling amplitude signals to control gadgets and applications requiring electricity or power. It basically controls the measure of power, in the viewpoint of the voltage segment that is given "on" phase or duty cycle

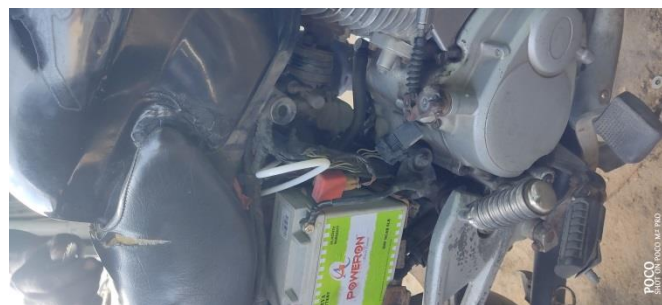


FIG-3 HHO System with battery

Carburetor

A carburetor is a gadget that mixes air and fuel for inside combustion engines in the ratio proportion for combustion. To carburet (and accordingly carburation or carburetion, separately) intends to blend the air and fuel or to prepare (an Engine) with a carburetor for that reason

Hose Pipe

A hose is an adaptable hollow tube intended to convey liquids starting with one area then onto the next. Hoses are additionally once in a while called lines or all the more by and large tubing. The state of a hose is typically tube shaped (having a circular cross section). Hose configuration depends on a blend of utilization and execution. Basic components are size, pressure rating, weight, length, straight hose or loop hose, and chemical compatibility

Air Filter

A particulate air filter is a gadget made out of fiber materials which eliminates strong particulates like residue, dust, shape, and bacterias from the air. filters containing an absorbent or catalyst like charcoal (carbon) may likewise eliminate odors and vaporous pollutants like unstable natural mixtures or ozone.[18-24]

TWO WHEELER SPECIFICATION TABLE

- | | |
|-------------------|-------------------|
| 1. Engine CC | :149 cc |
| 2. No Of Cylinder | :1 |
| 3. Max Power | :13.8 bhp@8000rpm |
| 4. Max Torque | :13.4Nm@6000rpm |
| 5. Valves Per | |
| 6. Cylinder | : 2 |
| 7. Fuel Delivery | : carburator |
| 8. Cooling System | : Air Cooled |
| 9. Mileage | : 35-45 Kmpl |
| 10. Emission | : BS III |



Fig- 4 Pulsar150 with HHO & Aqua Silencer

Experimental set-up of integrating the FC with the engine

It is vital to clarify how the Fuel cell is coordinated into the engine compartment securely. It ought to be mounted, leveled, and got with the goal that it won't skip around when the vehicle hits bumps. The fuel cell was situated so it tends to be handily gotten to and can be helpfully cleaned, adjusted, investigated and loaded up with water. The Fuel cell should be put far away from hot places of the engine. In laboratory, the yield line of the Fuel cell is

connected to the air filter tube of the engine. The produced HHO gas is sucked straightforwardly into the engine during the intake stroke.

Key futures

1. Increase in mileage of vehicle up to 40% and more.
2. Remove carbon deposit and prevent future carbon buildup.
3. Engine knocking will reduce.
4. Increase pick-up of vehicle.
5. The life of engine oil Increase more than 2 to 3 times.
6. Better smoother running engine.
7. The operating temperature of the engine will Reduce.
8. Decrease the oil consumption of the engine

Aqua silencer

When exhaust gases enter into the aqua silencer, the perforated tube changes over High Mass air pockets in to Low Mass air pockets. At that point, they are accessible in to contact with lime water they artificially respond with it and experience charcoal layer, which again decontaminate the gases. It is highly porous and posses extra free valences so it's high absorption capacity. Since the charcoal layer is roofed with outer shell which is crammed with water. Sound produced under water is a smaller amount hearable than it produced in atmosphere. This occurs due to small bonds in water molecules, which reduces mass volume of bubbles & control sound level, by this way aqua silencer reduces noise and pollution

Parts in aqua silencer

1. **Perforated Tube** – The Perforated tube converts High Mass bubbles into Low Mass bubbles, when exhaust gas is entered in aqua silencer.
2. **Outer Shell** – It want to cover whole assembly, which is formed from steel
3. **Flange** - A flange is that the connection of pipe where the connecting pieces have flanges by which the parts are bolted together flange is important part it connect the silencer to engine.
4. **Charcoal Layer**- These activated carbon layer having high absorption capacity and area produces heat up to 15000 C. Hence, its area get expanded.

Chemical Reaction

1. Chemical reaction 1;

The obnoxious product of combustion is NO_x- the oxides of Nitrogen. Water will absorb the oxides of Nitrogen to a larger extent. The following chemical reaction will enhance the proof for the above statement.



2. Chemical reaction 2;

If a small amount of limewater is reacted to the exhaust gases the reaction will take place as



3. Chemical reaction 3;

When the carbon dioxide present in the exhaust gas comes in contact with the limewater, calcium carbonate will precipitate. The calcium carbonate when further exposed to carbon dioxide, carbon bicarbonate will be precipitated. The following reactions,



4. Chemical reaction 4;

The sulphur dioxide present in the exhaust gas also reacts with the limewater. But the small trace of sulphur dioxide makes it little difficult to measure the magnitude of the chemical reaction and calcium sulphate will precipitate,



5. Chemical reaction 5;



From calcium carbonate, calcium sulphite will precipitate and CO₂ will be by-products. Because of the small percentage and SO₂ presence, the liberation of carbon dioxide is very less. But the liberated CO₂ will again combine with calcium carbonate to form calcium bicarbonate. This chemical reaction referred in[25]

Application of Aqua Silencer:

1. To scale back these pollutants from Exhaust of Engine a replacement technology is introduced called Aqua silencer.
2. An Aqua silencer might be a gadget wont to channel the harmful gases delivered from vehicles like CO, UBHC, NO_x and Lead.
3. It uses the charcoal layer, perforated tube and water for its working.
4. It is utilized in Industry to get rid of the harmful containment from the exhaust gases.
5. Generally suitable for heavy vehicles and industry applications.

EFFECT OF DISSOLVED GASES ON WATER

The water is a good absorbing medium. In aqua silencer the gases are made to be dissolved in water. When these gases

dissolved in water they form acids, carbonates, bicarbonates etc.

1. (1)Action of dissolved SO₂ When SO_x is mixed in water, it form SO₂, SO₃, SO₄, H₂SO₄, H₂SO, i.e. sulfur Acid (H₂SO₃), it forms Hydrogen Sulphide which causes fol rotten egg smell, acidify and corrosion of metals.
2. (2) Action of dissolved CO₂ The dissolved carbon dioxide forms bicarbonate at lower PH and Carbonates at higher PH. This levels 40-400 mg/liter. The form a scale in pipes and boilers. The carbon dioxide mixes with water to form Carbonic acid. It is corrosive to metals and causes green house effect.
3. (3) Effect of dissolved NO_x The Nitrogen in water under goes Oxidation to form ammonia, Nitrate, Nitrite, Nitric acid. This synthesis of protein and amino acids is effected by Nitrogen. Nitrate usually occurs in trace quantities in surface water.[6]

ADVANTAGES AND DISADVANTAGES

1. Advantages

- CO is reduced 60 to 70% compared to ordinary silencer
- Control emission in greater level
- Reduce noise pollution
- No vibration when the engine is running
- Chemical reaction will be fast
- Carbon is precipitated
- It is light in weight
- Outer shell will not rust because of lime water
- No need of catalytic convertor
- Low cost
- Easy in construction
- Easy starting

2. Disadvantages

- Lime water should be refilled once in a year
- Need a separate space to setup
- Design and reduction of carbon monoxide and NO_x in petrol engine Aqua silencer.[27]

Exhaust Gas Analyser

Exhaust gas analyser is used to measure exhaust emissions from the gasoline engine. It gives the values of CO, CO₂ and O₂% in volume, whereas NO_x and HC in ppm. It also shows

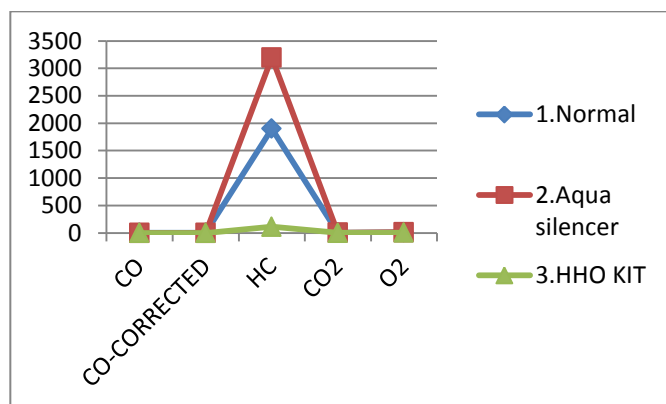
the exhaust gas temperature



FIG -5 Emission Test

Result and discussion

The aqua silencer is more effective in the reduction of emission gases from the engine exhaust using perforated tube and charcoal. by using activated charcoal in water we can control the exhaust emission to a greater level. The water contamination is found to be negligible in aqua silencer. It is smokeless and pollution free emission and also it is very cheap. It can be also used both Aqua silencer and fuel cell for two wheelers .The below graph show the value emission levels



Graph -1 Emission Comparison Graph

in the above graph the blue line indicates the normal condition of bike. The red line indicates values of aqua silencer with the higher value of hydrocarbon and the green line indicates the values of fuel cell . With all the emission values under the controlled levels In the similar to BS-III standard.

The conclusion of the aqua silencer and fuel cell are used the same time the emission level is reduced. And the fuel consumption is optimised

CONCLUSION

It has been experimentally observed that the aqua silencer is successfully effective in reducing emission of gases from the engine exhaust. it produces almost pollution-free and smokeless emission and is also cheap considering long term use. The aqua silencer's and performance is almost equivalent to the conventional silencer. in heavy weight vehicles. This project analyzed the smoke content of the exhaust gas before and after treatment and it was found that there is a considerable reduction in the emission as pointed out.

The Petrol engine performance and emission analysis are conducted with Petrol + HHO and petrol respectively. Thus the performance and emission analysis results are compared after conducting the tests with petrol on ,Reduction of fuel consumption in gasoline + HHO and petrol respectively. The modification in the current BS-III vehicle with HHO kit ,aqua

silencer and ethanol blend fuel to improve the fuel economy and more or less equal to BS-VI norms

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