

Experimental Investigation of Oxygen Enriched IC Engine

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ABSTRACT: There have been many methods and experiments are developed in the field of reducing emissions in IC engines and increasing their performance, since there is no any better development for complete combustion and zero emission. The method for decreasing emissions from the internal combustion engine involves supplying pure oxygen instead of atmospheric air and also using catalytic converter. In our normal conventional combustion engine the atmospheric air is used to mix with fuel and burned inside the combustion chamber which results in the emission of CO₂, unburned Hydrocarbons, etc. which are responsible for pollution. So in our experiment we are planned to use pure oxygen intake instead of atmospheric air supply, so that the emission of hazardous gases could be reduced 4x less than normal combustion method and engine performance and efficiency also would increase.

KEYWORDS: Reducing hydrocarbons and nitrous oxides, pure oxygen intake, increasing efficiency.

I.INTRODUCTION

The usual method of fueling the four strokes SI Engine for combustion is to draw in air from the atmosphere to mix with the fuel, such as gasoline or other petrol products to combustion chamber so as to ignite the mixture therein.

The major problem in this method is the emission of hydrocarbons, carbon monoxide, nitrous oxide and sulphur gases. It all caused due to the combustion of hydrogen and nitrogen which present in the air in large quantities along with the fuel and incomplete combustion of air-fuel mixture because of the presence of unwanted gases in atmospheric air, since oxygen is the only necessary for burning, which are results in reduced efficiency and also emission of poisonous gases which results in environmental problems and health hazards. This problem can be reduced by supplying the pure oxygen instead of the atmospheric air intake.

1.1. OBJECTIVE OF INVENTION

The main aim of our experiment is to make the engine more efficient and emission free combustion Oxygen is the only necessary component to burn the fuel in combustion chamber .By providing the mixture of oxygen and petrol to the combustion chamber the combustion process takes place without the emission of the harmful gases and complete combustion could be possible. The method of separation of oxygen and supplying it safely to the combustion chamber was the major difficult process in this experiment and hence it is done through electrolytic process, which is safer and cheaper and also efficient.

II. ELECTROLYSIS PROCESS SETUP

Water is used as an electrolyte solution to produce oxygen and hydrogen. Whereas nickel and iron are used as electrodes. Through the electrodes hydrogen and oxygen are evolved out. The hydrogen gas was set free in the atmosphere because the expansion of hydrogen causes explosion like in the hydrogen bomb. Only the oxygen is taken out and stored in the cylinder. The stored oxygen combined with fuel is allowed inside the combustion chamber.

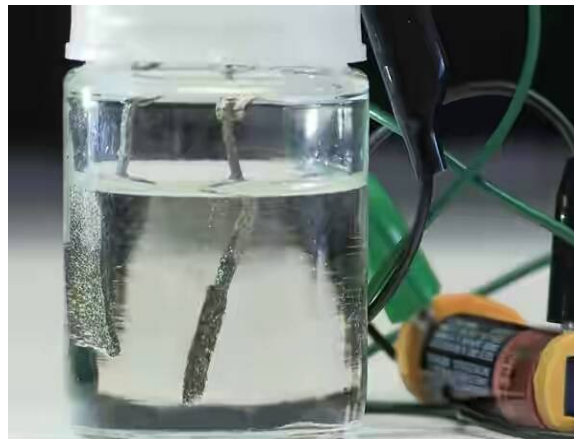


Fig 1: ELECTROLYSIS SETUP DIAGRAM

2.2. WORKING DESCRIPTION OF THE SETUP

FIG. 1 shows the practical working principle of the electrolysis process. The battery sends an electric current through two electrodes that split liquid water into hydrogen and oxygen gas. Using nickel and iron as an electro catalysts is active enough to split water at room temperature with a single battery. The nickel (anode) and iron (cathode) electrodes are dipped inside a normal water both are connected with a battery (1.5v or above). As per the type of application and size of electrodes the voltage of battery is selected. The water splitter continuously pumps out the clean hydrogen and oxygen in a steady flow and the flow is continuous for more than 200 hours. The hydrogen evolved from the cathode is allowed to go free in the atmosphere and the oxygen evolved from the anode is directly allowed inside the cylinder and after that it was mixed with the fuel then allowed into the combustion chamber through carburetor.

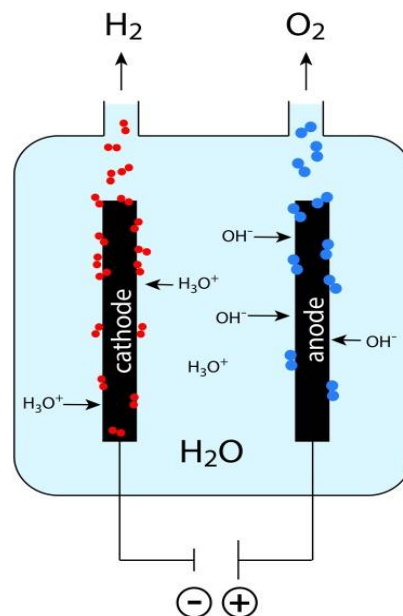


Fig 2: ELECTROLYSIS PROCESS

2.3. ELECTRODES

Nickel and iron plates are used as electrodes in this electrolysis process for the production of more amount of oxygen for a long period of time and they provide a continuous steady supply of oxygen for the requirement of mixture with fuel to give a complete combustion of the fuel.



Fig 3: NICKEL PLATES

Nickel is a hard silver white metal .It forms cubic crystals. It is malleable and ductile. It has superior strength and corrosion resistance. The metal is a fair conductor of heat and electricity. It exhibits magnetic properties below 345° C.



Fig 4: IRON PLATES

Iron is a chemical element with symbol Fe. It has an atomic number of 26.It is a metal in the first transition series .It is by mass the most common element on earth, forming much of earth's inner and outer core.

III. STORAGE OF OXYGEN

The oxygen was supplied continuously by the electrolysis method for about 200 hours. The evolved oxygen was stored in a cylinder for safety, preventive and additional use. The oxygen is stored to provide continuous supply for the fuel mixture to provide the emission free combustion.



FIG 5 : STORAGE TANK

IV. OXYGEN FUEL MIXTURE

The oxygen is mixed with petrol in the definite proportion to produce combustion without emission of harmful gases. Three kg of oxygen is needed for the complete combustion of one kg of petrol. **One liters of petrol = 0.71 kg. Oxygen** required to burn **1litre** of petrol =**1.95kg**. For a complete combustion process the amount of oxygen required to burn petrol is approximately about one kg of petrol takes about three kg of oxygen for a complete combustion process.

V. FOUR STROKE CYCLES

An internal combustion engine that utilizes four distinct piston strokes (intake, compression, power, and exhaust) to complete one operating cycle. The Piston makes two complete passes in the cylinder to complete one operating cycle. An operating cycle requires two revolutions (720°) of the crankshaft.

5.1. Intake stroke

The intake event is when the air-fuel mixture is introduced to fill the combustion chamber. The intake event occurs when the piston moves from TDC to BDC and the intake valve is open. The movement of the piston toward BDC creates a low pressure in the cylinder. Ambient atmospheric pressure forces the air-fuel mixture.

5.2. Compression stroke

The compression stroke is when the trapped air-fuel mixture is compressed inside the cylinder. The combustion chamber is sealed to form the charge. The charge is the volume of the compressed air-fuel mixture trapped inside the combustion chamber ready for ignition.

5.3. Power

The air-fuel mixture inside the combustion chamber is ignited by a spark produced by the spark plug and it forms hot expanding gases. These hot expanding gases force the piston head away from the cylinder head. Piston force and subsequent motion are transferred through the connecting rod to apply torque to the crankshaft.

5.4 Exhaust

The exhaust stroke occurs when spent gases are expelled from the combustion chamber and released to the atmosphere. The exhaust stroke is the final stroke and occurs when the exhaust valve is open and the intake valve is closed. Piston movement evacuates exhaust gases to the atmosphere.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

VI. EXPERIMENTAL ANALYSIS

LIST OF CONTENTS	NORMAL IC ENGINE	OXYGEN POWERED IC ENGINE
Fuel	Petrol	Petrol
Quantity	100ml	100ml
Engine speed	90km/hr	110km/hr
Time taken	3.2 sec	7.4 Sec

VII. INDIAN EMISSION STANDARDS

Bharat stage emission standards are emission standards instituted by Government of India to regulate the output of air pollutants from Internal Combustion Engine equipment, including motor vehicles. The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment & Forests and climate change.

The standards, based on European regulations were first introduced in 2000. Progressively these norms have been rolled out since then. All new vehicles manufactured after the implementation of the norms have to be compliant with the regulations. Since October 2010, Bharat stage (BS) 3 norms have been enforced across the country. In 13 major cities, Bharat stage 4 emission norms have been in place since April 2010. In 2016, the Indian government announced that the country would skip the BS-5 norms by 2020.

PETROL EMISSION NORMS

Norm	CO	HC	NOx	HC+NOx	PM
BS-III	2.30	0.20	0.15	—	—
BS-IV	1.00	0.10	0.08	—	—
Euro-VI	1.00	0.10	0.06	—	0.005

DIESEL EMISSION NORMS

Norm	CO	HC	NOx	HC+NOx	PM
BS-III	0.64	—	0.50	0.56	0.05
BS-IV	0.50	—	0.25	0.30	0.025
Euro-VI	0.50	—	0.06	0.17	0.005

FIG 6: INDIAN POLLUTION NORMS

VIII. PRACTICAL ADVANTAGES

As the engine uses pure oxygen would produce **more power** and engine could be made much smaller and lighter to produce the same amount of power. **Higher efficiency** due to the absence of Nitrogen, which is normally present in atmospheric air in a large amount as 78% which results in the loss of power. **Emission of hazardous gases is much reduced** due to the absence of other gases in combustion where oxygen is used for burning. If pure oxygen were used for the combustion of petrol then there will be only hot exhaust gases comes out, but it will be 4 times less of it while comparing to air-fuel combustion.

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IX.CONCLUSION

Hence the engine would never produce oxides of nitrogen, which are responsible for atmospheric pollution and component for acid rain and greenhouse effect. Nowadays catalytic converters are used to limit the production of these pollutants. Using pure oxygen then it would eliminate the oxides of nitrogen and helps in unburned fuel problems that mean complete combustion is possible and the engine could run at a higher efficiency with higher power. As engine uses pure oxygen only instead of atmospheric air the engine could be built in smaller and lighter size for the production of same high power.

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