ACETYLENE GAS BASED SI ENGINE

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Abstract–In a present stage where the fossils fuels goes on depleting rapidly. Therefore we have to find alternative fuel. We have many option like CNG, LPG as alternative fuel but it can carries some drawbacks like an emission of pollutant. These projects perform on the idea of using acetylene gas in internal combustion engine as alternative fuel which reduces the demand of petroleum product. Acetylene produce by have decomposition reaction of calcium carbide with water in presence of aluminum powder. Acetylene is renewable energy sources which emits less pollutant as compare to another petroleum product which makes suitable for use on economic and environment aspect and eco-friendly.

KeyWords: Alternative fuel, emission, comparison, efficiency.

1. INTRODUCTION

Burning fossils fuel like gasoline and diesel releases carbon dioxide, greenhouse gas, into the atmosphere. The buildup carbon dioxide ($co_{2)}$ and other greenhouse gasses like methane (CH_4), nitrous oxide (N_2O), and hydro fluorocarbons (HFC_S) is causing the earth's atmosphere to warm, resulting in changes to the climate we are already starting to sea today.

But recently we using fuels we are less compatible and more hazards to environment, however we using the hydrocarbon based fuel (petrol and diesel). Acetylene is a better change for their fuels on environment and economic aspects.

Before used as a fuel we have to pass the acetylene through the following stage –

- Production
- Storage
- Transfer

2. Principle

We provide fuel acetylene as main source which is renewable and less pollutant creator regarding environment with better efficiency.

3. About acetylene

Acetylene is produced by calcium carbide with water in following reaction

Calcium carbide + water ⟹ acetylene + calcium hydroxide.

Acetylene (systematic name: ethane) is the chemical compound with the formula C_2H_2.it is a hydrocarbon and the simplest alkynes. This colorless gas is widely used as a fuel and a chemical building block. It is unstable in its pure form thus is usually handled as a

Solution pure acetylene is odorless, but commercial grades usually have a marked odor due to impurities.

As alkynes acetylene is unsaturated because its two carbon atoms are bonded together in triple bond. The carbon triple bond Place all four atoms is the same straight line, with CCH bond angles of 180 degree.

Since the 1950 acetylene mainly been manufactured by the partial combustion of methane or appears as aside product in the ethylene stream from cracking of hydrocarbon approximately 400,000 tones were produce by this method in 1983.

Until the 1950 when the oil is supplanted coal as a chief source of reduce carbon, acetylene was the main source of organic chemical in the chemical industry it was prepare by hydrolysis of calcium carbide the reaction is discovered by FRIEDRICH WHOLER in 1862.

$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

Calcium carbide production required extremely high temperature

2000 degree Celsius, necessitating the use of an electric arc furnace. In the US, this process was an important part of the late -19th century revolution in the chemistry enable by the massive hydroelectric power project at naira falls.

4. STAGES-

1. Production
2. Storage
3. Transfer

1. Production-

These process consist two chamber in the first that is upper chamber keep the water and second that is lower chamber calcium carbide4 is kept .the water is to be released from the first chamber in such way that the process start itself. Then the water is passed through control wall in lower chamber, the calcium carbide is maintain with the water in equal amount through lower chamber is the wall is connect to storage tank in which gas is stored that produce during process.

2. Storage-

Fig .2.1 Storage Tank

Further the acetylene gas is stored in Fig .2.1. The pressure of the gas in the storage tank is measured by pressure gauge which is connected to the cylinder, the stored gas which passed through the pipes. The gas in the storage tank provided the pressure gauge causes gas in high concentration.

3. Transfer –

Fig.3.1Vaporizer

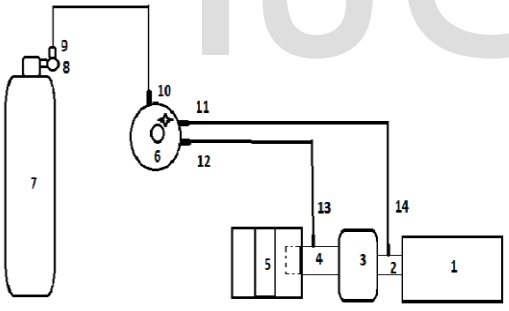
Vaporizer it is device which is use to transfer the gas from the gas cylinder to engine with proper amount of air it consist of four knob-

1. Vacuum inlet knob
2. Vacuum outlet knob
3. Gas inlet knob
4. Gas outlet knob

Quantity gas is transfer to the engine is control by special valve which present at the top of the vaporizer.

It works same as carburetor which control air fuel mixture and vaporizer control gas and air mixture.

5. Construction –



1. Engine	7. Acetylene Gas Cylinder	13. Gas Inlet Nipple
2. Hose Pipe	8. Pressure Gauge	14. Vaccume Inlet Nipple
3. Carburettor	9. Flash Trap	
4. Hose Pipe (rubber pipe)	10. Gas Inlet Vapourizer Knob	
5. Air Filter	11. Vaccume Outlet Vapourizer Knob	
6. Vapourizer	12. Gas Outlet vapourizer Knob	

Fig. 5.1 Flow Construction

1. The acetylene gas kit contains the following apparatus excluding once in the inlet system of SI engine.
1. Acetylene gas cylinder 2. Pressure gauge 3. Flash trap
4. Vaporizer 5. Nipple
2. The acetylene gas cylinder fitted with pressure gauge and flash trap over the outlet of nozzle of cylinder. Flash trap is used to prevent the flame from back fire.
3. Outlet pipe of acetylene gas cylinder is connected to the intake knob of vaporizer by pipe.
4. The gas outlet from the vaporizer is connected to hose pipe which placed between the carburetor and air filter.
5. The presence of vacuum in this process is essential and hence we provided vacuum from the vacuum knob of the vaporizer.
6. The hose pipes between carburetor and filter and another hose pipe between engine and carburetor are drilled for proper inlet of the required gases through nipple.

6. Working –

Fig.6.1Actually Construction

1. When we switch on the valve of cylinder gas flow through the pipes.
2.At the cylinder valve pressure gauge is present with help of this we control pressure of the gas and flash trap is connected to the pressure gauge which prevent the flame cause by the back fire. The pressure must be kept between 16 to 17 bars.
3. Then gas from acetylene gas cylinder is passed through the pipes and reaches to the vaporizer.
4. Then vaporizer passes this gas to the hose pipe which present between carburetor and air filter.
5. At the same time vaporizer provide the vacuum to the hose pipe with present between the engine and carburetor.
6. Then gas mix with proper amount of vacuum (air) goes to the engine and intern

7. Comparison-

Table: 7.1 Comparison of Acetylene, Diesel and Petrol

PHYSICAL AND COMBUSTION PROPERTIES OF FUELS	ACETYLENE	DIESEL	PETROL
Fuel	C_2H_2	$C_8 - C_{20}$	$C_4 - C_{12}$
Density kg/m^3 (at 1atm and 20° C)	1.092	840	717.7
Auto ignition temperature (°C)	305	257	267
Stoichiometric air fuel ratio (kJ/kg)	13.2	14.5	14.7
Flammability limits (volume %)	2.5 - 81	0.6 – 5.5	1.4 – 7.6
Flammability limits (equivalent ratio)	0.3 – 9.6	.....	.....
Lower calorific value (kJ/kg)	48,225	42,500	43,200
Lower calorific value (kJ/m^3)	50,636	.....	.....
Maximum deflagration speed (m/sec)	1.5	0.3	0.6
Ignition energy (MJ)	0.019	.....	.....

B) Calculation for Emission of co_2

$$\frac{0.068\ lb}{1\ cubic\ feet\ C_2H_2} X \frac{453.6g}{1\ lb} = \frac{30.845g}{1\ cubic\ feet\ of\ C_2H_2}$$

$$\frac{30.845g}{1\ cubic\ feet\ C_2H_2} X \frac{1}{26.04/_{1\ mol\ C_2H_2}}$$

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$$\frac{1.185\ mol\ C_2H_2}{1\ cubic\ feet\ C_2H_2} X \frac{2\ mol\ CO_2}{1\ mol\ C_2H_2} = \frac{2.370\ mol\ CO_2}{1\ cubic\ feet\ of\ C_2H_2}$$

$$\frac{2.370\ mol\ CO_2}{1\ cubic\ feet\ C_2H_2} X \frac{44.01}{1\ mol\ CO_2} = \frac{104.304\ g\ CO_2}{1\ cubic\ feet\ of\ C_2H_2}$$

$$\frac{104.304gCO_2}{1\ cubic\ feet\ C_2H_2} X \frac{1\ metric\ ton}{10^6} = \frac{1.403\times10^{-4}\ m.ton\ CO_2}{1\ cubic\ feet\ of\ C_2H_2}$$

$$\text{Acetylene consumed(cubic feet)} \times \text{Acetylene Emission Factor} \left(\frac{1.403\times10^{-4}\ metric\ ton\ C\ O_2}{1\ cubic\ feet\ of\ C_2H_2}\right) = \text{Total emissions (metric tons } CO_2\text{)}.$$

8 .Calculation

A) Calculation for weight

Density of acetylene =1.1 kg/m3

Density = mass/volume

1.1= mass / 1……

(Density = 1.1 kg/m3 at vol. = 1m3)

Mass= 1.1 kg

Weight = mass * gravity

Weight =1.1 * 9.81

Weight = 10.79 kg

1 m3 = 10.79 kg

Our storage tank contains 7.5 m3 acetylene gases

Therefore 7.5 * 10.79 = 80.93 kg

We get 7.5 m3 at ₹ 2000

Therefore we get 80.93 kg at ₹ 2000

1 kg = 2000 / 80.93

= ₹ 24.72

We get 1 kg acetylene gas at ₹ 24.72

And we get 1 kg LPG at ₹5

Advantage –

1. Emission is non-polluting as only carbon dioxide and water vapors are emitted.
2. Better efficiency.
3. Average of vehicle is increase by 15 to 20 km/hr.
4. It is renewable in nature.
5. It is a very cheap.
6. Use same handling system same as LPG and CNG.
7. Less component wear.
8. Flammability limits are greater than other petroleum product.
9. It is eco-friendly.
10 .auto ignition temperatures is high.

Disadvantage-

1. Modification in SI engine is required.
2. Knocking possibilities.
3. It cannot be available everywhere because there are no filling station as it is a new initiative.
4. Without flash trap it is very dangerous.

Future scope

1. Another advantage which justifies the use of acetylene in future is in the exhaust emission. On one hand fossil fuel during combustion produces CO2, CO, Knox Some unborn hydrocarbon are produces but in case of acetylene carbon dioxide is produced with traces of water vapors.

Conclusion –

1. As our project we concluded that acetylene is produce less pollution compares to other petroleum product and is more eco-friendly in nature.
2. Help of acetylene gas as a fuel we increases average of vehicle by 15 to 20 km/hr.

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