

Acetylene as an Alternate Fuel in I.C. Engine

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Abstract: In a present Stage where fossil fuels are on a verge to exhaust. People have been working in search for best alternative fuel to safeguard the environment ever since the transportation and industrial fields have started to grow rapidly. We have many alternative Fuels like LPG, CNG but it carries some drawbacks like emission of pollutants. This project performs on the idea of using acetylene as an alternative fuel in IC engine. Which subsequently reduces the demand of petroleum product. Decomposition of calcium carbide with water produces an acetylene gas. Acetylene gas is obtained from renewable source of energy and it emits less harmful pollutants as compared to petroleum products. Thus acetylene is a comparatively cheap and eco-friendly fuel.

Keywords: Alternative fuel, Emissions, Acetylene.

1. Introduction

Excessive use of the fossil fuels like Petrol and Diesel increases the concentration of harmful gases in atmosphere like CO₂, CO, Sox, NO_x and ppm. Which results in various climatic changes like Acid rain and Global warming. To overcome the adverse effect of fossil fuels on environment we are using acetylene as a fuel in IC engine. As acetylene is an environment friendly and economical in nature. In this project acetylene is produced from non-petroleum resources. Therefore, it is a best possible alternative to petroleum based fuels in SI engine. Acetylene is a synthetic gas that can be produced by reaction of Calcium carbide with water.



Acetylene gas shows a good combustible character hence it can be used in IC engine with certain modifications.

A. Need of alternative fuel

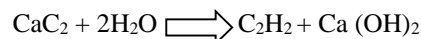
As a result, gases from fossil fuel emissions are causing significant damage to the atmosphere which results in Greenhouse effect and Acid rain. The use of alternative fuels to power our cars, buses and trucks would greatly reduce our dependence on fossil fuels. The use of acetylene reduces the running cost and minimizing the pollution, thus makes acetylene best for the use on economic and environmental standards.

2. Principle

We use acetylene gas as a main source because of its renewable and non-polluting nature.

3. Principle

Acetylene (IUPAC name: Ethyne) is a colorless gas with distinctive garlic smell. Its chemical formula is C₂H₂. Acetylene was discovered by Edmund Davy in 1836, while his experiment with potassium carbide. By the later half of 1800's a method was developed for making acetylene gas by reacting CaC₂ with water. Acetylene is a synthetic gas which is produced by reaction of Calcium carbide with water.



The Calcium carbide used in the preparation of acetylene is produced at extremely high temperature up to 200°C in an electric furnace. Because of its highly explosive nature; acetylene gas must be handled and store with care.

Table 1
Comparison of Properties of fuels

Physical and combustion properties of fuels	Acetylene	Petrol	Diesel
Fuel	C ₂ H ₂	C ₄ -C ₁₂	C ₈ -C ₂₀
Density(kg/ m ³)	1.092	748.7	840
Auto-ignition Temperature(°C)	305	267	257
Stoichiometric air fuel ratio(kJ/kg)	13.2	14.7	14.5
Lower calorific value(kJ/Kg)	48,225	43,200	42,500

4. Overview of project

We are using 3 tanks in our project in tank no.1 petrol is stored and this petrol can be used to drive a vehicle. In tank no. 2 we are storing water. The water from tank no.2 is passed through a control valve in tank no. 3 thus water from tank no. 2 is released in such a way that reaction takes place spontaneously. In tank no. 3 Calcium carbide is kept in desirable amount to react with water passed through tank no. 2. As soon as the water comes in contact with Calcium carbide it generates Acetylene gas. Acetylene gas produced in tank no. 3

is supplied through pipes into carburetor.

A. Acetylene storage tank

In this calcium carbide reacts with water to produce Acetylene gas and Calcium hydroxide. The cylinder is made up of mild steel sheet of 2 mm thickness. Dimension of tanks are 160 mm in diameter and 250 mm in length. In the tank no. 3 exothermic reaction takes place.

B. Dimensions of tank

Cylinder length =250 mm

Cylinder diameter =160 mm

Capacity of tanks:- In tank no.1 we can store 4.70L of petrol.

Volume of cylinder = $5.76 \times 10^{-3} \text{ m}^3$

Density of petrol =748.9 kg/m³

Density =Mass/Volume

$$=M/5.76 \times 10^{-3}$$

$$(M=4.31 \text{ kg})$$

In tank no. 3

Volume = $5.76 \times 10^{-3} \text{ m}^3$.

Density of Acetylene = 1.08 kg/m³

Density=Mass/Volume

$$(M = 6.22 \times 10^{-3} \text{ kg})$$



C. Pressure inside the tank

Pressure=Force/Area

Pressure=mg/A

$$P=3.03 \times 10^{-6} \text{ N/mm}^2$$

$$P=3.03 \times 10^{-5} \text{ bar}$$

The amount of pressure generated in tank no. 3 when acetylene gas is produced= $3.03 \times 10^{-5} \text{ bar}$.

5. Fuel consumption

- As the bike runs at a speed of 50-60km/hr by using petrol hence by using acetylene we can run the bike at a similar speed.
- 200grams of calcium carbide is required to run the engine for 12-15min.
- Therefore, to run an engine for 1hour it requires about 1kg of calcium carbide.
- Fuel consumed=Amount of fuel used to run the engine for 1hr/distance.
- Fuel consumption= $1000/60=16.66 \text{ gm/km}=0.01666 \text{ kg/km}$
- Average fuel consumption= $1 \text{ kg}/60 \text{ km}$.

6. Emission Test

Fuel	CO in %	HC in ppm	CO ₂ in %
Petrol	4.5	901	3.04
Acetylene	3.6	272	2.18

By the results obtained from emission test we can observe that amount of CO₂ emitted is fairly minimum and other emissions like SO_x, NO_x are highly negligible as compared to CO₂. This test illustrates that acetylene gas is more environment friendly than gasoline.

A. Advantages

- Acetylene gas is nonpolluting in nature because it emits carbon dioxide and traces of water vapours.
- Acetylene gas is cheap and it is available in abundance.
- Better efficiency.
- Acetylene gas is eco-friendly.
- Average of vehicle is increased by 10-12kms.

B. Disadvantages

- Modification in Engine is required.
- There is a possibility of knocking.
- As it is a new initiative filling stations are not available everywhere.

7. Future scope

According to the recent reports fossil fuels will extinct till 2035 and due to increasing demands of petroleum products its prices are increasing day by day. On the other hand, Acetylene is obtained from calcium carbonate which is available in abundance. There is a major advantage of acetylene gas which justifies the use of acetylene in exhaust emission. When the combustion of fossil fuels takes place many gasses like CO, CO₂, SO_x, NO_x and some unburned hydrocarbons are produced. Whereas in case of acetylene gas CO₂ is produced with traces of water vapor.

8. Conclusion

In our project we have used acetylene gas as an alternate fuel in an internal combustion engine. We conducted experiment on 100cc, 4-stroke petrol engine with certain modifications and we have compared the performance of acetylene gas with petrol. Hence; we can conclude following points:

- Acetylene gas which is being used in our project is made by the reaction of calcium carbide with water which is comparatively cheaper than petrol.
- We need to make modifications in air intake manifold because water is being produced in carburetor.
- Emissions of gasses like CO, CO₂, SO_x, NO_x are highly reduced.
- By using 1kg of calcium carbide we can run the bike up to 60kms, which means average of vehicle increases by 10-12kms.

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