

Filtration, Regulation and Reducing Knocking of Acetylene Gas to use as an Alternative Fuel in Modified SI Engine

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Abstract— Many research activities were developed in order to study the Internal Combustion Engines with alternative fuels. Acetylene is one of the tested fuels. So we tried to find out more suitable way to make it safe and work. And also a way to filtration and new way to remove water or moisture.

Key words: Acetylene Gas, Filtration, Alternative Fuels

I. INTRODUCTION

Acetylene (C₂H₂) is not only an air gas but also a synthesis gas generally produced from the reaction of calcium carbide with water.

It was burnt in "acetylene lamps" to light homes and mining tunnels in the 19th century. A gaseous hydrocarbon, has a strong garlic odor, it is colorless, is unstable, highly combustible, and produces a very hot flame (over 5400°F or 3000°C) when combined with oxygen.

Acetylene is generally produced by reacting calcium carbide with water. The reaction is continuously occurring and can be conducted without any sophisticated equipment or apparatus. Such produced acetylene has been utilized for lighting by street vendors, in mine areas etc. People often call such lighting sources "carbide lamps" or "carbide light". Industrial uses of acetylene as a fuel for motors or lighting sources, however, have been nearly non-existent. In modern times, the use of acetylene as a fuel has been largely limited to welding-related applications or acetylene torches for welding. In most such application, acetylene is used in solution form such as acetylene dissolved in acetone.

A fuel filter is a filter in the fuel line that screens out dirt and rust particles from the fuel, normally made into cartridges containing a filter paper. They are found in most internal combustion engines.

Fuel filters serve a vital function in today's modern, tight-tolerance engine fuel systems. Unfiltered fuel may contain several kinds of contamination, for example paint chips and dirt that has been knocked into the tank while filling, or rust caused by moisture in a steel tank. If these substances are not removed before the fuel enters the system, they will cause rapid wear and failure of the fuel pump and injectors, due to the abrasive action of the particles on the high-precision components used in modern injection systems. Fuel filters also improve performance, as the fewer contaminants present in the fuel, the more efficiently it can be burnt.

Fuel filters need to be maintained at regular intervals. This is usually a case of simply disconnecting the filter from the fuel line and replacing it with a new one, although some specially designed filters can be cleaned and reused many times. If a filter is not replaced regularly it may become clogged with contaminants and cause a restriction in the fuel flow, causing an appreciable drop in engine performance as the engine struggles to draw enough fuel to continue running normally.

Acetylene is stored under pressure in tank. It turns back into a gas when you release some of the pressure in the gas bottle by turning on your appliance. The pressure within a gas bottle can be very high. This varies based on the ambient temperature, exposure to the radiant heat of the sun and the amount of gas remaining in the tank.

The objective of knock control strategies is to attempt to optimize the trade-off between protecting the engine from damaging knock events and maximizing the engine's output torque. Knock events are an independent random process. It is impossible to design knock controllers in a deterministic platform. A single time history simulation or experiment of knock control methods are not able to provide a repeatable measurement of controller's performance because of the random nature of arriving knock events. Therefore, the desired trade-off must be done in a stochastic framework which could provide a suitable environment for designing and evaluating different knock control strategies performances with rigorous statistical properties.

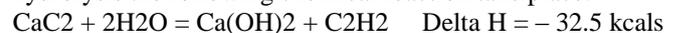
II. IDENTIFY, RESEARCH AND COLLECT IDEA

A. Methodology

1) Production of acetylene gas from calcium carbide:

Calcium carbide (CaC₂) is manufactured from lime and coke in 60:40 ratio in electric furnace at 2000 deg C to 2100 deg C temperature. The size of the calcium carbide is first reduced to fine powder in pulveriser. The pulverized calcium carbide is then added through a gas tight hopper valve arrangement to the acetylene gas generator in which the quantity of water used is sufficient to discharge the calcium hydroxide as lime slurry containing 85 % to 90 % water. In the gas generator the temperature is kept below 90 deg C while the pressure is maintained at 2 atm.

Acetylene is produced in the gas generator by the hydrolysis reaction of calcium carbide with water. During hydrolysis the following chemical reaction take place.



The crude acetylene gas from generator contains traces of H₂S, NH₃ and PH₃. It is scrubbed with water in a scrubber then sent to purifier where the gas is purified and dried with iron oxide and silica gel. The dry gas is filled into cylinders or sent through pipe line to continuous casting machines.

The flow diagram of the process is given in Fig 1.

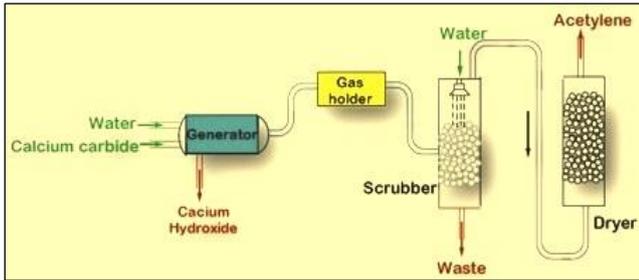


Fig. 1: Flow diagram of production of acetylene from calcium carbide

The production process is environmental friendly. The byproduct of the process is slaked lime which has several uses such as in construction activities as well as for Ph adjustment.

III. IDENTIFY, RESEARCH AND COLLECT IDEA

- 1) Experiment: Filtration, Regulation problem & Reducing Knocking:

A. Setup



Fig. 2: Experiment setup

B. Aim

- 1) To find solution for filtration and regulation of gas transferred from storage tank to engine.
- 2) To find solution for reducing knocking.

C. Observation: (Filtration & Regulation)

- 1) Checking without any filter or regulator we observed starting trouble since its require minimum press to start and while it is in running due to some water went inside it stop.
- 2) Checking with filter or regulator we observed that engine start near 0.2 psi

D. Observation: (Knocking)

As we study research paper it suggest that by adding alcohol as a secondary fuel it can be reduce.

E. Conclusion: (Filtration & Regulation)

We found using Filter-Regulator system IMI Norgren B07-233-M1KA (500-21-264) solve this issue.

F. Conclusion: (Knocking)

We can use alcohol as a secondary fuel to reduce knocking.

IV. CONCLUSION

A. Outcomes

- In past all experiment carried out uses air drier for removing moisture which can be possible solution for 4-wheelers but not for two wheeler since it require constant power supply. So, we tried FR which worked fine with our setup and even help us to filter the gas which was not done in future which increases chances of rusting inside engine.
- As there is already a solution for storing acetylene which can be further study and developed for vehicles like a cng kit. We tried a standard acetylene tank which is specially designed so that it can be transported. While storing they add acetone (liquid) to make it safe from transport.
- By our experiments we observe that on wheel production is idea of past and can't be applied on future vehicles. As mention above a smaller version of acetylene tank can be manufactured just like cng kit.
- The idea of on wheel production is not safe.
- Since there are specialized companies which manufacture acetylene gas which is much more purified then the normal gas produced by reacting calcium carbide with water. And as per over observation it give much more efficiency and power.

B. Advantages

- Comparably easy and less expensive to manufacture. (water + calcium carbide)
- Amount of CO₂ emitted is minimum and other emission like NO_x and Sox are less compare to CO₂.
- Doesn't require 3-way catalytic convertor, could be directly use in place of LPG and CNG and less working temperature which reduce chances of engine breakdown.
- Emission is non-polluting as only carbon dioxide and water vapours are emitted. Homogenous mixture is formed due to which complete combustion.
- Better efficiency.
- It is very cheap and available in abundance.
- It uses same handling system which is used in CNG and LPG cylinders.
- It has very low Photochemical Ozone creation Potential (POCP)
- An engine operated on such a fuel can be interchangeably utilized for indoor and outdoor operations without environmental concerns.
- Due to reduced operating temperatures, there are fewer tendencies for viscosity breakdown of engine lubricants and less component wear.
- Due to cleanliness of the combustion process, buildup of carbon- and sulphur compounds are eliminated thereby substantially extending the time intervals between routine maintenance.
- The waste slurry formed after reaction of calcium carbide and water to form acetylene gas can be used in agriculture.
- The small engine can be used for generating electricity in small town.

C. Future scope

- In nearby future, fossil fuel going to exhaust soon and at present we are facing acute scarcity of fuel due to which prices are rising day by day. On the other acetylene is cheap and is produced from calcium carbonate which is in abundance.
- 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, NO_x, Some unburnt hydrocarbon are produced but in case of acetylene carbon dioxide is produced with traces of water vapours.
- Acetylene being gas makes better homogenous mixture with air therefore better mixing of fuel which leads to better combustion; this is not possible with conventional SI engine fuel.
- Can be used as a power generator in rural area.
- Can be a useful fuel for all SI and CI engine vehicles in future. And specially for vintage cars.

D. Summary

- The Project carried by us is a step to move towards better economy and less polluting vehicle.
- Our vehicle can be seen as a future vehicle.
- As we have observed that this gas can be easily produced at any local gas welder shop we can easily setup gas station for our vehicle.
- As our fuel i.e. acetylene that show similar properties to that of petrol while combustion process.
- If acetylene use as an alternative fuel it will help the old and vintage vehicle running.

ACKNOWLEDGMENT

Foremost, I would like to express my sincere gratitude to my guide Prof. Kushal Mehta for the continuous support of my Project study and research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this report. I could not have imagined having a better advisor and mentor for my Project study.

Besides my advisor, I would like to thank to all my faculty of Mechanical Engineering department, who gives guidance for the Project work and their insistence for meeting deadlines we can do such excellent work.

I offer my special gratitude to all the faculty other Engineering Department, Indus University for their help and support.

I would like to express endless gratitude to "Our Parents" who gave me everything they could to enable me to reach the highest possible education level. I only hope that they know how their love, support and patience encouraged me to fulfil their dream.

I would like to thank all people who have helped and inspired me during my Report study.

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