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Implementation And Experimental Investigation Of Si Engine Using Acetylene As A Fuel

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Abstract

In the present statuesque where fossil fuel is on the verge to exhaust, the need of the hour is to search for a alternative fuel. and we have many choices like LPG,CNG with their drawbacks. Due to which it is complicated to use them among various options. Acetylene gas is a very good fuel for automobiles but it also has many shortcomings which are needed to be studied before using. the paper investigates the changes required to be done for running a S.I engine on Acetylene produced on-board by a decomposition reaction of calcium carbide with water. Thus reducing the running cost and minimum pollutant emission, which makes it fit for use on economic and environment standard. It is more eco-friendly fuel option.

Key Words: Acetylene, Calcium Carbide, S.I Engine

I. INTRODUCTION

As we are well informed about the extinction of fossil fuels and its deteriorating effect on environment causing: 1)Global warming 2)Ozone depletion 3)Respiratory ailments 4)Acid rain. Acetylene is produced by calcium carbide with water in following reaction: Calcium carbide + water acetylene gives calcium hydroxide + Acetylene is produced by mixing calcium carbide with water. This acetylene on combustion burns to give carbon dioxide with water vapours. Acetylene has high flammability. Auto ignition temperature of Acetylene is 3050 C and higher than Petrol. Calorific value of Acetylene is 48225 Kg/KJ and higher than Petrol. Acetylene will not explode under low pressure of normal temperature, it becomes unstable spontaneously combustible when compressed to a pressure over 15 psi Beyond 29.4 psi, it becomes self explosive.

Conventional hydrocarbon fuels used by internal combustion engines, which continue to dominate many fields like transportation, agriculture, and power generation leads to pollutants like HC (hydrocarbons), SOx (Sulphur oxides), and particulates which are highly harmful to human health. CO2 from Greenhouse gas increases global warming. Promising alternate fuels for internal combustion engines are natural gas, liquefied petroleum gas (LPG), hydrogen, acetylene, producer gas, alcohols and vegetable oils.

Among these fuels, there has been a considerable effort in the world to develop and introduce alternative gaseous fuels to replace conventional fuel by partial replacement or by total replacement. Many of the gaseous fuels can be obtained from renewable sources. They have a high self ignition

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temperature; and hence are excellent spark ignition engine fuels. And among these wide area of research, use of acetylene as internal combustion source in engine could be most appropriate field to research as alternative source of fuel and can be used as the synthetic fuel for transportation. The principal objective and advantages of the present project include: providing a fuel comprising acetylene as a primary fuel for an internal combustion engine; providing such a fuel including a secondary fuel for eliminating knock which might otherwise arise from the acetylene.

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 odour, it is colourless, is unstable, highly combustible, and produces a very hot flame (over 5400F or 3000C)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.

As a result, gases from fossil fuel emissions have caused and are continuing to cause great damage to the atmosphere (such as the greenhouse effect and acid rain). The use of alternative fuels to power our cars, buses, and trucks would significantly reduce our dependence on foreign oil. Alternative fuels, known as non- conventional and advanced fuels, are any materials or substance that can be used as fuels, other than conventional fuels like; fossil fuels (petroleum (oil), coal, and natural gas) as well as nuclear materials such as uranium and thorium as well as artificial radioisotope fuels. An alternative fuel vehicle is a vehicle that runs on a fuel other than traditional petroleum fuels and also refers to any technology of powering an engine that does not involve solely petroleum. Often, they produce less pollution than gasoline or diesel. Acetylene is produced domestically from calcium carbide stone. It produce less greenhouse gas (GHG) emissions than gasoline or diesel

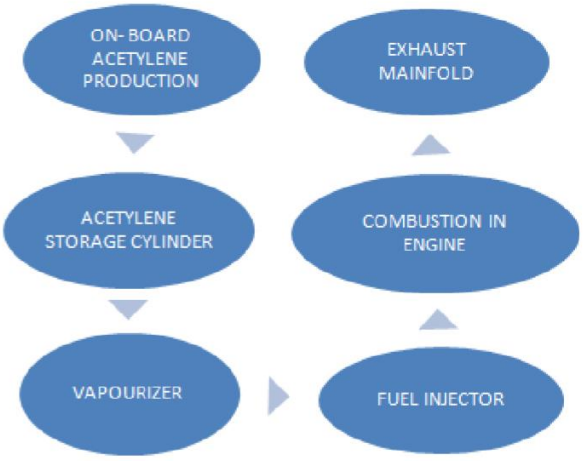


Fig. General diagram of acetylene based system

Acetylene storage tank In this calcium carbide reacts with water to produce acetylene and calcium hydroxide. Small amount of aluminium oxide is mixed to enrich the above reaction. Specification of

production tank Cylinder is made up steel which can withstand 2MPa pressure and dimension of tank are 33inch in length and 13inch in diameter. In this tank on board exothermic reaction takes place on which acetylene is formed through this reaction.

$CaCO3 + 2H2O \quad C2H2 + Ca(OH)$

Properties	Acetylene	Hydrogen	CNG
Composition	C_2H_2	H_2	CH_4:86.4-90% C_2H_6:3-6% C_3H_8
Density (kg/m3) at 1 atm &200ºC	1.092	0.08	0.72
Autoignition temp (K)	598	845	723
Stoichiometric A/F ratio (kg/kg)	13.2	34.3	17.3
Flammability limit (vol %)	2.5-8.1	4-74.6	5.3-15
Lower Calorific Value (kJ/kg)	48,225	120000	45800
Ignition energy (mJ)	0.019	0.02	0.28

Acetylene is a colourless and highly combustible gas with a pungent odour. If it is compressed, heated or mixed with air, it becomes highly explosive. It is produced by a straightforward chemical process in which calcium carbide reacts with water and generates acetylene gas and slurry of calcium carbonate. It needs no sophisticated apparatus or equipment and the reaction is spontaneous. It was widely used in acetylene lamps, to light homes and mining tunnels during 1980s. It is a gaseous hydrocarbon highly combustible and unstable. It also produces high flame temperatures ranging from 3000°C to 5400°C when combined with oxygen. Acetylene has been commonly utilized for lighting in mine areas by street vendors, besides which industrial uses of acetylene are many out of which it is used as a fuel for motors or lighting sources. The use of acetylene as a fuel has been largely limited in the recent times to acetylene torches for welding or welding related applications. The easy availability of economical and effective fuel which has better calorific value and effective flame speeds motivated to study and experiment on acetylene engine.

II. RELEVANCE

- It gives idea about how Acetylene is made from Calcium Carbide and Water.
- It gives idea about how S.I engine on Acetylene.
- It gives idea about manufacturing and assembly of components.
- Gives idea about how to control pollutant emission

III. MOTIVE

The idea using Acetylene gas in the internal combustion engine such that it reduces the demand of petroleum fuels except alcohol, CNG and LPG. Not so many fuels have been found to be matched with

I.C engine requirements. Thus this project is an attempt for the use of an alternative resource such that it can be prove to
be useful for people in near future. So our moto is to develop Acetylene working engine and reduce pollution in environment.
This technique permitted to obtain furthers reductions of pollutant emissions by searching optima controlling parameters combinations in all speed range. Therefore, It is possible to obtain lower pollutant emissions rather than the original configuration. In conclusion, the new engine configuration based on acetylene-alcohol represents a good alternative to gasoline and diesel engines in terms of pollutant emissions, as well as engine performance.

IV. OBJECTIVE STATEMENTS

Phase I:-Selection of SI Engine and studying its parameters.
•Selection of Single cylinder 4-stroke 100cc S.I Engine
•Studying Engine specifications
•Studying its performance parameters
•Testing of Exhaust Pollutants for petrol

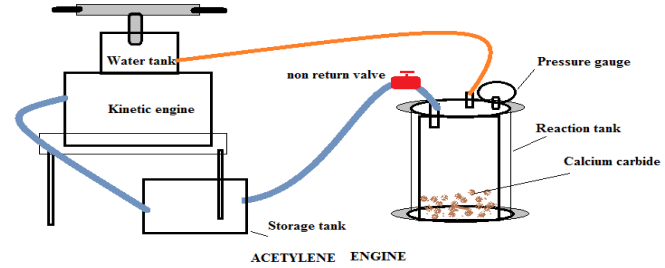
Phase II:-Design and manufacture additional setup
•Selection of materials for additional setup
•Design and Manufacture of frame, reaction tank and storage tank.
•To design a Mechanism for transmission of Acetylene from Reaction tank to storage tank.
•Mounting of above setup on Engine
Phase III:-Testing of SI Engine by using Acetylene.
•Optimizing proportion of Calcium carbide and water to obtain Acetylene
•Comparing obtained acetylene with petrol
•To obtain constant pressure of Acetylene in storage

Phase IV:-Comparison of exhaust pollution
•Testing and Studying performance parameters by Acetylene
•Testing of exhaust gas pollutants
•Comparison and validation of exhaust gases with petrol

SUMMARY

Experimental investigation and performance of acetylene fuel based petrol engine, from literature review we have got to know about how acetylene is produced by a simple reaction as Discussed above.
Fabrication of SI Engine to use acetylene as fuel, from literature review we got to know about how to prepare Acetylene from chemical reaction and also proved that acetylene is a better fuel than others.
Use of acetylene as an alternative fuel in SI engine, acetylene makes a homogenous mixture which is much good for combustion of fuel , it is cheaper than fossil fuels.
In literature paper we studied Acetylene reduce pollution and detonation phenomena is controlled by water or alcohol and it reduces Carbon monoxide.

FIGURE



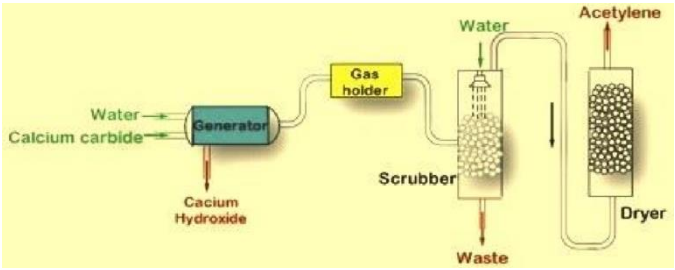


Fig. 2. Flow diagram of production of acetylene from calcium carbide

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