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A Review on Working of Four Stroke Engine Using Biogas

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ABSTRACT

One of the major problem for the successful application of biogas as a major fuel for SI (Spark Ignition) engines is the modifications that are required into the engine as well as intake system overcome this problem a new intake device was designed. With the use of this new intake device, engine will be effectively run on biogas. A new intake device could be serviceable by making simple modifications on the carburettor venture and this modification would not cause complications in the carburetor system. The paper includes design and working of an intake device for biogas operated single cylinder 4^{-S} spark ignition engine.

I. INTRODUCTION

As the population and economic growth increase, most of developing countries facing the increasing demand of energy. Energy saving and emission reduction are two worldwide problems. In order to meet the increasing demand on the performance of internal combustion engine and satisfy more and more restricted emission regulations, the power, reliability, life cycle, emissions and mileage of IC engine need to be further improved. In order to meet theincreasing energy requirements, there has been growing interest in alternative fuels like biodiesels, methyl alcohol, ethyl alcohol, biogas, hydrogen and producer gas to provide a suitable fuel substitute for internal combustion engines. Biogas has been a major source of energy and it is also a renewable source of energy. The biogas is easily developed under specific climatic and socio-economic conditions and cost of production of biogas is very low. Also 60-80% methane gas present in biogas hence, we can use the biogas a fuel in the SI engine.

II. NEED OF INTAKE SYSTEM DESIGN

In SI engine the air and fuel is mixed in carburettor and the homogeneous mixture of air and fuel is then admitted into the combustion chamber. The fuel used for this engine is petrol which is in the form of liquid. Air comes through the air filter and fuel comes from fuel tank into the float chamber of carburettor and gets mixed with each other into throat of carburettor. This carburettor is specially designed for stable liquid phase fuels. If it is need for fuels like biogas, it cannot be effectively used for the biogas. The major problem with biogas as a fuel for SI engine is phase difference, the biogas exists in the form of gaseous phase. Besides, biogas is required to be stored at high pressure in the tank and when high pressure biogas comes to the intake manifold large amount of fuel is entered into the cylinder due to the high pressure. So overcome these problems, the intake system needed to be designed for biogas fuel. In general, to design intake system using biogas as a fuel in petrol engine we need to make modifications in the engine. Major modifications required are as follows,

- **Modification in Intake System**
  - A. Carburettor Design
  - B. Intake manifold design
- **Modification in Engine**
  - **A.** Valve timing
  - **B.** Compression ratio
  - **C.** Spark timing
  - **D.** Turbulence in combustion chamber
  - **E.** Flame propagation

Before directly going to design an engine, it is logical to design intake system. In this paper the focus is limited to the intake system design.

III. METHOD AND MATERIAL

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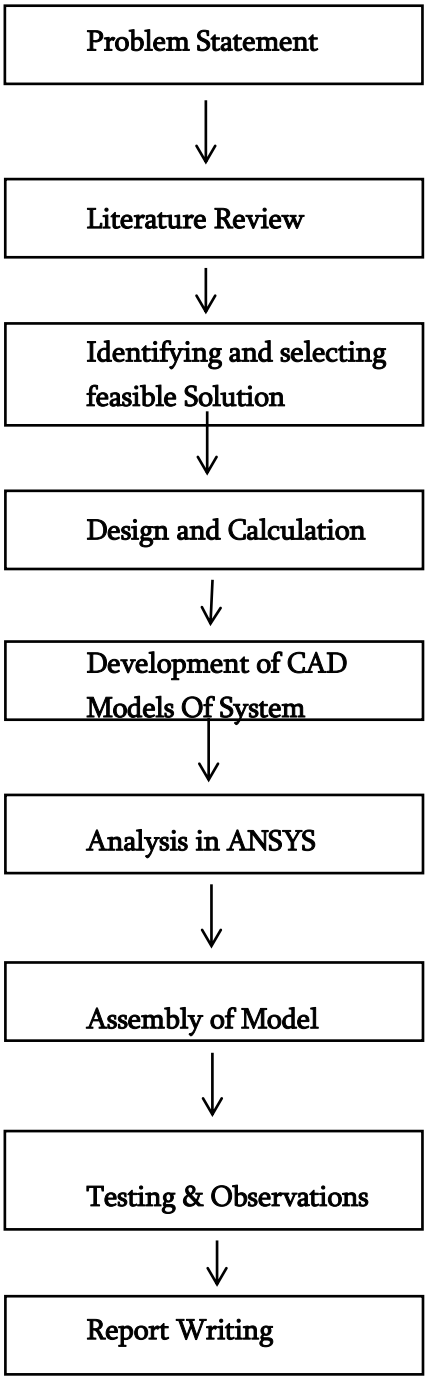

Figure 1

IV. PROBLEM STATEMENT

There are so many fuels used in IC Engine, but they have certain physical and chemical properties. Other words, fuels used in IC engine redesigned to satisfy performance requirements of engine system. Gasoline contains many impurities. It has low octane number. All fuels oxidize slowly in presence of air. In alcohol, higher latent heat of vaporization reduced charge temperature before combustion. Alcohol suffers disadvantages of water absorption, corrosive and lubricant incompatibility. In LPG, it decreases volumetric efficiency due to its high heat of vaporization. The road sensitivity is very high. It is very corrosive. Response to blending is very poor. In electricity, they use starting generated power stations that use fossil fuel of nuclear power. There are other problems too. To overcome these problems researchers found some other solutions. They used biogas as a fuel in engines to overcome pollution and other problems facing by peoples.

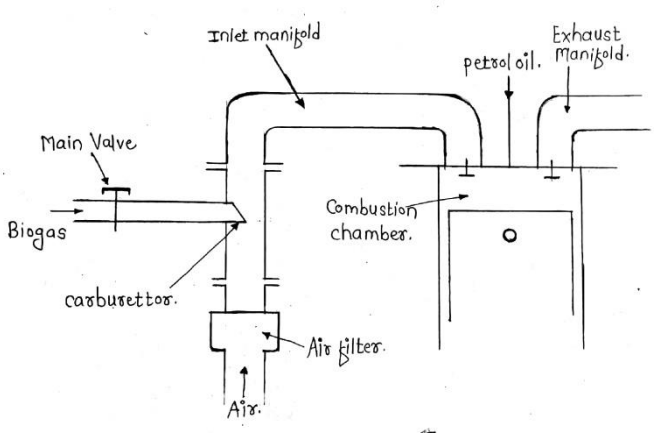

Figure 2

Objective

- Study and analyse the four stroke SI engine using biogas.
- Modification of the prototype of existing four stroke SI engine.
- Compare the experimental results with the other existing engines.
- Reduction of fuel consumption an increase in reliability.

Proposed Work

- The study of the research work will be carried out on a four stroke petrol engine.
- Present layout of a Biogas operated engine.
- We have to run Two wheeler on Biogas.
- Also we are going to run the motor for watering the farm.
- Also for Stationary applications like generators in colleges.

V. LITERATURE REVIEW

N. S Hanamapure carried out Biogas Otto engines when modified from Otto engines using petrol fuel are found to produce less power than in petrol version. The reason is reduction in volumetric efficiency as a gaseous fuel occupies a larger portion of the mixture's volume sucked into the engine than liquid fuel and displaces air accordingly. The liquid fuel has a high volumetric energy content than biogas and also cools the air/fuel mixture when evaporating in intake manifold. The cooling effect an expand in density, and hence the amount of air/fuel mixture actually sucked into the engine on a mass basis is higher. A gas engine, basically when operating on biogas with a large amount of unnecessary carbon dioxide, can suck a reduced amount of air only to allow room for the necessary amount of fuel gas. Otto engines has an excess air ratio of $\lambda = 1 \pm 0.1$ has to be maintained and the inlet ducts and manifolds are dimensioned for operation with petrol, the overall fuel energy in a mixture of biogas and air is less than in petrol operation. With the decrease in the maximum possible supply of fuel energy for the energy density of the mixture (mixture heating value) the maximum power output consequently decreases in the same proportion. The rate of reduce in power is largely dependent on the volumetric heating value of the gas, e.g. biogas with 70% CH4 has a high volumetric calorific value than biogas with 50% CH4 only. The power output of an engine is higher in operation on gases with high calorific value than in operation on "weak" gases.

Shardul S Mane stated that The utilization of biogas in vehicles requires a method of compact storage to facilitate the independent movement of the vehicle for a reasonable time. Higher quantities of biogas can only be stored at small volumes under high pressure, e.g. 200 bar, or purified as methane in a liquid form at cryogenic conditions, i.e. -161 °C and ambient pressure. The process, storage and handling of compressed or liquefied biogas demand special and costly efforts. Compression is completed in reciprocating gas compressors after filtering of H2S. At a moderate pressure of about l5 bar the CO2 content can be "washed out" with water to reduce the final storage volume. Intermediate cooling and elimination of the humidity in molecular sieve filters are essential as the storage containers should not be subjected to corrosion from inside. The storage equipment, similar to oxygen cylinders known from gas welding units, can be used on the vehicle as "energy tank" and in larger numbers as refilling store.The volume thus required on the vehicle is still five times more than is required for diesel fuel.

Poonam Mahadev Salgar stated that Purification of biogas to CH4 increases the storage efficiency by 25 to 30% but involves an extra gas washing column in the process. Purified biogas, i.e. methane, has various combustion features than biogas because of the lack of the CO2 content. It burns faster and at higher temperatures; this requires different adjustments of ignition timing. Dual fuel methane engines are suitable to increased problems with injector nozzle overheating and have to operate on higher portions of diesel fuel (about 40%) to effect sufficient cooling of the jets. Liquidification of biogas requires drying and purification to almost 100% CH4 in one process and an additional cryogenic process to cool the CH4 down to -161 °C where it condenses into its liquid form. Storage is optimal at these conditions as the volume reduction is remarkable, i.e. 0.6 m^3n with an energy

content of 6 kWh condense to one lifer of liquid with an energy equivalent of 0.61 diesel fuel. The required tank capacity is only 1.7 times the volume needed for diesel fuel. This advantage is restricted by a more easy multistage process, the handling of the liquid in specially designed cryo-tanks with vacuum insulation and the fact that for longer storage it has to be keep at its required low temperature in order to prevent evaporation.

VI. CONCLUSION

It is concluded that The study concludes the biogas production from organic wastes, its composition and properties for use in I.C.Engines. Different techniques for CO_2, H_2S elimination are discussed, among which water scrubbing is a simple continuous and cost effective method for purification. Attention is also focused for making biogas as alternate fuel in Diesel Engines and dual fueling is recommended to be the best one for biogas CI operation. Drop of CO_2 in biogas for dual fuel increases the thermal efficiency. In biogas HCCI mode, the presence ofCO_2 controls the high heat release rate; hence the durability of engine components will not be affected. Therefore it is suggest to use biogas as alternate fuel in diesel engines.

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