# Biogas as Alternative Fuel in Diesel Engines

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*Abstract*— Ever since the birth of a person he starts consuming significant amount of energy in his daily life each and every day. This consumption of energy takes place in various forms, either conventional energy or non conventional energy. The conventional energy is limited type source while the non conventional energy is an unlimited type source. Biogas is a type of non conventional energy source this review paper is all about the utilization of the biogas as an alternative fuel in diesel engine. This can be done in two ways either by completely replacing the diesel fuel with biogas or by making an appropriate mixture of biogas, diesel and air. It is used in internal combustion engine as a supplementary fuel along with the diesel and air. Biogas is a very good option for fulfilling energy demand as far as current energy cries is concerned. This review paper is about the better utilization of the biogas in the diesel engines along with the present developed status of this energy option and the possible options of developments in this field.

***Key words:*** Conventional Energy, Non - Conventional Energy, Biogas, Internal Combustion Engine

## I. INTRODUCTION

the present condition of energy cries is not hidden from any one specially the cries of the fossil fuels. But we cannot do anything about this as far as the production of fossil fuel is concerned. The only way to solve this problem is to increase the use of non conventional energy sources such as solar energy, hydro energy, biogas etc. The other sources are cannot be used so easily and locally to fulfill the energy demand but such condition does not occur with the biogas because India is one of the biggest cattle breeding nation and most part of it is in the Indian villages, It means the material required to produce biogas and other such kind of fuels, are very much in the span of Indian common people.

Gaseous fuels have number of advantages of using them in place of other kind of fuels due to their some qualities as better flammability, calorific value, no ash content etc. The gaseous fuels also have advantage of producing less pollution content as compared to liquid and solid fuels.

## II. BIOGAS

Biogas is produced by the anaerobic digestion of different kind of wastes such as municipal waste, sewage waste, farm wastes etc. the anaerobic digestion is a kind of the chemical reaction which take place in presence of micro organisms but in absence of the oxygen. It is a natural process which converts the organic matter into methane and carbon dioxide.

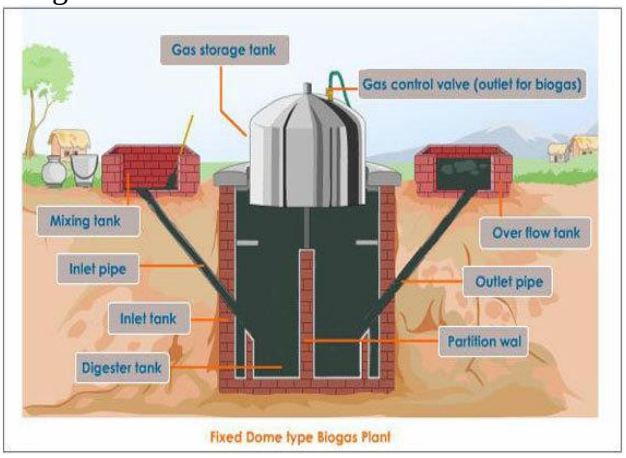



Fig. 1: Fixed Dome Type Biogas Plant

### A. Composition of Biogas

generally the biogas is composed of methane, carbon dioxide, hydrogen, nitrogen, water vapour. The percentage composition of these contents is in following ratio.

a) Methane - 50 – 70%
b) Carbon dioxide - 30 – 40%
c) Hydrogen - 5 – 10%
d) Nitrogen - 1 – 2%
e) Water vapor - 0.3%

### B. Raw Material ffor Producing Biogas

There can be different kind of raw materials used to produce the biogas.
The main materials are listed below.

a) Animal manures
b) Sewage wastes
c) Farming wastes
d) Garden wastes
e) Sugar industry wastes
f) Crop residues.
g) Food remained
h) Starch industry waste etc.

### C. Applications of Biogas

The biogas can be utilized in several places in several ways. Some of them are following

a) For cooking and heating purpose.
b) Can be used for lightning purpose
c) With some changes in design the internal combustion engines can also be operated with it.

## III. PARAMETERS FOR USE OF BIOGAS

a) The main parameter which must be considered is the calorific value of the biogas. Which plays a vital role in deciding whether it can be used in engine or not.
b) The consumption rate of biogas in the engine is also an important factor which must be taken into account during designing the engine for such kind of use.

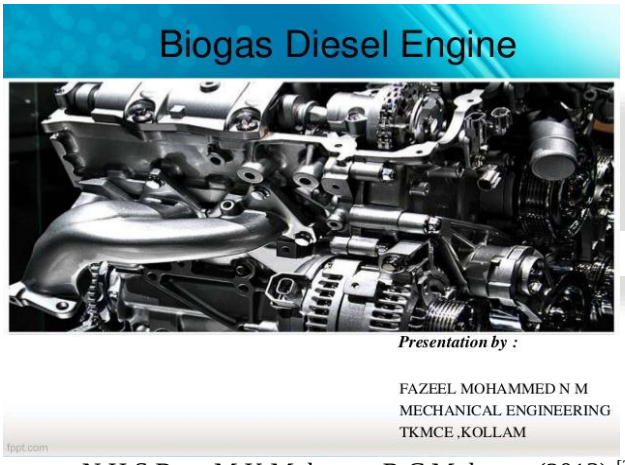
 

c) Ignitability of methane and air mixture is best at ratio of 85 – 95% and 15 – 5%.other than this proportion lead to poor combustion of mixture.
d) Methane and biogas both are quite stable against the knocking so by virtue of these qualities these can be used with the engines of higher compression ratio compared to the petrol engine.

## IV. LITERATURE REVIEW

E. Porpatham, A. Ramesh, B. Nagalingam (2011) [1] was analysis the biogas powered spark ignition engine with different values of compression ratios. The engine was operated at 1500 rpm with throttle opening of 25 – 100% at different equivalence ratios. They got the peak power output of 4.8 kW under a compression ratio of 15.The peak efficiency thermal was about 26%.

Jayesh D. Vaghmasi, Mr.D.R.Shah, Mr.D.C.Gosai (2014)[2] was analysis the current use and possible developments possible in utilizing the bio gas in the internal combustion engine. Their main focus was on removal of carbon dioxide {$CO_2$} and hydrogen sulphide {$H_2S$} by scrubbing process. The conclusion of this paper is that biogas is very useful renewable energy source and can be used in internal combustion engines to reduce the pollution to some extent.




N.H.S.Ray, M.K.Mohanty ,R.C.Mohanty (2013) [3] was mainly analysis the current status and future perspective of the bio gas utilization in different operations and applications (mainly in engine application).they proposed to use the biogas in diesel biogas duel cycle. They have also investigated the combustion properties of the biogas. The conclusion was that after all investigation biogas can be used as alternative fuel for the internal combustion engine.

Shyam S. Kapdi, Virendra K. Vijay, Shivanahalli K. Rajesh and Rajendra Prasad (2006)[4] did a lot work on the topic up gradation of the biogas for utilization as a vehicle fuel. The research paper was centralized on use of biogas in place of petrol. They observed a significant amount of saving of petrol pricing about 0.66 millions rupees per year. The idea behind it was to make the villages self powered.

## V. PURIFICATION OF BIOGAS FOR IC ENGINES

### *A. Removal Of $CO_2$*

Carbon dioxide is highly corrosive in nature when have any amount of moisture content in it. So its removal becomes very essential for a proper and efficient operation of the engine.

Potash solution - KOH - 40% $KOH + CO_2 = KHCO_3$

The removal of carbon dioxide can be easily be done by using alkaline salts such as Sodium, calcium hydroxide and potassium.

### *B. Removal Of $H_2S$*

The method used for biogas up gradation is known as the "Water scrubbing". In this method the $H_2S$ present is removed by flow of water because $H_2S$ is dissolvable in the water.

## VI. CONCLUSION

The conclusion of the whole study about the utilization of biogas in internal combustion engines was that the biogas can be used in such engines with some modifications in the design of the IC engine, some purification processes. The modification made in the purification process is that we have used KOH in place of NaOH for removal of the carbon dioxide.

After the purification reaction applied on the biogas, biogas will have an increased percentage of methane content, which makes it equivalent to the natural gas. The biogas can be a very good choice alternative of the natural gas. the only limitation with biogas is that it's production is little slow otherwise it is cheaply available as compared to natural gas and other fuels of the same class.

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