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India's Bio CNG: Challenges and Opportunities

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Abstract: *Natural resources (fuels) cannot be prepared in the laboratory. It takes millions of years for dead organisms to get converted into these fuels. Continues usage of these fuels is the major concern of these fuels are fast depleting. Bio CNG is the purified form of biogas, where all the unwanted gases are removed to produce (>95%) pure methane gas. Bio CNG is exactly similar to the commercially available* ***natural gas****. In India, we lack fuel resources, so we are dependent on fuel rich countries like Saudi Arabia, UAE and etc. Those countries development is mainly due to highly available fuel resources in there countries. But in India, we are lacking it and the resources are getting exhausted. Considering our future generations, we need to safe guard our resources. A replacement to those exhausting resources can be made by using* ***Bio CNG****. We can use many waste products like agricultural and animal residue, for preparing biogas and then petrol, diesel can be replaced by Bio CNG. But using Bio CNG directly in vehicles leads to corrosion of metal parts of the engine, as the biogas may contain impurities even after refinement and compressions. With the limited availability of petroleum products domestically, India is compelled to import over 75 percent of petrol products every year. At that compulsion, we can use Bio CNG. If the Indian Government concentrates on Bio CNG, then there would be reduction in imports of petroleum products, thus saving a huge chunk of* ***foreign exchange*** *every year.*

Keywords -*Natural gas, Bio CNG, Foreign exchange.*

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I.INTRODUCTION

This Paper tells about various methods of removal of CO_2 from the biogas. It also tells about the various Bio CNG plants in Chennai, India and Around many parts of the world. The most important is that, this paper showcases the advantages of Bio CNG and it also gives us awareness about the fast depleting resources in our country. It list outs the advantages of Bio CNG over petrol and diesel.

II.CHENNAI'S BIO CNG

1. Mahindra's Bio CNG:

This plant will convert 8 tons of food and kitchen waste generated every day at the MWC into 1,000 cubic meter of raw biogas. Further, the raw bio gas can yield 400 kg per day of purified CNG-grade fuel which is equivalent to a 200 kW power plant. The by product, four tons of organic fertilizer will be produced per day. In MWC, the biogas will be used for generating power and fueling CNG buses and tractors. Further, the power generated will be used for street lighting, buses for free shuttle service and tractor for cultivation. The green energy (bio CNG) can be used to replace CNG as automative fuel and LPG for cooking purpose as well as to power streetlights at MWC. The organic fertilizer will be used by farmers to enhance soil fertility. It will convert 8 tons of waste into 1,000 cubic meter of raw biogas . The biogas so generated can be further enriched into 400kg/day of purified CNG grade fuel, equivalent of a 200kW power plant. The biogas will also be used for generating power, which will be subsequently employed for street lighting in the city. As a bi-product, 4 tons of fertilizers will be produced per day which will be used by farmers to enhance soil fertility.

Figure.1: Mahindra's Bio CNG plant

III.BIO CNG PLANTS IN INDIA

1. SREL

Spectrum Renewable energy Private Limited (SREL) developed a large scale biogas generation and bottling project at Kodoli near Kolhapur in the state of Maharashtra. It is a 100 TPD press mud to biogas and organic manure generation plant. SREL is purifying and enriching about 20,000 m^3 of biogas produced from press mud as well as spent wash which generates around 8000 kg Bio CNG which is CNG grade fuel also called as CBG(compressed biogas). This is a price-competitive renewables energy that can be used in vehicles as well as heating application in heat treatment facilities replacing LPG(Liquefied Petroleum Gas), Diesel or other fossil fuels. CBG can also be used for electric power generation.

Figure.2: SREL,Maharashtra

IV.BIO CNG AROUND THE WORLD

1. Biogas upgrading in Germany:

Electric power was the main aim of Germany's biogas producers due to high EEG-compensation. The utilization of surplus heat has become vital importance because of the rising prices for substrates. Missing legislative regulations hindered the upgrading and injection of biogas into the natural gas grid.

Figure.3: SunGas

V.CO_2 REMOVAL

1. Water Scrubbing

It removes both CO_2 and H_2S simultaneously by taking advantage of their higher water solubility compared to CH_4, To enhance absorption, biogas is usually compressed. After absorption in the scarier, the purified biogas, which contains more than 97% CH_4 is collected from the top of the scrubber, while liquid effluent containing high concentrations of CO_2 and a trivial amount of CH_4 is treated in a flash tank to recover CH_4.

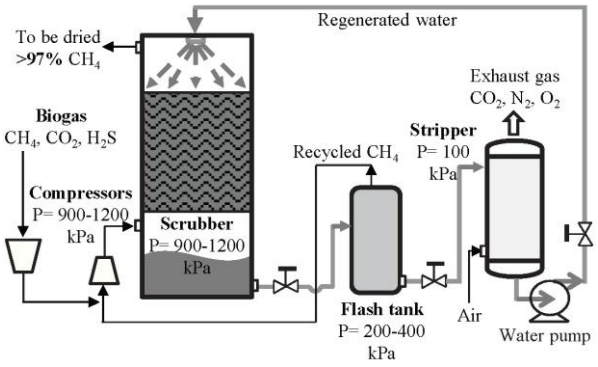

Figure.4: Water Scrubbing

2. Membrane Permeation:

At certain pressure, gases with high permeability can be transported through the membrane while gases with low permeability are retained. High Permeable impurities such as CO_2, O_2 and H_2O pass through the membrane as permeate.

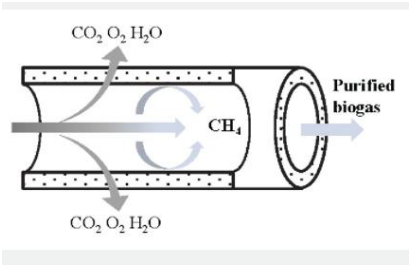

Figure.5: Membrane Permeation

3. PSA:

Pressure swing adsorption uses the absorbent's pressure dependent gas adsorption rate to capture preferred gases at a high pressure, and then release the adsorbates at a low pressure to regenerate the adsorbent. As the gas released contains both impurities and small amount of CH_4, it is recycled. The pressure is further decreased to near vacuum. The gas that leaves the vessel mainly consist of CO_2 , N_2 and O_2.

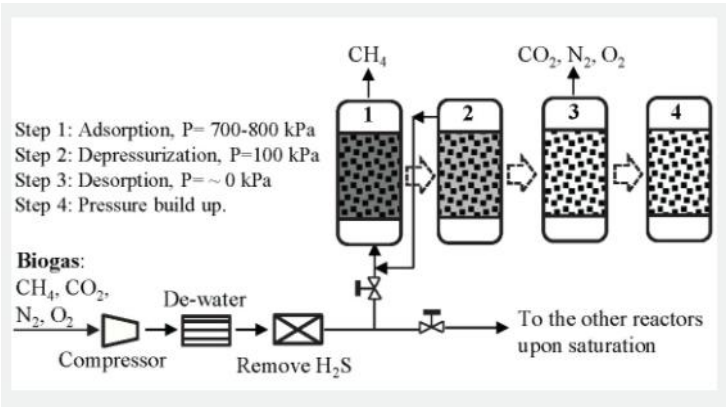

Figure.6: Pressureswing adsorption

4. Amine Solvents:

Amine Solvents such as monoethanolamine (MEA), diethanolamine (DEA) and methyldiethanolamine (MDEA), can selectively absorb CO_2 . Absorption happens at a high pressure and relatively low temperature,

with high purity CH_4 collected from the absorption reactor.A heat exchanger is usually emptied to pre-heat the CO_2 -rich amine using the hot lean amine for energy saving.

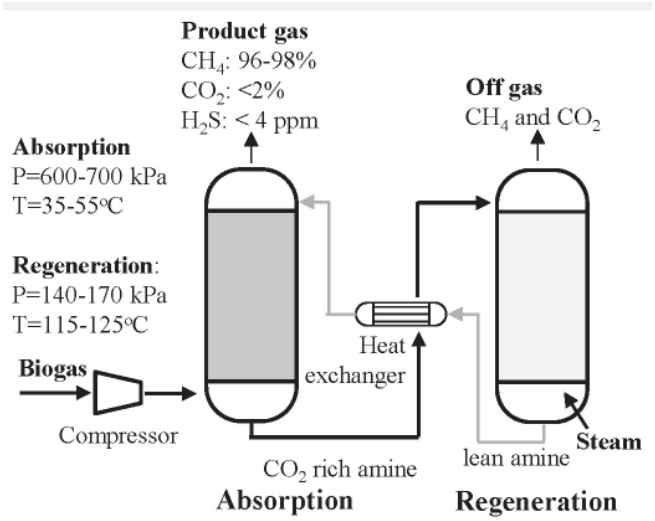

Figure.7: Amine Solvents

5.Cryogenic Technology:

Cryogenic technology takes the advantage of the different boiling points of gases and progressively cools the biogas to obtain high purity CH_4. Most impurities can be condensed at -25 degree celsius and CO_2 , can be frozen and separated from the gas stream at -78.5 degree celsius.

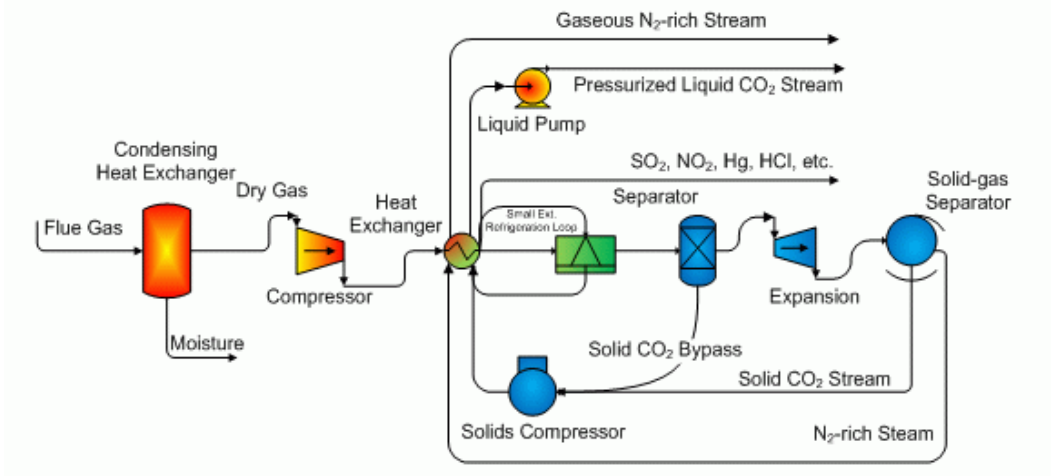

Figure.8: Cryogenic Technology

VI.BIOGAS CONVERSION

1.Biogas To Bio CNG:

The bio Gas contains normally 40-60% methane and rest being CO_2 and N_2. For getting the enrichment of methane to covert it into comparable to natural gas CO_2 and N_2 has to be taken out from bio gas. For this we provide PSA base twin Tower adsorption System. This Purifies the bio gas to methane 92-98% pure. In this method biogas is compressed and passed over Molecular Sieve where CO_2 and N_2 is adsorbed and pure methane 92-98%purity is obtained.

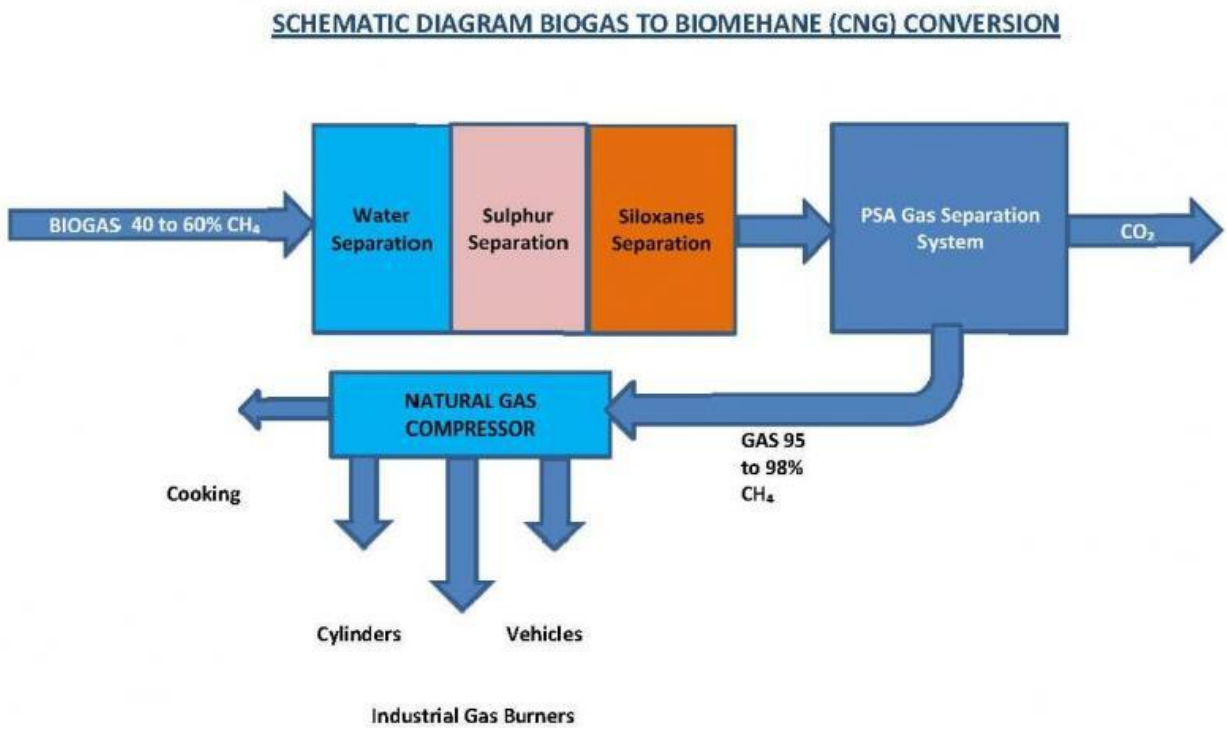

Figure.9: Biogas Conversion

VII.BIO CNG OVER PETROL AND DIESEL

1.Environmental Benefits:

CNG burns cleaner when compared to traditional petrol and diesel. Carbon monoxide emissions are reduced by roughly 80 percent, and 44 percent less hydrocarbonous are produced in comparison to gasoline-powered vehicles.

2.Safety:

CNG has a flammability rating of approximately 5-15 percent, which makes it less flammable and safer than other fuels.

3.Not a Fire Hazard:

CNG has a ignition temperature of 600degree celsius, which is higher than the gasoline (320degree celsius) and diesel (285degree celsius). This means that CNG vehicles are likely to catch fire under any circumstances.

4.Other Benefits:

CNG causes less damage to our car. CNG on combustion leaves little to no residue when compared to traditional gasoline and diesel. It cannot be siphoned off by thieves and adulterated. Has a calorific value, which is equivalent to half a liter of diesel. Lowering your fuel costs to half the cost of gasoline and diesel.Up to 90% reduction in noise pollution.Ultra low NOx emissions.NOx formation is dominant in diesel engine as the nitrogen and sulphur content is high in diesel engine.

5.Gaseous Emission:

Fuel	Emission from vehicles (g/km)			
	CO	Hydrocarbon	NOx	Suspended Particles
Diesel	0.2	0.4	9.73	0.1
CNG	0.4	0.6	1.1	0.22
Biogas	0.08	0.35	5.4	0.5
BioCNG	0.02	0.12	0.48	0.1

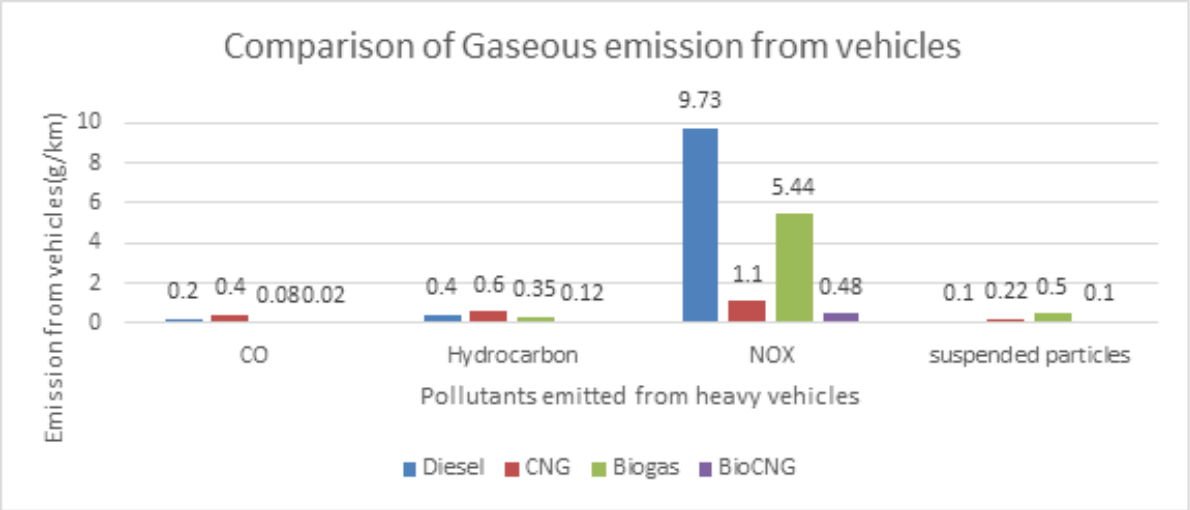

Table:1

VIII.CONCLUSION

From the above study, we are concluding that, it is important to find a fuel equivalent to petrol and diesel. At the same time, we need to design the engine with both fuel injector and gas injector. Bio CNG has been the most efficient fuel that can be replaced in the place of petrol and diesel. It lowers our dependency for fuel to other countries.Water scrubbings able to remove CO_2 , H_2S, NH_3 and Dust at the same time it needs a lot of water. PSA requires low energy input, but needs pretreatment to remove H_2S and water, which may damage adsorbents. Amine absorption shows low CH_4 loss and produces high quality of CO_2 , but is energy sensitive. Membrane permeation systems are compact and easy to operate, but with a relatively low CH_4 purity. This study will be useful for choosing efficient method of removing CO_2 from biogas.

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