

# PERFORMANCE OF DUAL FUEL ENGINE (DIESEL AND BIOGAS)

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## ABSTRACT

The main objective of this work is, to produce bio gas from organic waste and reduce the usage of diesel fuel. The increase in population leads to depletion of diesel fuel. Another reason is instead of disposing the organic waste in landfill, this can be converted into a useful product (bio-gas).So that it can be used in the existing engine without any modification. The dual fuel engine is a combination of diesel and biogas. By varying the amount of biogas and varying load conditions the engine was tested. Octane number of the gas is high. So, the compression ratio of the engine is also high (18.5:1). Due to high compression ratio power developed by the engine is also high. By less consumption of the fuel, the power produced is more. This engine produces less emission (Due to complete combustion). This fuel can be used in the engine without any modification.

**Index Terms:** Bio-Gas, Dual fuel, organic Waste, anaerobic digestion, Digester

### 1. Introduction

One of the main environmental problem is increasing the production of organic waste. Instead of disposing the waste into open atmosphere, energy recovery and recycling nutrients of organic matter is aimed. Production of biogas by anaerobic digestion of animal waste and organic waste into a renewable energy. The fossil resources of oil, gas and coal are

available in limited level. Actually the bio gas which is produced by the fermentation of animal dungs, human sewage or agricultural residues is rich in methane and has the same characteristics as the natural gas ( anaerobic digestion). This alternate source should not produce pollution problem, as well as should not have bad smell, while running the engine. Also should not create noise in the engine. Biogas not alone used in the engine. It is combined with diesel fuel (50%,75%, 100%) at varying load condition.

Dual fuel engine durability is high and also for long run of engine.

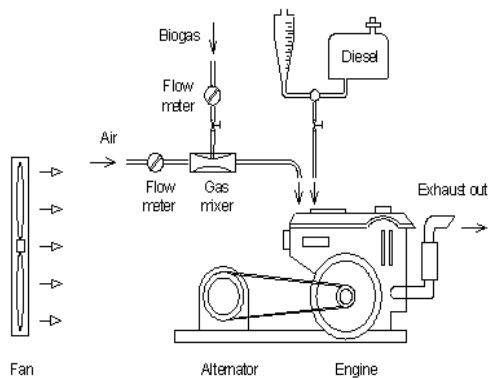
### 2. Materials and method (Production of bio-gas)

Cow dung, agricultural waste , were sun dried for 20 days ,then oven dried at 110°c for 10 hrs. The dried samples were made into powder form. By keeping this in a anaerobic digester it will become into biogas.

### 3. Engine set- up

Apart from installing a gas mixture upstream of the air inlet duct, the test engine was coupled to an alternator acting as a variable load system. Bio- gas was 250 pascal pressure. Bio gas was passed through a condensation trap

and a gas treatment unit to remove moisture and trace sulphur compounds present in bio- gas.



**Fig 1.Existing Engine Model**



**Fig 2. Modified Engine set up**

#### 4. Engine specification

Engine	5 HP I.C Engine
Type Inline	4-stroke, naturally aspirated
Combustion injection	Direct compression ignition
Number of cylinders	1
Bore	82 mm
Stroke	78mm
Displacement	411cm <sup>3</sup>
Rated power	5.5 kW at 2400 rpm
Maximum torque	25 Nm at 1900 rpm
Compression ratio	18:1
Injection timing	16° BTDC
Dimension(L W H)	682 mm x 336 mm x 455 mm
Dry weight	82kg
Governor type	Mechanical, variable speed
Cooling system	Water, pressurized circulation

5.

#### 6. Engine performance

The engine was fitted with mechanical loading properly. For doing performance test in the engine, it was made to run at the idling condition for certain period of time. The engine was made to run with diesel fuel alone. Then the fuel level was gradually reduced, then bio-gas was added (50%, 75%, 100%). Bio-gas was added with air inlet of the engine gradually. The readings were taken for different load conditions with dual fuel (Diesel and bio-gas). The test result values were taken.

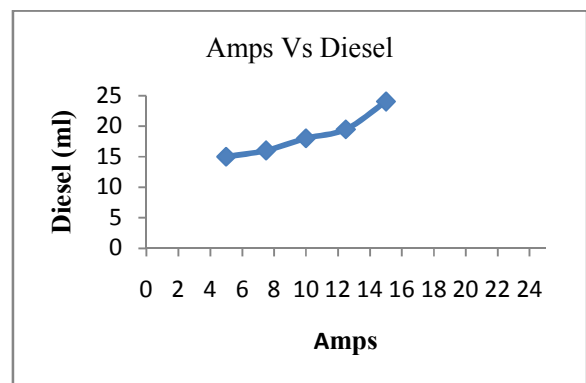
#### 7. Result and discussion

##### Tabulations

##### 6.1 . Engine Run with Diesel (100% Diesel)

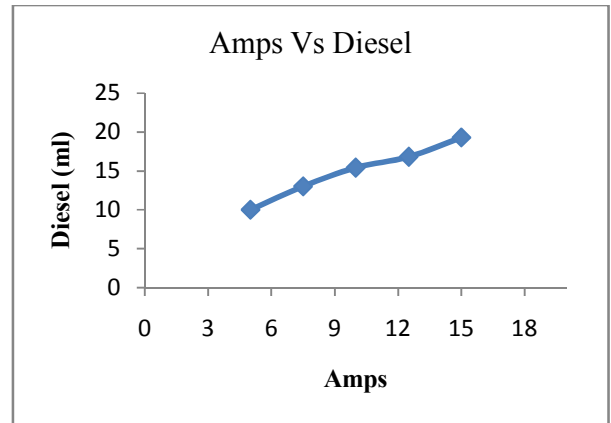
S.NO	Volt	Amp	Diesel for 1min (ml)	Speed in rpm
1	240	5	15	790
2	235	7.5	16	785
3	230	10	18	772
4	230	12.5	19.5	744
5	220	15	24	720

The diesel consumption is 15 ml in 1 minute and speed is 790 rpm .



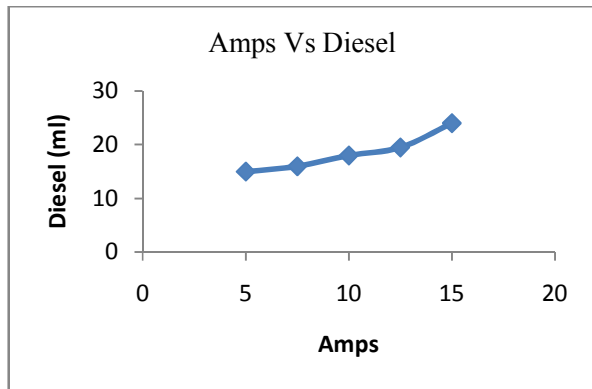
### 6.2 Engine Run with Diesel and Bio-Gas (50% Intake of Engine)

S. No	Volt	Amp	Diesel for 1 min (ml)	Gas flow meter in m <sup>3</sup>			Speed in (rpm)
				n <sub>1</sub>	n <sub>2</sub>	n <sub>2</sub> - n <sub>1</sub>	
1	245	5	11	54	68	14	770
2	240	7.5	15.3	72	87	15	769
3	230	10	17.4	88	106	18	765
4	238	12.5	19.8	112	131	19	760
5	235	15	21.7	136	152	19	753



Engine run with diesel and bio-gas (75% intake of engine)

Similarly through this combination of biogas with diesel the engine consumption for 1min is 11ml of diesel and 18ml of biogas with 5amp at 771 rpm.



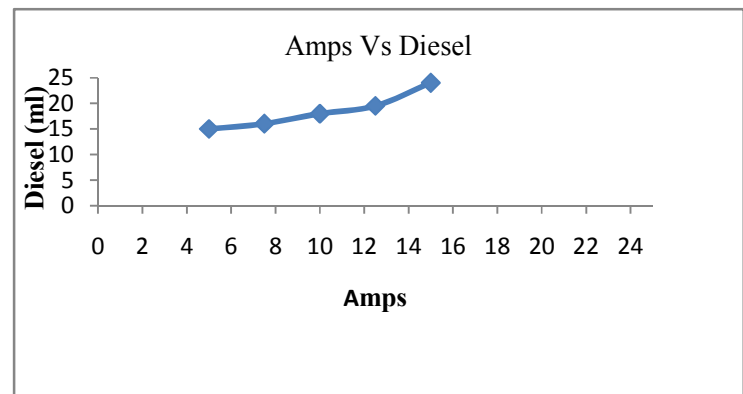
Similarly through this combination of biogas with diesel the engine consumption for 1min is 13ml of diesel and 14ml of biogas produces 5amp at 770 rpm.

### 7.3 Engine Run With Diesel And Bio-Gas 75% (Intake Of Engine)

S. No	Volt	Amps	Diesel for 1 min (ml)	Gas flow meter in m <sup>3</sup>			Speed in (rpm)
				n <sub>1</sub>	n <sub>2</sub>	n <sub>2</sub> - n <sub>1</sub>	
1	245	5	10	160	178	18	771
2	240	7.5	13	182	201	19	768
3	230	10	15.4	205	224	19	767
4	238	12.5	16.8	226	246	20	760
5	235	15	19.3	249	269	20	755

### 6.4 Engine run with diesel and bio-gas (100% intake of engine).

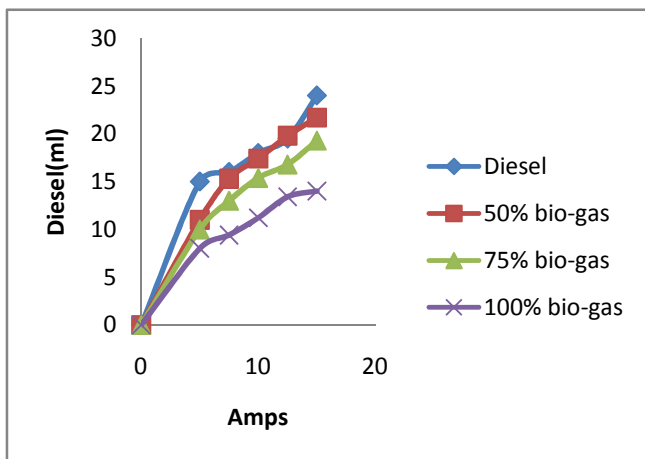
S. No	Volt	Amp	Diesel for 1 min (ml)	Gas flow meter in m <sup>3</sup>			Speed in (rpm)
				n <sub>1</sub>	n <sub>2</sub>	n <sub>2</sub> - n <sub>1</sub>	
1	245	5	8	307	329	22	780
2	240	7.5	9.4	344	365	21	775
3	230	10	11.2	393	413.5	20.5	769
4	238	12.5	13.4	446	467	21	764
5	235	15	14	486	507.5	21.5	758



Engine run with diesel and bio-gas (100% intake of engine)

Similarly through this combination of biogas with diesel through the engine consumption for 1min is 8ml of diesel and 22ml of biogas produces 5amp and 780 rpm.

### 6.5 Comparison of fuel graphs (Fuel Consumption)



Graph shows that the engine consume less amount of fuel for giving larger power out put. Emission also less because of complete combustion.

### CONCLUSION

In this research study, Investigation of engine performance was found by operating on biogas/diesel dual fuel in a small Diesel injection engine at constant speed and varying load condition were carried out.

- Efficiency of the engine increased by 20% using dual fuel arrangement
- Fuel consumption was saved by 50% by using biogas/diesel(dual fuel) at varying load condition.

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