OPTIMIZE THE PRODUCTION OF BIOGAS WITH VARIOUS DIESEL ENGINES AND ITS UTILIZATION IN VARIOUS FORMS

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SUMMARY

AUTHOR PRESENTS THE USE OF BIOGAS FUEL IN INTERNAL COMBUSTION ENGINES (I.C. ENGINES) WITH THIS, ALSO COMPARING IT WITH DIESEL FUEL. INTERNAL COMBUSTION ENGINES ARE WIDELY USED IN VARIOUS ELECTRICAL EQUIPMENTS IN ISOLATED FARMS AND VARIOUS RURAL AREAS.

ABSTRACT

BIOGAS IS DERIVED FROM THE BIOMASS PRODUCTION AND IT IS A VERY GOOD ALTERNATIVE AGAINST PETROLEUM FUELS. THE BIOGAS WHICH WE PRODUCE CAN BE USED IN VARIOUS INTERNAL COMBUSTION ENGINES (I.C. ENGINES). THE PRODUCTION OF BIOGAS IS DONE THROUGH VARIOUS ORGANIC WASTES SUCH AS COW DUNG, AGRICULTURAL WASTE, MUNICIPAL WASTE ETC. THIS IS THE REASON THAT BIOGAS IS CONSIDERED AS A VERY LOW COST AND LOW EMMISSION SECONDARY FUEL.THIS PAPER REVIES THE PRODUCTION OF BIOGAS, IT'S STATUS, PURIFICATION, BIOGAS FUEL PROPERTIES AND IT'S USES IN VARIOUS INTERNAL COMBUSTION ENGINES ALONG WITH FUEL PROPERTIES AND BIOGAS COMPOSITION, IT'S APPLICATIONS IN VARIOUS FIELDS.

INTRODUCTION

AFTER SEEING THE CONDITION OF WORLD AND KNOWING ALL SOURCES OF ENERGY,MENTIONED AS CRUDE OIL, COAL, NUCLEAR, NATURAL GAS ARE NOT RENEWABLE SOURCES OF ENERGY, BUT THERE ARE ALTERNATIVE SOURCES SUCH AS SOLAR ENERGY, HYDRO ENERGY, BIOGAS AND ENERGY OF WIND. ALL THESE ALTERNATIVE SOURCES ARE RENEWABLE BUT THE BIOGAS IS

VERY SIGNIFICANT DUE TO ITS USE IN INTERNAL COMBUSTION ENGINES. THESE ENGINES ARE WIDELY USED IN VARIOUS TRANSPORT VEHICLES FOR POWERING THE GENERATORS OF ELCETRICAL ENERGY AND MAKES BIOGAS A VERY GOOD SOURCE FOR IT. USE OF BIOGAS IN THESE INTERNAL COMBUSTION (I.C.) ENGINES IS VERY CONVENIENT. THESE DIESEL ENGINES ARE ALSO USED FOR VARIOUS AGRICULTURAL APPLIANCES AND CONSTRUCTION MACHINES DUE TO ITS HIGHER FUEL EFFICIENCY AND DURABILITY.

MATERIAL AND METHODS

THE MATERIALS USED ARE –

- INTERNAL COMBUSTION ENGINE
- TURBOCHARGED DIRECT INJECTION ENGINE
- DIESEL FUEL
- BIOGAS FUEL

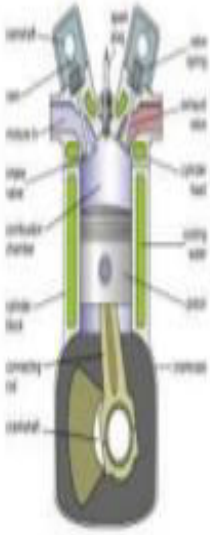
KEY PARAMETERS OF TURBOCHARGED DIRECT INJECTION ENGINE(TDI)

PARAMETER	VALUE
ENGINE CAPACITY	1996
CYLINDERS	4
G.D. SYSTEM	OHC
COMPRESSION DEGREE	19.5
DIAMETER OF PISTON	79.5
PISTON STROKE	95.5
POWER	66(4000RPM)
TORQUE	182(2000-2500RPM)
FUEL INJECTOR PRESSURE	190

IC Engines and Biogas

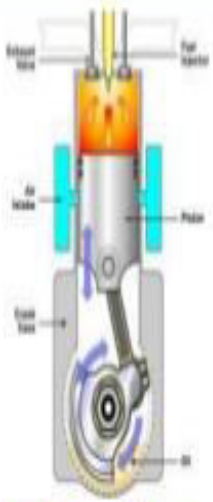
Biogas

- ✓ Octane rating=130
- ✓ Extremely suitable for engines with high CR



SI Engine

- Derating of Power [Walsh et al. (1989), Bari (1996),Henham and Makkar (2002),Bedoya (2012)]
- Rough engine operation for methane < 23% [Jawurek et al. (1987)]
- Engine performance deterioration [Huang and Crookes (1998)]



CI engine

- Drop in Efficiency [Sahoo (2011), Yoon (2011)]
- CO emission is higher[Sahoo (2011)]

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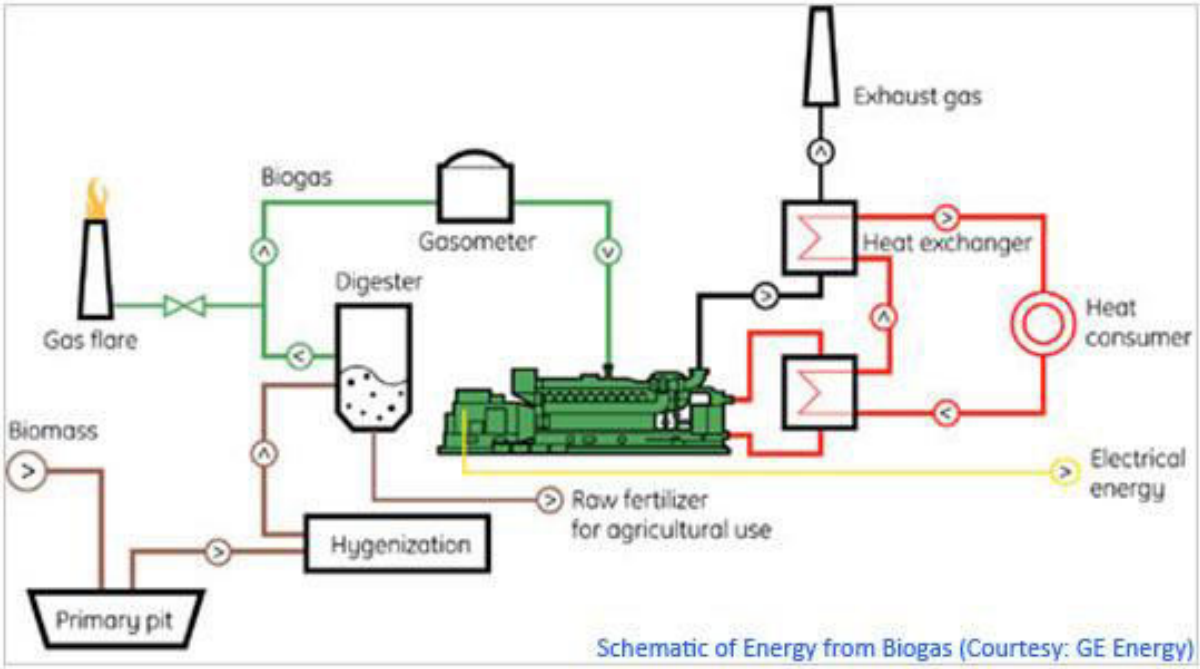
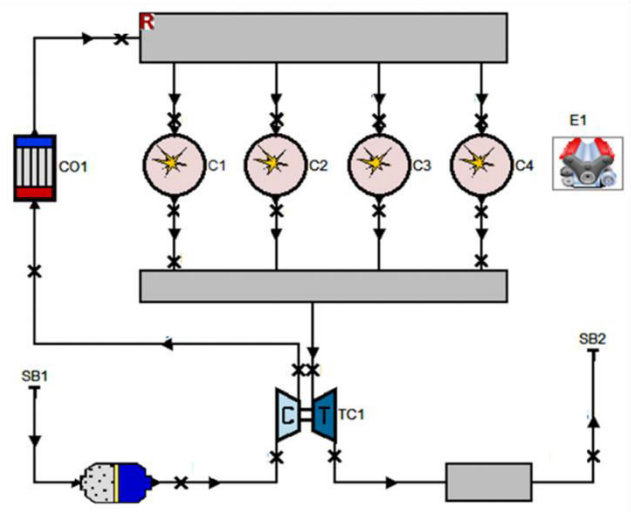


Schematic of Energy from Biogas (Courtesy: GE Energy)



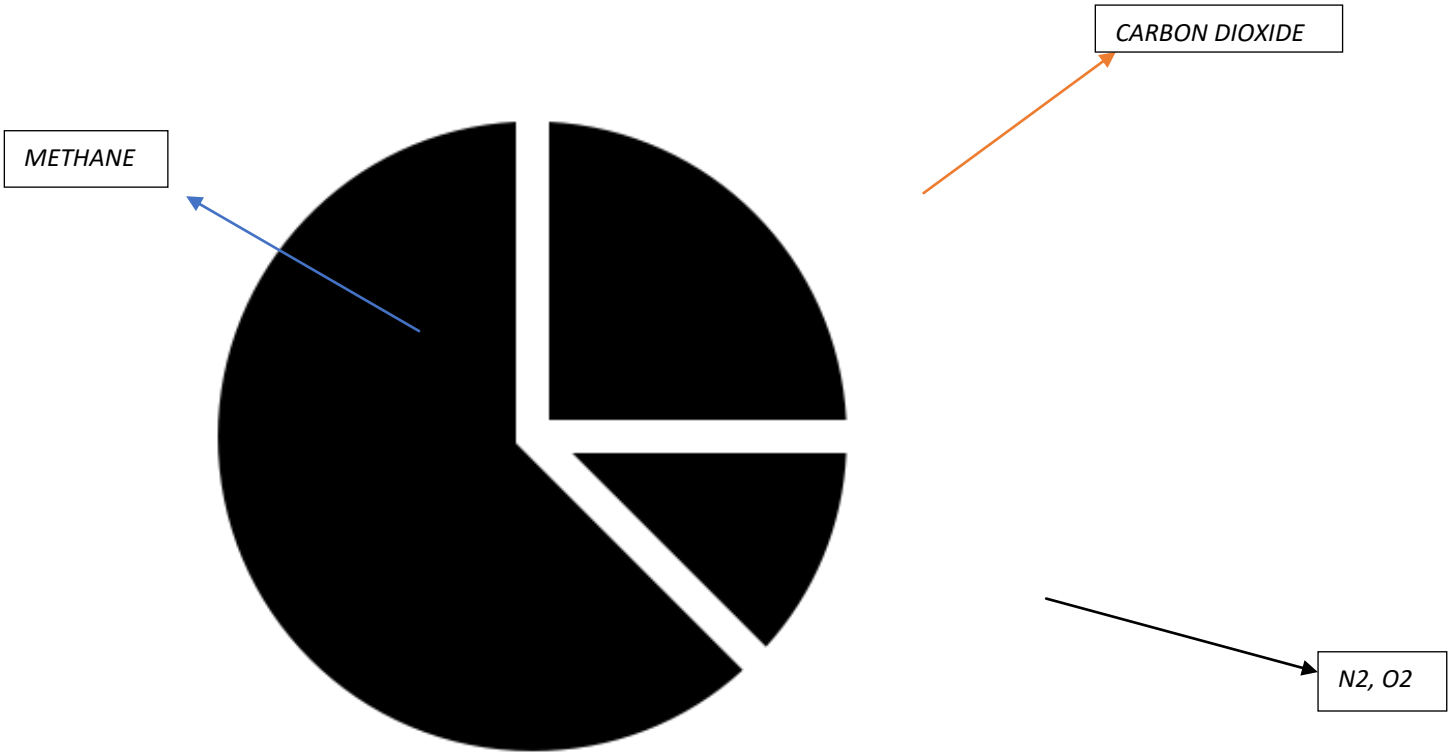
ENGINE MODEL

BIOGAS COMPOSITION

BIOGAS CONSISTED METHANE (CH4), INERT CARBON DI OXIDE GAS (CO2). THERE ARE TWO TYPES OF COMPOSITION OF BIOGAS

- PHYSICAL CHARACTERISTICS
- CHEMICAL COMPOSITION

PHYSICAL CHARACTERISTICS



CHEMICAL COMPOSITION

COMPONENTS	HOUSEHOLD WASTE	WASTEWATER TREATMENT PLANTS SLUDGE	AGRICULTURAL WASTE	WASTE OF AGRIFOOD
METAHNE	45-55	58-72	58-72	69
CARBON DIOXIDE	37-33	32-18	32-18	25
NITROGEN	4-0	0-1	0-1	NA
OXYGEN	0-1	0.5	0.5	NA
WATER(H2)	6 (40 C)	5(41 C)	5(41C)	5(41 C)
TOTAL	90	90	90	90
HYDROGEN SULPHIDE	100-800	1000-3800	3500-10000	400
AMMONIA	NA	NA	45-100	-
AROMATIC	0-200	-	-	-
ORGANOCHLORINATED OR ORGANOFLUORIDE MG/M3	100-800	-	-	-

PROPERTIES OF DIESEL FUEL

PROPERTIES	VALUE
DENSITY	0.8116
FLASH POINT	59
KINEMATIC VISCOSITY AT 15^C AT 40^C	 4.68 2.734
DYNAMIC VISCOSITY AT 15^C	3.7997
CONVENTIONAL VISCOSITY AT 15^C	1.321
DISTILLATION % AT 180^C % AT 250^C % AT 340^C	 10 <65 95
POUR POINT	-2
FREEZING POINT	-11
ANILINE POINT	70
DIESEL INDEX	30

PROPERTIES OF BIOGAS USED AS FUEL IN I.C. ENGINES

BIOGAS IS COMPOSED OF 55 TO 70% OF METHANE, 4-10% OF H2, 30-38% OF CO2.IF WE CLEAR CO2, THEN IT IS A VERY HOMOGENOUS FUEL, WHICH CONSISTS OF 80%OF METHANE AND HAVE A GOOD CALORIFIC VALUE.

THE IMPORTANT COMPONENT OF BIOGAS IS METHANE, IN CALORIFIC VALUE.OTHER COMPONENTS ARE NOT INVOLVED IN COMBUSTION PROCESS, ABSORB ENERGY RATHER FROM COMBUSTION OF CH4, BECAUSE THEY POSSESS A HIGHER TEMPERATURE THAN THEY HAVE ONE THEY HAD BEFORE THE PROCESS.

BIOGAS PURIFICATION FOR I.C. ENGINES

- REMOVAL OF CARBON DIOXIDE
- REMOVAL OF H2S

BIOGAS IN I.C. ENGINE APPLICATIONS

- USED BOTH IN HEAVY DUTY AND LIGHT DUTY VEHICLES

- CLEAN FUEL FOR BOTH SI(PETROL) AND CI(DIESEL) ENGINES
- USING BIOGAS AS A FUEL PROVIDES CLEAN COMBUSTION.

CONCLUSION

AS A RESULT, USING BIOGAS ALTERNATIVE FUEL IN VARIOUS INTERNAL COMBUSTION ENGINES PROVIDES VARIOUS BENEFITS.LOW COST AND CLEAN FUEL, ARE MAINLY OF THEM. MAIN PURPOSE IS MAKING BIOGAS AS ALTERNATIVE FUEL IN DIESEL ENGINES WITH BOTH FUELING IN CI OPERATION. THE DROP OF CARBON DIOXIDE MAKES BIOGAS AS A VERY THERMAL EFFICIENT FUEL.