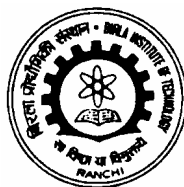


A
REPORT ON
PERFORMANCE STUDY OF
“BIO-FUEL PILOT DEMONSTRATION PROJECT”
FOR ELECTRIFICATION OF

VILLAGE : GARDIH
BLOCK : NAWADIH
DISTRICT : BOKARO
STATE : JHARKHAND

IMPLEMENTED BY
JREDA, RANCHI

SUBMITTED BY



DEPARTMENT OF MECHANICAL ENGINEERING
BIRLA INSTITUTE OF TECHNOLOGY
MESRA, RANCHI

PROJECT DETAILS

Technical Specifications of D.G. Set:

1. **Diesel Engine** : Four Stroke, single cylinder, Vertical Air-cooled engine, Kirloskar Make
 - Engine Bore : 95 mm
 - Stroke length : 110 mm
 - Compression Ratio : 17.5:1
 - Rated Power : 8 HP
 - Rated RPM : 1500

2. **Generator (alternator)** : 5 kVA, 415 V, 3 Phase, 0.8PF, Kirloskar Make

3. **Oil Crushing Unit** : 50 kg/hour capacity, 'N' type powered by 14/10 HP, 1000 RPM, liquid cooled Kirloskar engine.

4. **Household Electrification** :
 - No. of houses : 100
 - No. of CFL lamps in each house: 02
 - CFL Rating : 11 Watts
 - No. of street lights : 20
 - Total load in KW : $100 \times 2 \times 11 + 20 \times 11 = 2.42 \text{ kW}$.

FUEL PHYSIOCHEMICAL CHARACTERIZATION

Fuel : Non-edible raw Karanj oil obtained from locally available Karanj seeds.

Properties of raw Karanj Oil:

- (1) **Density (kg/m³)= 921 kg/m³**
- (2) **Calorific value (MJ/kg) = 36 MJ/kg.**
- (3) **Flash point (C^o) = 230°C**
- (4) **Fire point (°C) = 248°C**
- (5) **Kinematic viscosity (cst, at 40°C) = 27.84 cst.**

Properties of raw Kusum Oil:

- (1) **Density = 917 kg/m³**
- (2) **Calorific value = 38.14 MJ/kg**
- (3) **Flash point = 289°C**
- (4) **Kinematic Viscosity (at 40°C) = 50 cst**

ENGINE TESTING:

Before testing the D.G. set, the engine was thoroughly cleaned, old filters were replaced by new filters and mobile oil was changed. The fuel supply tube was connected to a suitably calibrated burette fitted along the side of the especially designed cylindrical fuel tank fixed on a wooden stand of suitable height. When it was required to measure the fuel consumption, the valve was closed so that the fuel could flow into the engine through filter from the graduated burette. In the first phase, the engine was allowed to operate on raw Karanj oil and engine parameters were recorded.

Engine speed was measured using Tachometer and the time for a known volume of fuel (10 c.c.) consumption was measured using stop watch.

OBSERVATIONS:

Fuel used: Raw **Karanj Oil**.

S.No.	Voltmeter reading (V)	Ammeter Reading (I)	Engine rpm (N)	Time for 10 c.c. of oil consumed (sec)	Remarks
1	0	0	1500	79.0	No load
2.	230	8	1500	44.0	
3.	230	9	1500	42.0	
4.	230	10.2	1500	39.4	
5.	230	10.9	1500	38.4	
6.	230	11.8	1500	35.6	
7.	230	12.5	1500	34.5	Full load

CALCULATIONS:

1. Engine Brake Power (B.P.):

$$\text{B.P.} = \text{Voltage} \times \text{Current} = V \times I \text{ Watts}$$

2. Brake Specific fuel consumption (BSFC):

$$\begin{aligned} \text{BSfC} &= \frac{\text{Mass flow rate of fuel (mf)}}{\text{Brake Power (B.P.)}} \\ &= \frac{mf}{B.P} \text{ gm / kW - sec} \end{aligned}$$

3. Brake thermal efficiency(% η_{th}) :

$$\% (\eta_{th})_{\text{brake}} = \frac{\text{B.P}}{\text{C.V} \times \text{mf}} \times 100$$

4. Brake mean effective Pressure (P_m):

$$P_m = \frac{\text{BP.}}{\text{LA} \left(\frac{N}{2} \right) \times \frac{1}{60}} \text{ bar}$$

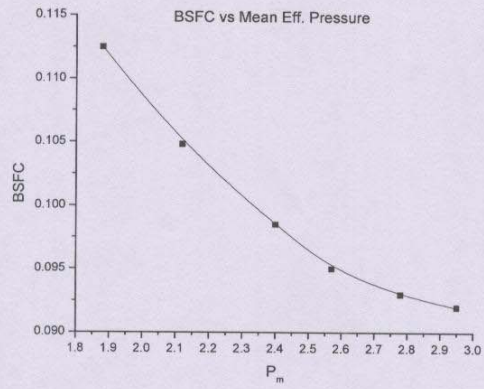
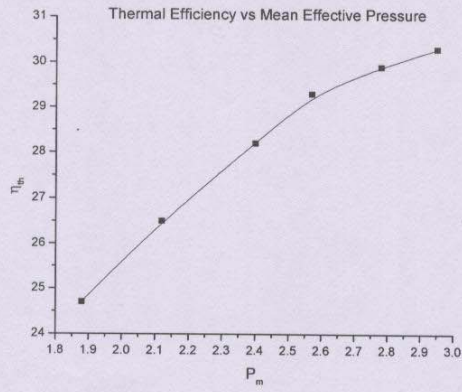
Where

L = stroke length

A = Area of Cylinder

N = RPM of engine

S.No.	Brake power B.P.(kW)	Fuel mass flow rate mf (gm/sec)	BSFC (gm/kW- sec)	Heat input mf x C.V. (kJ/sec)	% thermal efficiency $(\eta_{th}) = \frac{\text{B.P.}}{\text{Heatinput}}$	Mean effective pressure P_m (bar)
1	0	0.1154	-	4.154	-	-
2	1.84	0.207	0.1125	7.452	24.7	1.88
3	2.07	0.217	0.1048	7.812	26.5	2.12
4	2.346	0.231	0.0985	8.316	28.2	2.40
5	2.507	0.238	0.095	8.568	29.3	2.57
6	2.714	0.256	0.0943	9.216	29.5	2.78
7	2.875	0.264	0.092	9.504	30.3	2.95



Karanj Seeds



Generator Set







The details of deposit formation on the cylinder head and piston head per 25 hours of operation will be sent to you after second phase of testing is over. Lubricating oil condition is under observation.

The above test results are for your information and further necessary action. I shall be happy to provide more information, if required.

(Dr. Arbind Kumar)
Associate Professor
Deptt. of Mechanical Engineering
B.I.T., Mesra, Ranchi

(Dr. R.P.Sharma)
Reader
Deptt. of Mechanical Engineering
B.I.T., Mesra, Ranchi