



are raised because of fuel recirculation needed to cool the fuel injection system. Temperatures as high as 93<sup>0</sup>C may be expected. A key hazard of the higher flammability limits is ignition of the plume of vapor leaving the tank during refueling as a result of external sparks, static discharge or smoking materials.

### 3. Experimental Analysis

The specification of the selected diesel engine is shown in Table 1. Single cylinder four-stroke watercooled diesel engine running at constant speed of 1500 rpm was used for this work. The engine consists of an electric loading arrangement for measuring net load and fuel consumption.

**Table 1: Engine Specifications**

Bore Diameter	80 mm
Stroke Length	110mm
No. of Strokes	4
No. of Cylinders	1
Rated Power	5 hp (3.73 KW)
Rated Speed	1500 rpm
Type of Cooling	Water Cooled
Type of Loading	Electrical Type
Alternator Efficiency	80%
Energy Meter Constant	300rev/kwhr

#### a) Properties of the blended fuel used

##### 1) Calorific value

The calorific value of any substance can be found using a bomb calorimeter.

##### 2) Density

Density of the fuel blend can be found out by using a measuring flask and weighing machine.

**Table 2: Density and Calorific Value Of Various Blends**

Fuel	Density(kg/m <sup>3</sup> )	Calorific Value(kJ/kg)
DIESEL	820	44514
E5	818.99	43631
E10	811.60	43192
E15	806.3	42744
E20	803.4	41874

#### b) Performance test

Performance test is carried out in a single cylinder four stroke diesel engine by using the diesel fuel and ethanol blends such as E5, E10, E15, and E20.

##### 1) Specific fuel consumption

The variation of brake specific fuel consumption with brake power is shown in table 4.1. It reveals that as the load increases the fuel consumption decrease. At full load condition specific fuel consumption obtained are 0.336 kg/kwhr, 0.316 kg/kwhr, 0.301 kg/kwhr, 0.287 kg/kwhr, 0.282 kg/kwhr for fuels of diesel, E5, E10, E15 and E20 respectively. Brake specific fuel consumption is decreased with the blends when compared to diesel.

**Table 3: SFC for Various Blends At Various Loads**

DIESEL	E5	E10	E15	E20
1.02	0.880	0.867	0.850	0.890
0.504	0.470	0.425	0.413	0.421
0.439	0.354	0.349	0.337	0.357
0.357	0.306	0.303	0.299	0.306
0.336	0.316	0.301	0.287	0.282

#### 2) Brake Thermal Efficiency (BTE)

The variation of brake thermal efficiency with brake power is shown in table 4.2. From the plot it is observed that as the load increases the brake thermal efficiency increases. At full load condition the brake thermal efficiency obtained are 24.08%, 26.11%, 27.69%, 29.25% and 30.46% for fuels of diesel, E5, E10, E15 and E20 respectively.

**Table 4: BTE for Various Blends At Various Loads**

DIESEL	E5	E10	E15	E20
0	0	0	0	0
7.96	9.37	9.61	9.90	9.65
16.03	17.53	19.57	20.36	20.41
18.45	23.34	23.82	24.98	24.06
22.71	27.00	27.49	28.16	28.07
24.08	26.11	27.69	29.24	30.46

#### 3) Indicated Thermal Efficiency (ITE)

The variation of indicated thermal efficiency with brake power is shown in table 4.3. It reveals that as the load increases the indicated thermal efficiency increases. At full load condition the indicated Thermal efficiency obtained are 35.90%, 33.92%, 36.02%, 37.89% and 39.36% for fuels of diesel, E5, E10, E15 and E20 respectively.

**Table 5: ITE for Various Blends At Various Loads**

DIESEL	E5	E10	E15	E20
20.83	13.82	14.53	14.55	14.68
26.59	22.09	22.79	23.42	23.16
32.06	28.18	30.91	32.23	32.34
33.48	33.27	34.17	35.70	34.54
35.18	35.53	36.32	37.25	37.22
35.90	33.92	36.02	37.89	39.36

#### 4) Mechanical Efficiency (ME)

This is the rating that shows how much of the power developed by the expansion of the gases in the cylinder is actually delivered as useful power. The factor which has the greatest effect on mechanical efficiency is friction within the engine. The friction between moving parts in an engine remains practically constant throughout the engine's speed range. Therefore, the mechanical efficiency of an engine will be highest when the engine is running at the speed at which maximum bhp is developed. The variation of mechanical efficiency with brake power is shown in table 4.4. It reveals that as the load increases the mechanical efficiency increases. At full load condition the brake thermal efficiency obtained are 67.06%, 76.98%, 76.88%, 77.18% and 77.38% for fuels of diesel, E5, E10, E15 and E20 respectively.







