# Performance and Emission characteristics of DI diesel engine using Datura Biodiesel and Ethanol blend with EGR

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***Abstract :*** The objective of the experiment is to performance and the emission characteristic of the gases that are harmful for the environment like NOx, CO, CO2, and HCs on the setup of single cylinder diesel engine by taking different percentages of the blends of biodiesel, here: datura methyl ester 20% and Ethanol at 10%, 20% with and without EGR. Analysing the results and comparing the two biodiesel's efficiency by calculating the brake power, brake specific fuel consumption, total fuel consumption etc. and the graph plotting of the emission of the gases with the help of the readings of the gas analyser.

Keywords— datura methyl ester, ethanol, diesel engine.

## I. INTRODUCTION

With increment in populace over the time will likewise prompt increment in vehicles running on roadways. Along these lines, it turns out to be inevitable to take a gander at the natural effects of vehicle emanations on a worldwide scale The fatigue of world's oil holds and the broadened ecological concerns has blended the look for elective hotspots for oil based powers[1].

In the current worldwide situation of mechanization and industrialization, the most widely recognized parameter to survey any item is by its execution or proficiency[2]. In the vehicle area scientists are thinking of better than ever plans of motor and different parts to diminish its weight and improve its proficiency. Besides, with fast increment in the quantity of cars over the previous decade has raised numerous worries in regards to the earth we are living which prompted the requirement for an elective fuel for a more secure and greener condition [3].

## II. MATERIALS AND METHODOLOGY

In this work transesterification process are done, depend on the free fatty acid level three types of process are done.

| S.NO | PARAMETERS | DIESEL | BIODIESEL | ETHANOL |
|---|---|---|---|---|
| 1 | Cetane number | 51 | 59 | 18 |
| 2 | Density(kg/m$^3$) | 850 | 880 | 790 |
| 3 | Flash point($^0$c) | 53 | 82 | 14 |
| 4 | Fire point($^0$c) | 68 | 96 | 21 |
| 5 | Viscosity(30$^0$C) in CST | 2.8 | 4.80 | 1.82 |
| 6 | Calorific Value ( MJ/ kg) | 43 | 39.6 | 26.7 |

Table 1. Properties of diesel, biodiesel and ethanol

The extraction of oil was carried out utilizing mechanical expeller. The free unsaturated fat substance in the oil was dictated by titrimetric technique. Two stage Transesterification process, for example corrosive pre-treatment step pursued by base catalyzed technique was utilized to create biodiesel from datura seeds [4]. The impact of salt fixation on the yield of biodiesel was contemplated by differing the concentration extending from 0.5% to 1.5% with 0.25 % increases. The impact of the molar proportion of methanol to oil on the yield of methyl ester shaped from methanolysis was learned at different measures of methanol. The diverse molar proportions of methanol to oil contemplated were 3:1, 5:1, 7:1, 9:1 and 11:1. The temperature was fixed at 65° C and catalyst focus was fixed from the optimization considers [5]. The Transesterification responses were completed to decide the optimum response time (30, 60, 90, 120 and 150 minutes). The biodiesel generation was additionally enhanced for response temperature via conveying out transesterification process at different temperatures ranges of 40-50°C, 50-60°C, 60-70°C, 70-80°Cand 80-90°C . The impetus focus was fixed at 1.0% and the methanol to oil proportion was fixed at7:1 proportion for investigations with shifting temperature and changing response time [6].

## III. EXPERIMENTAL SETUP

The engine specifications are listed below

TABLE.2. SPECIFICATIONS OF ENGINE

| Make | Kirloskar |
|---|---|
| Type | TV1 model 4-Storke, 1 – cylinder diesel engine (water cooled) |
| Rated Power output | 5.2 kW, 1500 RPM |
| Bore and Stroke | 87.5 mm x 110 mm |
| Compression Ratio | 17.5 : 1 |
| Dynamometer | Eddy current type |
| Emissions | AVL Gas analyzer 444 |

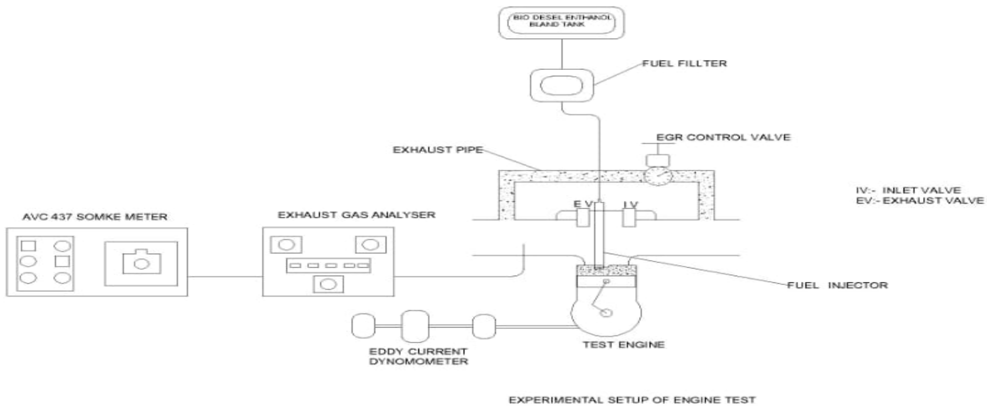


Fig.1. Engine setup.

AVL 444 gas analyser is used to measure the exhaust emissions like carbon dioxide. Carbon monoxide, unburned hydrocarbons and oxides of nitrogen.

## IV. RESULTS AND DISCUSSION

### 4.1 Performance Parameters

#### 4.1.1. Brake thermal efficiency

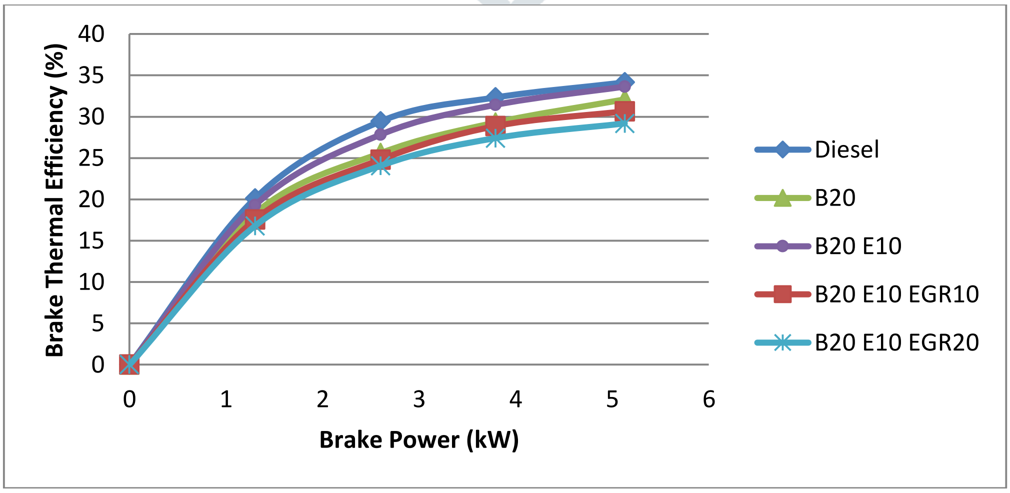


Fig.2. Brake thermal efficiency with Brake power.

The fig.2. shows the variation of brake thermal efficiency with brake power, collected values are 34.15 for diesel fuel, 32.09 for B20, 33.62 for B20 E10, 30.65 for B20E10 EGR 10 and 29.17 for B20E10 EGR 20 at full load condition. The diesel fuel got maximum brake thermal efficiency due to the maximum calorific value of diesel fuel.

#### 4.1.1. Brake specific fuel consumption

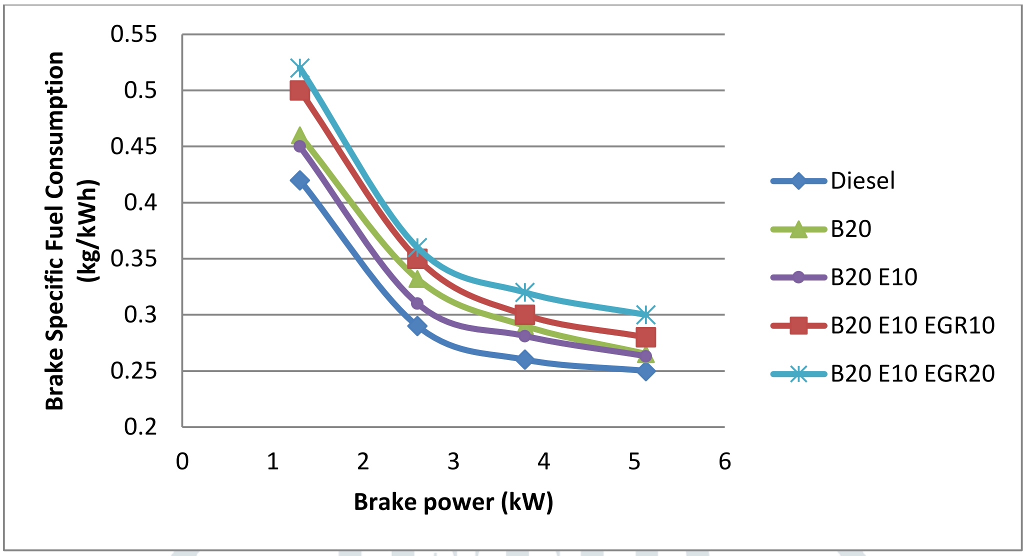


Fig.3. Brake specific fuel consumption with Brake power.

The fig.3. shows the variation of brake specific fuel consumption with brake power, collected values are 0.25 for diesel fuel, 0.265 for B20, 0.263 for B20 E10, 0.28 for B20E10 EGR 10 and 0.3 for B20E10 EGR 20 at full load condition. From all the cases fuel consumption is increased from initial to full load condition.

### 4.2. Emission Parameters

#### 4.2.1. Unburned Hydro carbons

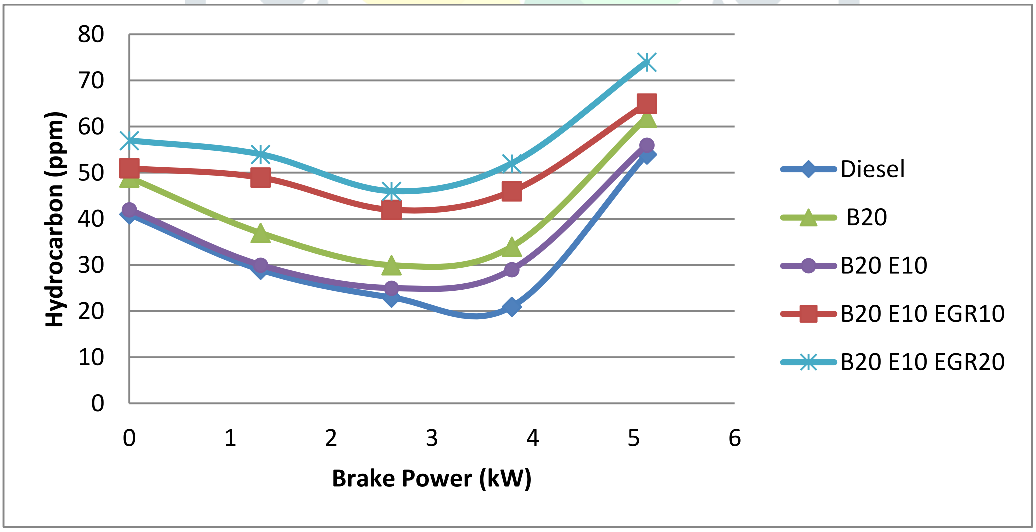


Fig.4. Unburned hydrocarbons with Brake power.

The fig.4. shows the variation of unburned hydrocarbons with brake power, collected values are 54 ppm for diesel fuel, 62 ppm for B20, 56ppm for B20 E10, 65 ppm for B20E10 EGR 10 and 74 ppm for B20E10 EGR 20 at full load condition. From all the cases unburned hydro carbons is increased from initial to full load condition.

#### 4.2.2. Oxides of nitrogen

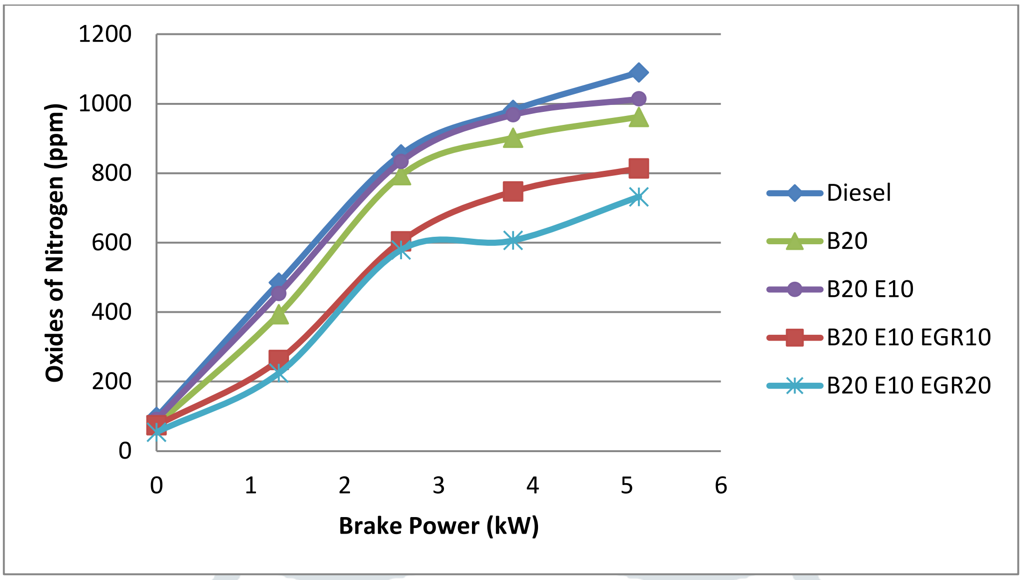


Fig.5. Oxides of nitrogen with Brake power.

The fig.5. shows the variation of oxides of nitrogen with brake power, collected values are 1090 ppm for diesel fuel, 962 ppm for B20, 1014 ppm for B20 E10, 814 ppm for B20E10 EGR 10 and 732 ppm for B20E10 EGR 20 at full load condition. From all the cases oxides of nitrogen emissions are  decreased from initial to full load condition.

#### 4.2.3. Carbon dioxide

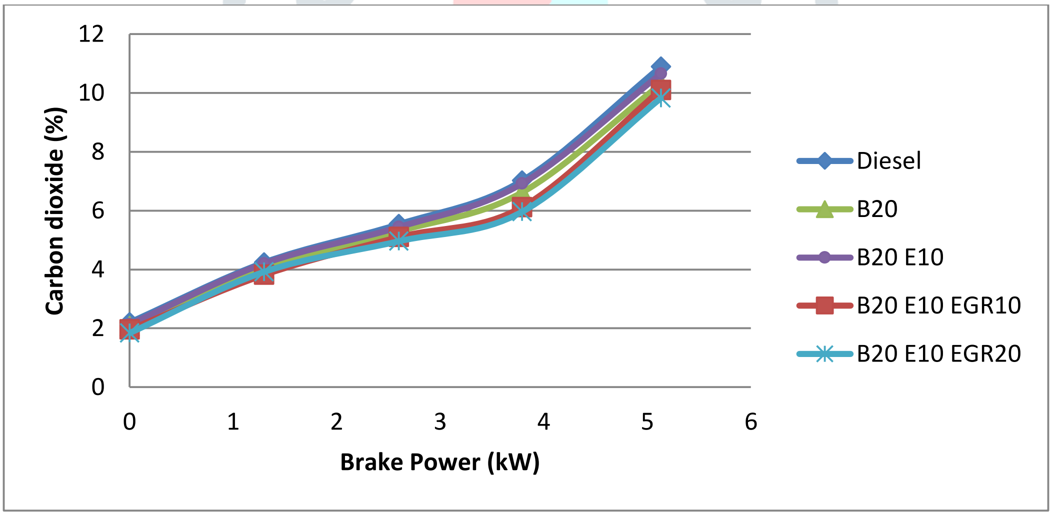


Fig.6. Carbon dioxide with Brake power.

The fig.6. shows the variation of carbon dioxide with brake power, collected values are 10.89% for diesel fuel, 10.3% for B20, 10.65% for B20 E10, 10.1% for B20E10 EGR 10 and 9.82% for B20E10 EGR 20 at full load condition. From all the cases oxides of carbon dioxide are decreased from initial to full load condition.

#### 4.2.4. Carbon monoxide

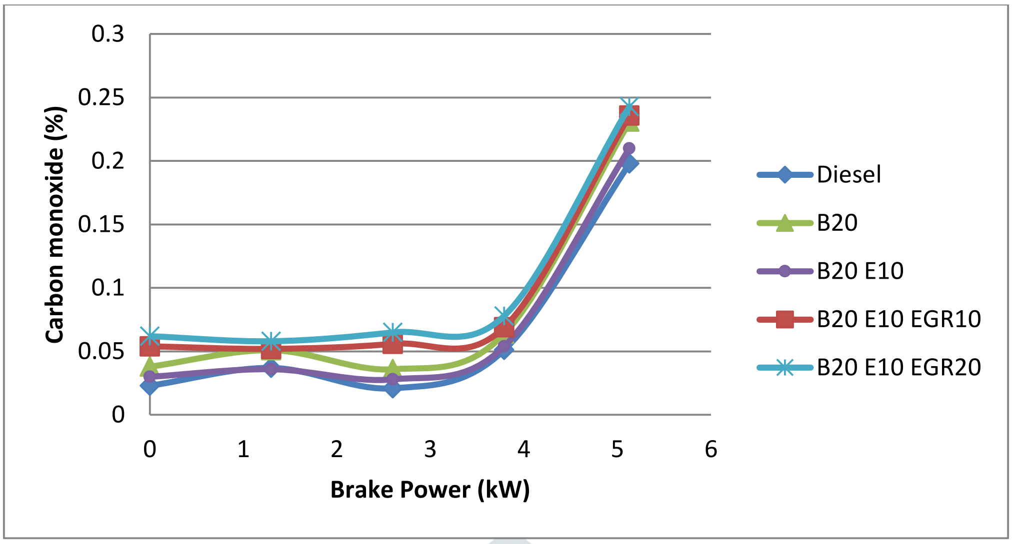


Fig.7. Carbon monoxide with Brake power.

The fig.7. shows the variation of carbon monoxide with brake power, collected values are 0.198 % for diesel fuel, 0.321 % for B20, 0.21 % for B20 E10, 0.236% for B20E10 EGR 10 and 0.243% for B20E10 EGR 20 at full load condition. From all the cases oxides of carbon dioxide are increased from initial to full load condition.

**Conclusion**

- The diesel fuel got maximum brake thermal efficiency due to the maximum calorific value of diesel fuel.
- The oxides of nitrogen decreased all load conditions compared with diesel fuel.
- The BSFC increased entire conditions,
- The UHC, CO and $CO_2$ are increased compare with neat diesel fuel.

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