COMPATIBILITY OF A DIESEL ENGINE FOR JATROPHA AND TAMARIND SEED OIL MIXED BIOFUEL AND ITS IMPACT ON ENVIRONMENT

RADHA KRISHNA GOPIDESI1*, RAJAVARAPU RAMBABU2, CHUNCHU BALARAMA KRISHNA3, YEMINENI SIVA SANKARA RAO4 & S. SRIKANTH REDDY5, PREMKARTIKKUMAR SR6

1,6Automotive Research Centre, School of Mechanical Engineering (SMEC), Vellore Institute of Technology (VIT), Vellore, Tamil Nadu, India
2Assistant Professor, Department of Mechanical Engineering, Eswar College of Engineering, Narasaraopet, Andhra Pradesh, India
3,5Assistant Professor, School of Civil Engineering, Reva University, Bangalore, India
4Department of Mechanical Engineering, Vignan’s Lara Institute of Technology and Science, Vadlamudi, Guntur, Andhra Pradesh, India

ABSTRACT

Experimental investigation runs by a diesel engine fuelled by jatropha with Tamarind Seed Oil Methylester (TSOME) mixed biodiesel. The biodiesel (B10) contains 5% of jatropha, 5% tamarind seed oil, and the remaining 90% of diesel by volume. Here, noted higher Brake Thermal Efficiency (BTE) for biofuel than neat diesel by the effect enhanced combustion rate. Further, change the standard compression ratio (CR) of 17.5 to 19.5 and 21. However, higher BTE reported at CR21, followed by lower CR conditions. CO emissions showed lower for the compression ratio 21 than the other CR conditions and higher for the diesel. But, it emits higher CO2 and HC emissions for the CR 21 and lower for the diesel.

KEYWORDS: Jatropha, Tamarind Seed Oil, Brake Power, Efficiency & Emission

Received: Jun 05, 2020; Accepted: Jun 25, 2020; Published: Jul 07, 2020; Paper Id.: IJMPERDJUN2020228

1. INTRODUCTION

Energy is an essential input for a nation's scientific, engineering, communal, and financial development [1]. Once upon a time in history, wood supplied as much as 90% of our energy needs [2],[3]. Because of its efficiency and low carbon fuels, costs could be dropped globally. The current energy situation has become very skewed towards conventional fuels such as petroleum and coal, which produces resulted in the general financial development of the world[6]. The power accessible for the cultivation process in the country and metropolitan areas have been produced by using fossil and stationary energy resources such as fuel oil, coal, and atomic energy and a partial amount by hydropower[7]. These foundations have a huge persuasiveness on our financial system and ecological aspects[8]. These have valid deliberation also been conveyed about for its use and convenience of abundant verte操ossessions. DhanaRaju et al.,[9] performed their test concentrated on the biofuel mix with tamarind seed methyl ester (TSME) with both the increase of Dimethyl carbonate (DMC) and 1-Pentanol as oxygenated fuel added substances to evaluate the qualities of presentation, burning and emanation[10]. Tests were conducted on single-chamber engines performing under different load conditions for the power of Diesel, TSME20, and TSME20 with DMC and 1-Pentanol fuel added substances are mainly used to boost the properties of biodiesel to an excess capacity due to its
increasingly stable, low consistency, higher starting rate and abundant innate oxygen fixation [11]. Yamini et al., [12] look at the accomplishment of TSOME as an elective fuel in a diesel motor. They coordinate TSOME through the Transesterification technique, and the chattels of the oil were found inside sufficient cut off focuses. A weight turn over the engine was fuelled with three blends of TSOME (10, 20&30) with diesel subject to volume, and the introduction and release results are surveyed and differentiated and standard data of diesel. The presentation results show that there is a development in BTE and reduction in BSFC, the surge limits are HC, and smoke haziness have lower diverged from diesel. This may be authorized to improve the consumption of TSOME blends. The oxides of nitrogen transmissions are all nearer for combinations that appeared differently about the diesel fuel[13], [14].

The uniqueness of the current examination is the run the engine with a blend of jatropha with tamarind seed oil at different pressure proportions. It indicated a sharp decrease in HC and CO outflows.

2. MATERIALS AND METHODS

In this present study, crude jatropha oil and tamarind seed oil has been procured from the market and done the transesterification of oil Jatropha and tamarind seed oil. The jatropha and tamarind seed oil methyl esters are mixed each 5%, and 90% diesel by volume is used for the preparation of biodiesel blend B10. The test is carried out for all fuel samples for finding fuel properties. The fuel chattels are shown in table 1.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Specific Gravity</th>
<th>Calorific Value (kJ/kg)</th>
<th>Kinematic Viscosity (mm²/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Diesel</td>
<td>0.82</td>
<td>46049</td>
<td>2.10</td>
</tr>
<tr>
<td>B10: D90JB5PB5</td>
<td>0.83</td>
<td>45233</td>
<td>2.35</td>
</tr>
<tr>
<td>Pure JB</td>
<td>0.87</td>
<td>39847</td>
<td>5.48</td>
</tr>
<tr>
<td>Pure TB</td>
<td>0.85</td>
<td>36494</td>
<td>4.03</td>
</tr>
</tbody>
</table>

3. EXPERIMENTAL SETUP AND PROCEDURE

The current experimental investigation is conducted on a diesel engine with methyl ester for jatropha and tamarind seed [15]. This configuration requires a programming interface to get the automated results. It linked to the gas analyzer AVL DI to analyze pollutants such as CO, CO₂, NOₓ, HC, and O₂. Smoke was measured using the AVL smoke meter, for the pressure analysis pressure transducer was used. Figure 1 showed the engine setup.
4. RESULTS AND DISCUSSIONS

The current trial examination is run on a solitary chamber water-cooled diesel engine. Right off the bat, the engine is run with the unadulterated diesel and sequentially run with a B10 at different CR's 17.5, 19.5, and 21. In the current segment, conscious the exhibition and outflow qualities of the engine all the samples of energizes. The exploration engine was run at a consistent speed of 1500rpm from no heap to full load condition. From that got outcome watched the higher BTE for biodiesels when contrasted and the unadulterated diesel activity.

3.1 Performance Characteristics

The Performance characteristics of BTE and BSFC are analyzed by using figures 2 & 3, respectively. The BTE is shown a continuous increase with an increase in brake power. The BTE is higher for biodiesel due to high oxygen content[16]. The biodiesel blend at the compression ratio 21 shows lower BSFC compared to other compression ratios.

![Figure 2: BTE Versus Load.](image1)

![Figure 3: BSFC Versus Load.](image2)

3.2 Emission Characteristics

3.2.1 HC Emissions

These are emitted due to incomplete burning[17]. Figure 4 shown that HC emissions. HC emissions were higher for the compression ratio 21 compared to the other samples and lowered for the diesel[18].

3.2.2 CO Emissions

The CO emission is the significance of the fuel's unequal incineration due to lower oxygen content[19]. The CO emission is reduced with the increase in load. The higher CO emission is observed for the neat diesel fuel compared to biodiesel. The combustion rate increases with an increase in biodiesel due to their higher oxygen content. And also, combustion improved with the rise of the compression ratio. CO emissions lower for the compression ratio 21 compared to the other fuel samples and higher for the diesel[20], [21]. Figure 5 shown the CO emission with load

3.2.3 CO$_2$ Emissions

CO$_2$ is a global warming gas whose originis the augmenting temperature of the earth due to the higher absorption of radiation. The continuous industrialization causes higher emissions of CO$_2$ in the atmosphere. Figure 6 observed the relation between CO$_2$ and load. CO$_2$ emissions higher for the compression ratio 21 compared to the other samples and lower for diesel[22].
4. CONCLUSIONS

Data obtained at the end of the experiment, throughout the conclusion, is as follows. BTE is improved with amplification in load. The BTE is higher for the biodiesel effect of superior oxygen content. The biodiesel blend at CR 21 shows lower BSFC impart of other compression ratios. CO2 emissions were higher for the compression ratio 21 than the different samples of CR and lowered for the diesel. HC emissions were higher for the compression ratio 21 compared to the other CRs and reduced for the diesel.

REFERENCES


