An experimental investigation is conducted to evaluate the use kapok oil methyl ester as biodiesel with the addition of Diethyl Ether as an additive. A single cylinder, four stroke, constant speed, direct injection diesel engine developing 5.2 KW. The test results were analyzed for blends such as B10, B20, B30, B40 of KME with 3% Of DEE comparison with standard diesel at various loads. The performance and emission results of the diesel engine revealed that biodiesel can be blended with diesel up to 40% at an optimum CR of 17:1, in order to get improved Performance and reduced Emission. B20 blend was improve the brake thermal efficiency 6% than the diesel. DEE helps to reduce the heat of vaporization and reduce flame temperature caused in B10, B20 blends are predominantly reduce the NOx emission. The objective of this paper is experimentally evaluating the performance and emissions of various blend ratios with help of DEE as additive. The kapok oil methyl ester blends results are compare with neat diesel.

Keywords: Kapok oil Methyl Ester (KME), DEE (Diethyl Ether), Emission.

INTRODUCTION

Our economy for the transportation fuels has been raising concern over their cost, sustained availability, and impact on global warming and pollution. Biodiesel is produced by the transesterification of vegetable oils with alcohols to produce esters. Different blends are tested in a single cylinder diesel engine among those blends, B25 blend a chive 4% increase in BTE than diesel. Using B10 the BSFC was very low compare with other biodiesel and also Carbon monoxide, Hydrocarbon, smoke capacity was lower. 1, 4-Dioxane was mixed with KME, in order to reduce engine emission such as CO, HC, and NO for B25-10 ml result with B25. The performance parameter such as BSFC, BTE was improved with results without adding additives. KOME properties such as viscosity, density, acid value, flash point and calorific value fulfill the requirements. The CO emission and smoke density reduced by using B20, B40 blends. Oxides of nitrogen emission reduced when adding the DEE with the diesel fuel blends compare with neat diesel fuel and also reduce the smoke capacity with increasing the DEE proportions.

MATERIALS AND METHODS

Kapok raw oil extracted from kapok seeds, after extracting the raw oil needs to be transesterification process because of raw oil contains the fatty acid, water. Once the reaction was completed the methyl ester and glycerol were separated. KME is separated out and mixed in various blend proportions with diesel to form different blends such as B10 (KME – 10% , diesel – 87% and DEE 3%), B20 (KME – 20% , diesel – 77% and DEE 3%), B30 (KME – 30%, diesel – 67% and DEE 3%), B40 (KME – 40%, diesel – 57% and DEE 3%). Table 1 shows the properties of various test fuel.

Experimental procedure: The engine test was conducted in Single cylinder four strokes diesel engine with eddy current dynamometer set is used in experimentation. It is kirloskar water cooled, vertical four stroke compression ignition engine. The catalytic converter fabricated is installed next to the exhaust flange before the tail pipe. The experiment is carried with compression ratio 17:1 using four different blends of fuels like neat diesel, B10, B20, B30 and B40. The first stage test was performed at constant speed. The experiment was conducted at six load levels. The engine load was adjusted by using the eddy current dynamometer. AVL smoke meter for smoke density measurement, AVL gas analyzer used for measure emissions such as CO, CO2, HC and NOx. Fig 2.1 Shows the Schematic diagram of experimental setup.

RESULT AND DISCUSSION

The engine BSFC whether increase or decrease depends up on the calorific value of the fuel. The specific fuel consumption when using biodiesel fuel is expected to increase as compared to the consumption of diesel fuel but BSFC
decreased sharply with increase in brake power for all fuel samples. The Fig.3.1 shows among those blends B10 and B20 give better BSFC, blends B30 and B40 experiences less complete combustion due to higher viscosity. Higher density reduces the calorific value, therefore increase the fuel consumption.

![Fig 1 Engine experimental setup](image)

**Table.1 Properties of fuels and additives**

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th>KOME</th>
<th>DIESEL</th>
<th>DEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cetane number</td>
<td>56</td>
<td>40-55</td>
<td>&gt;125</td>
</tr>
<tr>
<td>Density (kg/m³)</td>
<td>864</td>
<td>816-840</td>
<td>712</td>
</tr>
<tr>
<td>Kinematic viscosity (mm²/s)</td>
<td>4.9</td>
<td>3.2</td>
<td>0.25</td>
</tr>
<tr>
<td>Calorific value (MJ/kg)</td>
<td>38</td>
<td>43</td>
<td>34</td>
</tr>
<tr>
<td>Oxygen (wt %)</td>
<td>11.68</td>
<td>0</td>
<td>21.6</td>
</tr>
</tbody>
</table>

![Fig 3.1 The variation of BSFC with Brake Power](image)

![Fig 3.2 The variation of BTE with Brake Power](image)
The Brake Thermal Efficiency obtained from lower viscosity, lower colorific value, higher cetane number, chemical composition BTE obtained from KME with DEE as additives. The Fig.3.2 shows BTE in the B20 blend were 29% more than the diesel fuel that indicated at full Brake power.

Fig 3.3 shows the variation of CO with BP. Emissions of CO from a DI diesel engine mainly depend upon the physical and chemical property of fuel. The main difference in diesel, KME with DEE blend based fuel is the oxygen content and cetane number. B20 give better result than the other blends such as B10, B30 and Energy conversion for B40 was incomplete caused the increase in CO emissions. When increasing blend ratio increase despite the presence of inherent oxygen within KME, DEE acts as a combustion promoter, inside the cylinder result better combustion than diesel fuel. B20 better combustion velocity and reduce emissions.

The Higher HC emissions are probably due to higher viscosity, density, poor volatility and fuel rich operation at full Brake power it can be noticed from the Fig.3.4 shows that the concentration of hydrocarbon of kapok oil diesel fuel blends with DEE as additive is less than diesel. Kapok oil contains excess oxygen atom improve the combustion quality, With increase in power output. KME have higher cetane number decrease the combustion delay reduce the HC emissions.

The NOX emission for various blends of KME increases with the increase in load. From the Fig 3.5 shows the NOX emission for B10, B20 blends is noticed 3% lesser than diesel because of adding DEE. DEE blending into diesel fuel reduces temperature both by increased heat of vaporization and by reduced flame temperature. Consequently, combustion temperature abates and hence NOx emissions are significantly diminished. But the blend ratio B30, B40 shows higher NOX emission because of when blend ratio increasing in order to increase the oxygen atom it will react with nitrogen molecules to form higher oxides of nitrogen.

The variations of Smoke density are shown in Fig. 3.6. Smoke was formed due to incomplete burning of hydrocarbon and carbon particles in the fuel itself. Higher values of smoke can be attributed to poor mixture formation due to higher viscosity and poor volatility. KME blends such as B10, B20 smoke capacity pair with diesel but the blend ratio B40 increases the Smoke 23% at full load conditions.
CONCLUSION

An experimental study was carried out on a VCR engine, compression ratio of 17:1 using Kapok oil methyl ester blends of B10, B20, B30 and B40 were used and the performance and emission characteristics were compared with the characteristics of conventional diesel. The following conclusions were inferred from the experiments: B20 blend claims 6% increase in the BTE than the diesel. B10 and B20 reduce the Brake Specific Fuel Consumption simultaneously reduces the NOx emissions with help of DEE. Coming to smoke density in the blend ratio B10, B20 pair with diesel at the same time B40 blends 23% smoke density was increased.

REFERENCES