A Review on Performance & Emission Analysis of Different Biodiesel and its Blend

Abstract: Now a day the world is facing the duel crises of fossil fuel depletion and environmental degradation. From the point of view of global environment protection and the concern for long-term supplies of conventional diesel fuels, it becomes necessary to develop alternative fuels comparable with conventional fuels. Biodiesel is an alternative fuel of diesel; it is described as fatty acid methyl ester from vegetable oils or animal fats. Manufactured by using transesterification process having the properties such as density, calorific value, flash point, fire point and specific gravity of bio-diesel. Emission parameter such as emission of carbon dioxide, hydrocarbons and oxide of nitrogen gases in exhaust were recorded.

Keywords: Biodiesel, Alternative Fuels, Fatty Acid Methyl Ester, Transesterification, Emission Parameters.

I. INTRODUCTION

Diesel engine is a popular prime mover for transportation, agricultural machinery and industries. Diesel fuel is largely consumed by the transportation and agricultural sectors. Import of petroleum products is a major drain on our foreign exchange sources and with growing demand in future years the situation is likely become even worse. Diesel and petrol engines are the main sources of carbon dioxide, carbon monoxide and un-burnt hydrocarbon emissions and increase in carbon dioxide, carbon monoxide levels in the atmosphere leads to global warming and green house effect. The world is on the brink of energy crises. Efficient use of natural resources is one of the fundamental requirements for any country to become self sustainable with the fossil fuel depleting very fast, researchers have concentrated on developing new agro based alternative fuels, which will provide sustainable solution to the energy crises. India is focusing on Pongamia Pinnata, which can grow in arid and wastelands. Oil content in the Pongamia seed is around 30-40%.[1] Chemically biodiesel is referred as mono-alkyl esters of long chain fatty acid derived from renewable biological sources. Biodiesel is directly used in the compression ignition engine. Biodiesel is a clean burning alternative fuel that comes from 100% renewable resources. Many people considers the Biodiesel is a fuel of the future. Biodiesel is also called as Biofuel. Biodiesel which is derived from triglycerides by transesterification and from the fatty acids by esterification.[2] Petroleum resources are finite and almost provides 90% energy needs to the world by fossil fuels which are depleting at an alarming rate. In recent years, the consumption of petroleum products in India has been increased significantly. As far as India is concerned the need to search an alternative fuels argent to meet the demand for transportation, agricultural sector. Apart from the depleting resources, petroleum, another important aspect of their use is in the alarming rise of pollutants like CO, HC, NOx, CO2 etc. by automobiles and industries which have tremendous effect on human life and vegetation.[3] There are various vegetable oil available for production of biodiesel such as sunflower oil, rubber oil, Jatropha oil, karanja oil, soyabean oil, rapeseed oil, mahua oil, palm oil, rubber seed oil etc. Sunflower oil, soyabean oil, palm oil are edible oils hence it cannot be used for biodiesel production. On the other hand Karanja oil, Jatropha oil etc are non edible oil and are attractive due to easy availability and low production cost.[4] We have introduced a non edible and unutilized, wild plant that is Thumba. In this research work, investigations were carried out to optimize highest yield with major parameters like molar ratio of oil to methanol, catalyst concentration, reaction temperature and reaction time.[5] It has a higher molecular weight, viscosity, density, and flash point than diesel fuel. From Algae, oil can be extracted which have similar properties as diesel but some properties such as viscosity, flash point and ignition point is very high in Algae oil. By some chemical reactions, Algae oil can be converted into biodiesel. Algae oil can also be used directly by blending with diesel. It has a higher molecular weight, viscosity, density, and flash point than diesel fuel. Alternative fuels, other than being renewable, are also required to serve to decrease the net production of carbon dioxide (CO2), oxides of nitrogen (NOx), particulate matter etc., from combustion sources. [6]

II. LITERATURE REVIEW

D. Subramaniam, A. Murugesan and A. Avinashinvestigates the performance, combustion and emission characteristic of Neem oil with their diesel blends was experimentally examined on CI engine. The Brake Thermal Efficiency increased with increased brake power. The Biodiesel blends up to B30 among the B10, B30, B50, B70 and B100 has maximum brake thermal efficiency. The performance and emission characteristics is not more affected by biodiesel blend of B30. If the ratio of blend increased, it gives incomplete combustion due to less time for mixture formation. [9]

M. C. Navindgi, Dr. MaheshwarDutta and Dr. B. SudheerPrem Kumar they perform an experiment on LHR engine by using the biodiesel blends. The
experimental analysis gives comparison of various properties with diesel. The maximum efficiency obtained in case of LHR engine with use of biodiesel was lower than diesel used in LHR engine. The efficiency of LHR engine is well by using biodiesel fuel. The exhaust gas temperature was lower. This indicates that heat release rate was comparatively lower than diesel fuel. The specific fuel consumption of this biodiesel is higher. The specific energy consumption also higher with use of this biodiesel. [10]

T. VenkateswaraRao, G. PrabhakarRao and K. Hema Chandra Reddy, in their experimental investigation, they have been studied the properties, performance and emissions of different blends (B10, B20 and B40) of Pongamia methyl ester, Jatropha methyl ester and Neem methyl ester. Among the blends B10, B20, B40 it can be concluded that B20 have closer performance to diesel fuel. Also B100 has lower brake thermal efficiency. From the experimental investigation, it is seen that the blend B100 cannot be used in CI engine. But the Pongamia, Jatropha and Neem methyl ester can be directly used in diesel engine without any modification in the engine.[11]

A. V. Kulkarni, S.D. Bhopale, they gives key factor for good CI engine performance such as good mixture formation and lower smoke emission. The above factors are highly influenced by density, viscosity and volatility of fuel. For use of biodiesel, this factors are decided by the effectiveness of transesterification process. The biodiesel from Jatropha, Pongamia Pinnatta and Neem seed oil gives the properties nearly close to diesel fuel. The biodiesel fuel blends may gives an alternative option for diesel fuel because they are renewable resources and less polluting. The non-regulated emissions were found to be lowered by using the Neem oil as a biodiesel.[12]

Ramaraju A. and Ashok Kumar T. V. they take non-edible oil like Punnakka for their investigation to produce biodiesel by esterification process. The oil contains FFA of 19.8% with C18 Chains. They performs the two stage processes are as:

i. Acid Esterification,
ii. Alkaline Esterification.

The Free fatty acid is about 19.8% present in the oil which was reduced by acid esterification. In acid esterification, the purpose is to reduce the FFA in the crude oil less than up to 3%. In this stage, concentrated sulphuric acid is used as a catalyst. In the alkaline esterification process, the product of first stage is subjected to transesterification process by using KOH as a base catalyst.[13]

S. A.Ransing and M. H. Attal the Undi oil blends with diesel and the properties was tested by ASTM D6751 standard. The test has been conducted by using different blends such as 10%, 20%, 30%, 40%, 100%. The blends B20 gives to close performance that of the use of pure diesel. This B20 blend shows the variation in BTE is about 2.51% and BSFC is about 7.17% at maximum power. In this experiment, the result are shown that for BTE and BSFC of pure diesel and blend B20 is vary within 10%. The experimental results shows that BTE decreases as percentage of blend increases and BSFC increases with increase in blend percentage because of the biodiesel has higher viscosity and density and lower calorific value than pure diesel. The engine emission analysis gives NOx increases with biodiesel percentage and HC decreases as biodiesel percentage increases because oxygen in biodiesel helps for the complete combustion.[14]

III. SUMMERY

Table 1: Properties of Different Oils

<table>
<thead>
<tr>
<th>Oil</th>
<th>Density Kg/m³</th>
<th>Sp. Grav.</th>
<th>Flash Point °C</th>
<th>Fire Point °C</th>
<th>CV (Kj/Kg)</th>
<th>Ref No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahua oil Ethyl Ester</td>
<td>920</td>
<td>0.8</td>
<td>65</td>
<td>164</td>
<td>173</td>
<td>3910</td>
</tr>
<tr>
<td>Waste cooking oil</td>
<td>876</td>
<td>0.8</td>
<td>93</td>
<td>160</td>
<td>164</td>
<td>3976</td>
</tr>
<tr>
<td>Neem oil Ethyl</td>
<td>932</td>
<td>N. A.</td>
<td>242</td>
<td>N.A</td>
<td>3970</td>
<td>(8)</td>
</tr>
<tr>
<td>Turmeric Leaf Oil</td>
<td>884</td>
<td>N. A.</td>
<td>110</td>
<td>N.A</td>
<td>4600</td>
<td>(8)</td>
</tr>
<tr>
<td>Diesel</td>
<td>850</td>
<td>0.8</td>
<td>56</td>
<td>63</td>
<td>4280</td>
<td>(8)</td>
</tr>
<tr>
<td>Thumba Oil</td>
<td>870</td>
<td>N. A.</td>
<td>164</td>
<td>172</td>
<td>3700</td>
<td>(5)</td>
</tr>
<tr>
<td>Algae Oil</td>
<td>940</td>
<td>N. A.</td>
<td>49</td>
<td>78</td>
<td>N.A</td>
<td>(6)</td>
</tr>
<tr>
<td>Neem Oil</td>
<td>965</td>
<td>N. A.</td>
<td>214</td>
<td>222</td>
<td>4000</td>
<td>(10)</td>
</tr>
</tbody>
</table>

The NOx, CO and HC emissions were measured for diesel and biodiesels blends. NOx was found to increase with increase in blend proportion. Nitrogen content of the fuel affects the NOx emissions by formation of fuel NOx. CO and HC emission decreases with increase in blend proportion. Karanja methyl ester found good results as compared to other biodiesel. The flash and fire points of turmeric leaf oil was high than diesel. Also the cloud point, pour point and density of turmeric leaf oil is high. The density of turmeric leaf oil can be reduces as the temperature reduces.
References


