

PERFORMANCE AND EMISSION CHARACTERISTICS OF BLENDING DIETHYL ETHER IN KARANJA VEGETABLE OIL USING A SINGLE-CYLINDER DIESEL ENGINE

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Abstract

Most countries of the world faces crises of energy demand, rising petroleum prices and depletion of fossil fuels forces the researcher to find the alternate fuel for diesel engines. A lot of research work point out that biodiesel and its blends with diesel is employed as alternate fuel for diesel engine without any modifications in the existing diesel engine. Very few works have been done with the combination off two different biodiesel blends with the neat diesel fuel and leads to lot of scope in this area. This paper presents experimental results on dual fuel operation of a single cylinder a single-cylinder diesel engine with diesel, karanja oil and mixture of karanja oil and diethyl ether (DEE) as primary fuels. Results on brake thermal efficiency, fuel consumptions and emissions, namely, un-burnt hydrocarbon (HC), carbon monoxide (CO) and NO_x are presented here. The paper also includes vital information regarding performances of the engine at a wide range of load conditions with different blended fuel substitutions.

Keywords: Diethyl Ether (DEE); Biodiesel; Karanja oil; Trans-esterification; Diesel

1. Introduction

The effect of vegetable oil methyl ester on the DI diesel engine performance characteristics and emissions. The have conducted the experiments using Soybean oil, peanut oil, corn oil, sunflower oil, rapeseed oil, palm oil, palm kernel oil, and waste fried oil (vegetable oil basis)[1]. The bio diesel was production from Mahua (Madhuca Indica) oil through esterification followed by transesterification. The results show that 4% H₂SO₄, 0.33% v/v alcohol/oil ratio, 1 hr reaction time and 65⁰C temperature are the optimum conditions for esterification [2]. The suitability of transesterified mahua oil as a fuel in C.I. engine. The experiments 7B.H.P single cylinder four stroke and vertical, water cooled Kirloskar diesel engine at rated speed of 1500rpm. The increase in brake thermal efficiency and decrease in specific fuel consumption was observed in the case of esterified mahua oil (at 75% mahua oil blends) compared to that of diesel fuel [3]. The effect of mahua oil methyl ester, ethyl and butyl esters of a four stroke, direct injection, constant speed, compression

ignition diesel engine, on performance and emissions were analyzed .The CO, HC and NO_x is low for alkali esters were compared to neat diesel fuel. The ethyl ester showed lower NO_x emission compared to other esters [4]. The mahua oil methyl ester was in a single cylinder, four stroke, direct injection, constant speed, compression ignition diesel engine on the performance and emissions. The emissions of CO, HC were too low for mahua oil methyl ester and Oxides of nitrogen were slightly lower compared with diesel [5].

2.4 Blend Preparations:

2.4.1 The two biodiesel blends were prepared in different proportions as:

- i. Blend A- Karanja oil + DEE 25%
- ii. Blend B- Karanja oil + DEE 20%
- iii. Blend C- Karanja oil + DEE 15%
- iv. Blend D- Karanja oil + DEE 10%
- v. Blend E- Karanja oil + DEE 5%

Experimental setup:

Test Engine

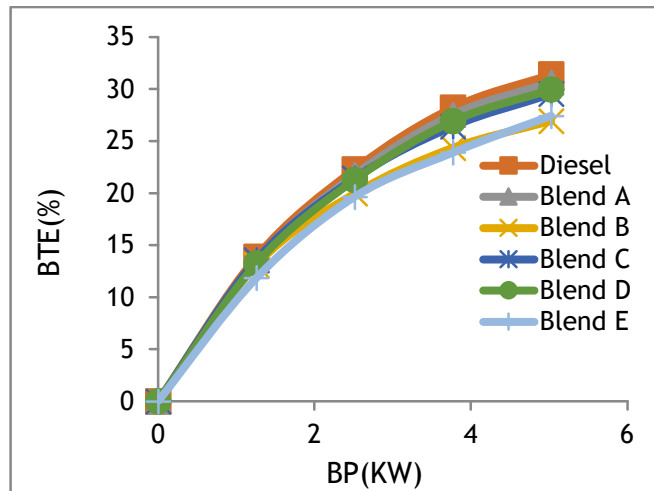
Table-1: Engine Specification:

| Type | Vertical, Water cooled, Four stroke |
|--------------------|-------------------------------------|
| Type | Water Cooled, 4-stroke DI CI engine |
| Number of cylinder | 1 |
| Bore | 87.5 mm |
| Stroke | 110 mm |
| Compression ratio | 17.5:1 |
| Maximum power | 5.2 kW |
| Speed | 1500 rev/min |
| Dynamometer | Eddy current |

Results and discussions:

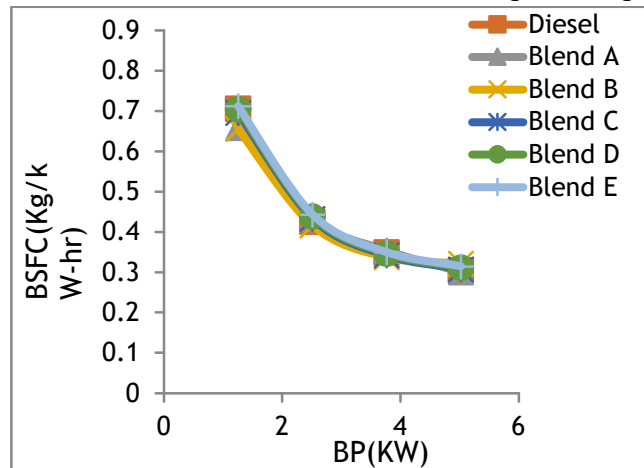
Brake thermal efficiency

The brake thermal efficiency of Blend A operation has been found to be 27.73% as compared to 26.01% of pure diesel operation respectively. The increase in the thermal efficiency can be attributed to the addition of the oxygenated additive, thereby enhancing the combustion of the fuel to a greater extent.



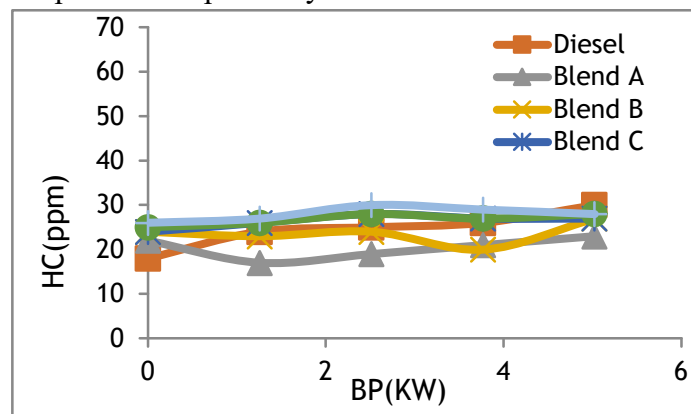
Fuel consumption

The fuel consumption of Blend A increased from 5% to 25% .It is observed that at higher engine loads, the fuel consumption for the blends is higher than the fuel consumption for pure diesel. This is attributed to the lower calorific value of the blends when compared to pure diesel.



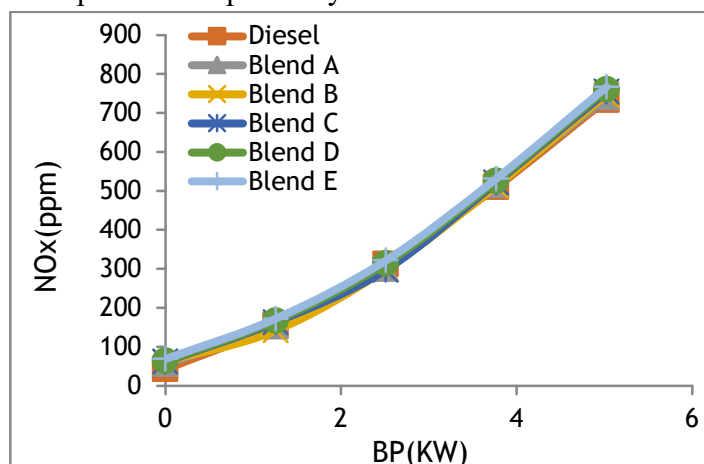
HC Emissions

The total volume of unburnt hydrocarbons in the exhaust expressed in ppm by volume for pure diesel, karanja oil and its blends. it is observed that the overall HC emissions for the blends are higher than those for pure diesel. At lower engine loads, the higher than pure diesel but the gap narrows down. The HC emissions of Blend A with karanja oil operation has been found to be 27 ppm as compared to 29 ppm of pure diesel operation respectively.



NO_x Emissions

The nitrous oxides emissions at various engine loads for neat diesel, karanja oil and its blends up to 25% with diethyl ether. One of the important factors that decide the nitrous oxide formation is the peak combustion temperature in the engine cylinder and availability of O₂ in the combustion chamber. The NO_x of Blend A with karanja oil operation has been found to be 265 ppm as compared to 488 ppm of pure diesel operation respectively.



Conclusions:

- The brake thermal efficiency of Blend A with karanja oil operation has been found to be 27.73% as compared to 26.01% of pure diesel operation respectively.
- The CO emissions of Blend A with karanja oil operation have been found to be 0.035 ppm as compared to 0.135 ppm of pure diesel operation respectively.
- The NO_x of Blend A with karanja oil operation has been found to be 265 ppm as compared to 488 ppm of pure diesel operation respectively.
- The HC emissions of Blend A with karanja oil operation has been found to be 27 ppm as compared to 29 ppm of pure diesel operation respectively.

Reference

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