International Journal of Environmental Research and Development.
ISSN 2249-3131 Volume 4, Number 4 (2014), pp. 353-360

http://www.ripublication.com

Performance and Emission Analysis of Diesel by Adding Jamun Seed Powder

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Abstract

In the present energy scenario of fuels, bio- diesels has already been given great importance. However, a perfect replacement of the fossil fuel by bio-diesels is still unsatisfactory. As the demand for bio-diesels has been consistently increasing, there is also a need for a consistent increase in the research activities related to it. In this point of view, we have extended our research activity to generate a potential bio-diesel. As diesel is predominantly used than petrol, we confined this paper for analyzing only diesel. Oxide formation has been a major concern in normal fuels as well as in bio-fuels. So there is a need for the presence of anti-oxidant in the fuel we use. After clearly examining the anti-oxidant properties of various natural products we predicted Syzygium cumin which is also called as jamun fruit, to have better anti-oxidant properties, As we highly interested in utilizing natural waste we used jamun seed powder instead of jamun fruit. The main aim of this paper is to reduce oxide emissions. So we prepared blends by adding 20%, 30% of jamun seed powder to the diesel with the help agitator at room temperature. We left the blend idle for fifteen days and then filtered the blend to remove the impurities. We have used a twin-cylinder diesel engine for performance and emission tests.

Keywords — *Syzygium cumin, Jamun seed powder, Oxide formation*

1. Introduction

For producing any kind of bio-diesel there are various factors that has to be considered. Factors such as specific fuel consumption, mechanical efficiency, thermal efficiency, emission gases are to be considered, to determine the overall efficiency and effectiveness of the bio-diesel. In particular considering the emission gases Carbon monoxide (CO), Carbon dioxide (CO_2), Hc Hexane, Nitrogen oxide (NO),

Oxygen (O_2). As clearly oxide formation is predominant in emission gases there is a need to add anti-oxidants to reduce the formation of oxides. Many researchers have worked on alternate fuels such as CNG, H_2 etc and biodiesels using Jatropa oil [1], Rice bran oil [2-4], Honge oil [4], Neem oil [4-6], Thumba oil [7], ethanol blends [8] etc. Most of the above biodiesels result in an increase in NO emissions, however some studies report varying or opposite results [9].

So, clearly we can see the increase of formation of oxides in the Bio-diesels emission, which clearly shows the need for adding anti-oxidant to the bio-diesel. By observing the anti-oxidant properties of the jamun fruit [10-11], we decided to use jamun seed powder as anti-oxidant in our work. Jamun fruit can be generally found in India, Bangladesh, Indonesia, Sri lanka, Nepal, Pakistan. It consists of elements such as Calcium (ca), Magnesium (mg), Iron (Fe), Phosphorous (P), Potassium (K) and Sodium (Na).

The following are the specifications of the engine in table 1 that was used for testing the samples.

Table 1. Specifications of the test engine

Type	**Four stroke twin cylinder water cooled engine**
Number of strokes per cycle	2
Type of cooling	Water cooling
Fuel used	Bio-diesel
Speed	1500 rpm
Power	6 kva
Bore	87.5 mm
Stroke	110 mm

2. Blend Preparation

The jamun seed powder was procured in fine grain size, it was filtered with the help of fine mesh in order to remove unwanted impurities. The filtered powder was segregated based on ratios mixing with diesel. The segregated mixtures were added to their corresponding volume of diesel in order to deduce the bio-diesel samples. The table 2 shows the ratios of the samples that were tested in the test engine.

Table 2. Composition of the samples

Sample number	**Jamun %**	**Diesel %**
Sample A	20	80
Sample B	30	70

3. Blend Properties

The main properties that have to be considered for a fuel to be used in internal combustion engine are Calorific value, Fire point, Flash point and Density the observations on the properties are made and the following values are concluded in table 3.

Table 3. Properties of diesel

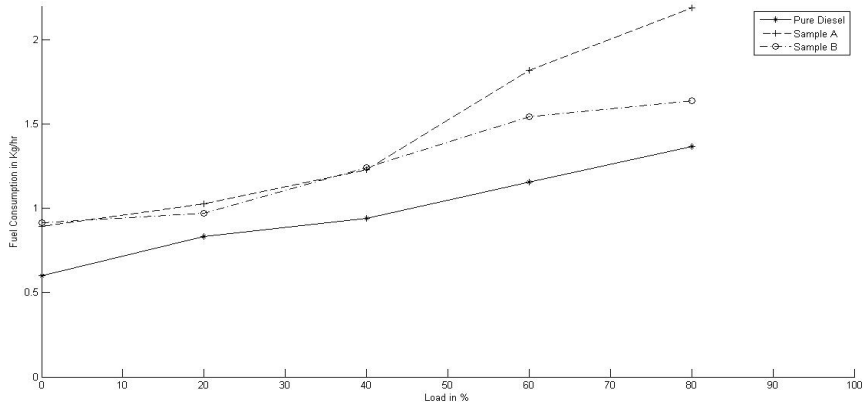
Test parameters	Sample A	Sample B
Flash point in ^{o}C	158	169
Fire point in ^{o}C	182	185
Gross calorific value by KJ/kg	43252	43200
Density	925	925

4. Performance Analysis

The performance test is carried out in a twin cylinder diesel engine and the parameters like Fuel consumption, Brake power, Fuel power, Brake thermal efficiency are calculated. And graphs are plotted between load and above parameters respectively.

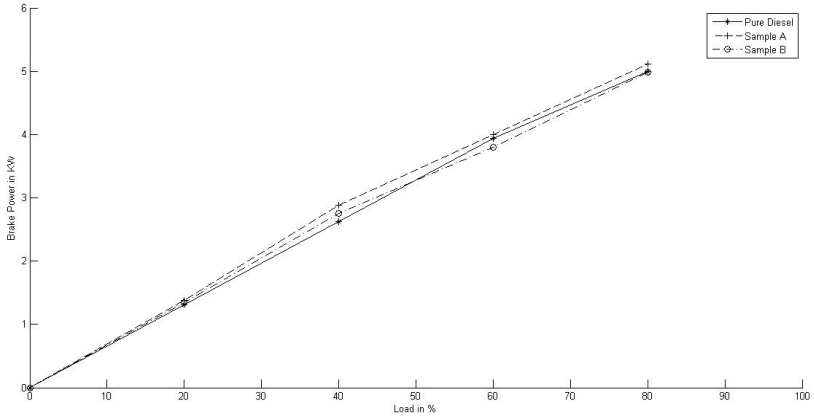
4.1 Fuel consumption

Figure.1 Load – Fuel consumption



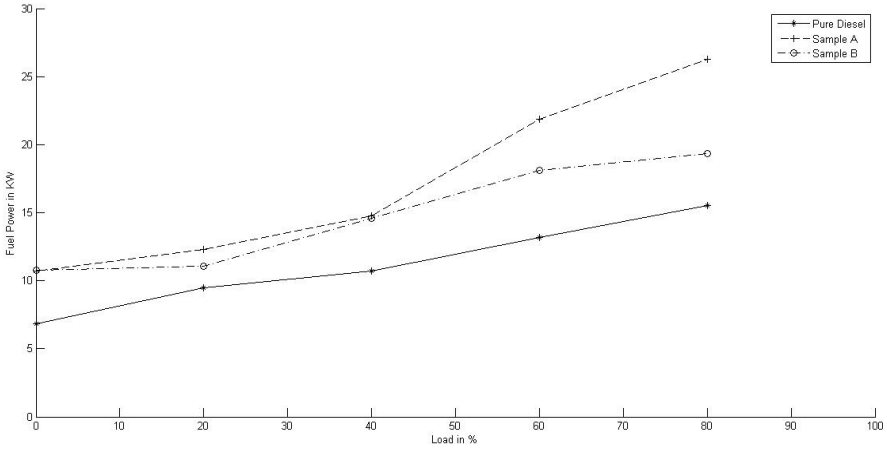
4.2 Brake power

Figure.2 Load – Brake pow



4.3 Fuel power

Figure.3 *Load – fuel power*



4.4 Brake thermal efficiency

Figure.4 *Load – Brake thermal efficiency*

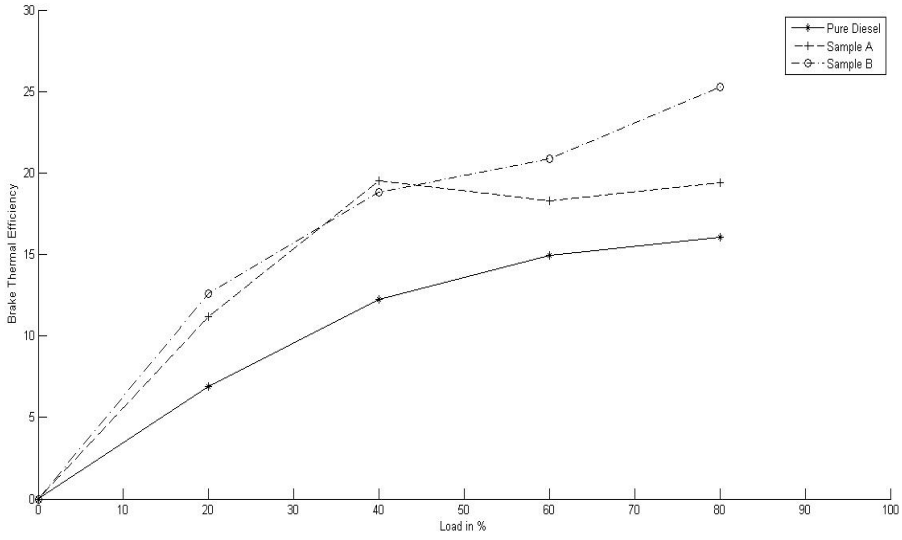


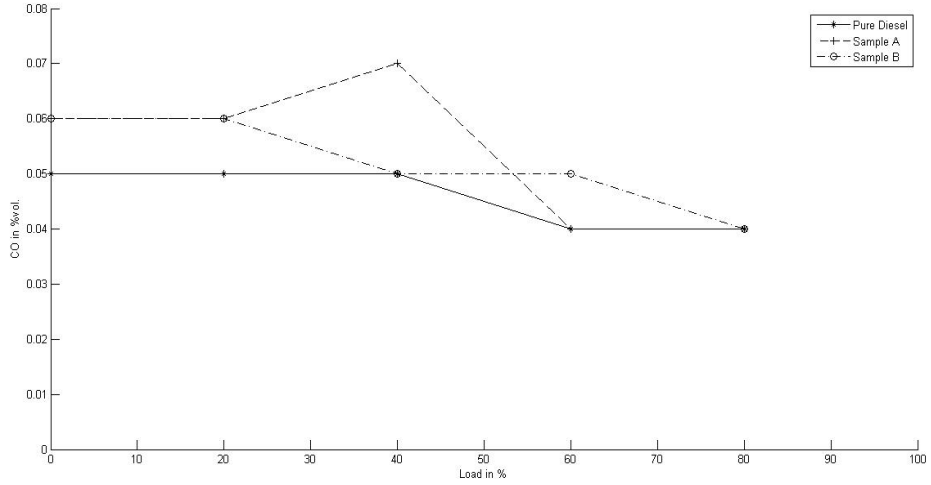
Fig.1 gives the relationship between load and the Fuel consumption. As shown in the graph the results are not up to the mark. The efficiency of this parameter tends to give declining results. But in Fig.2, Fig.3, Fig.4, Brake power, Fuel power and Brake thermal efficiency has shown positive results. Though there is a very high levels of fuel consumption this has been successfully compensated by the high levels of Fuel power and Brake thermal efficiency yielding a overall positive result.

5. Emission Analysis

The emission analysis is carried out in a twin cylinder diesel engine and the exhaust gases emitted like CO, CO_2, NO, HC hexane percentage volume levels are calculated.

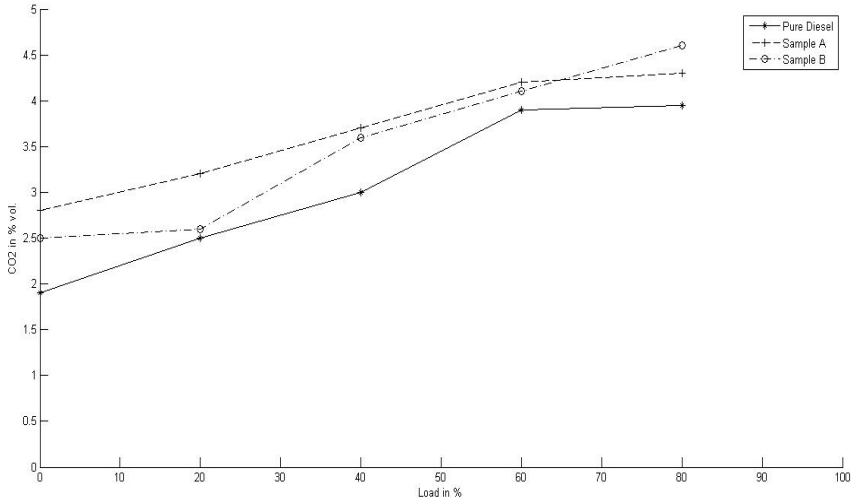
5.1 CO Emission

Figure.5 *load-CO emission*



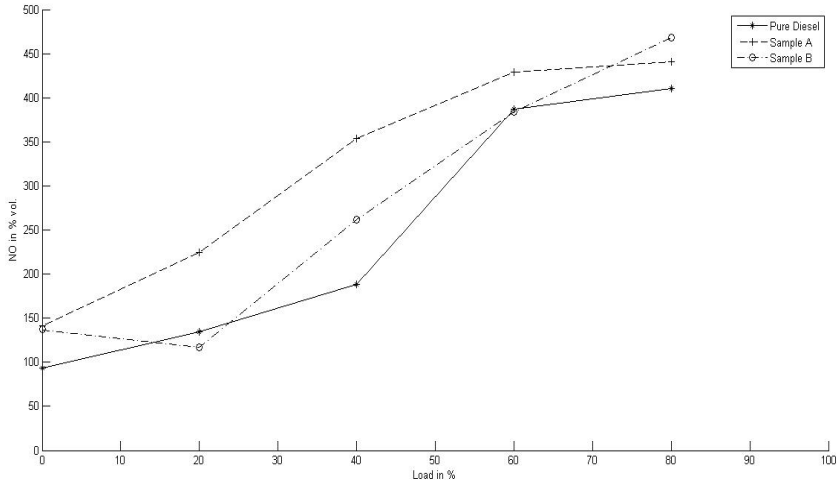
5.2 CO_2 Emission

Figure. 6 *Load–CO_2 EMISSION*



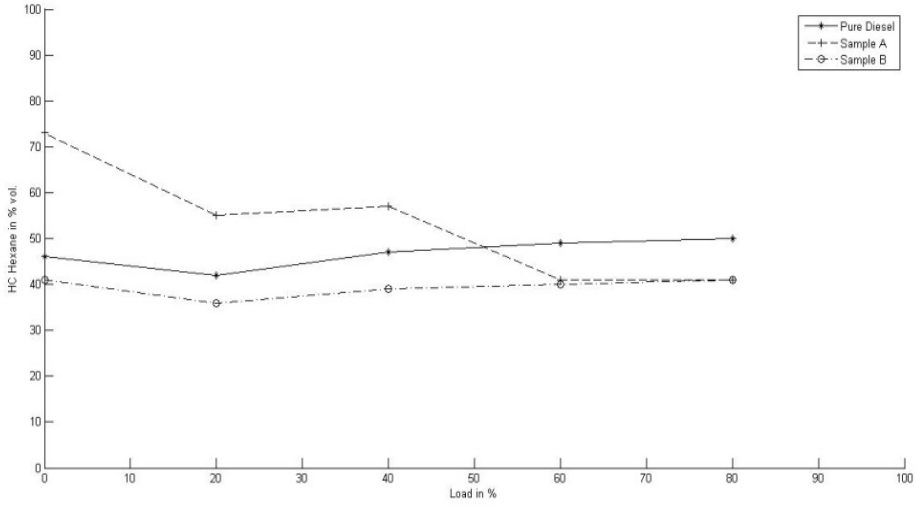
5.3 NO Emission

Figure. 7 *Load-NO emission*



5.4 HC Hexane Emission

Figure. 8 *Load-HC HEXANE emission*



As indicated by the graphs (Fig.5, Fig.6, Fig.7) there has been a high raise in the emission in the levels of Carbonmonoxide, Carbondioxide and Nitrogen oxide clearly showing the ineffectiveness of the anti-oxidant (Jamun seed powder) used in the fuel. However there has been a peculiar variation in the HC Hexane emission which is shown in the Fig.8. the two samples proved to have a very low levels of HC Hexane when compared with the pure diesel, although there is a negligible varation in sample A.

6. Conclusion

The anti-oxidant properties of the jamun seed which is assumed to reduce the levels of oxide formation was proved to be ineffective. And there by giving unyielding results. There has been a enormous increase in the oxide formation levels however the unexpected reduced emissions of HC Hexane has captured the importance of jamun seed. While coming to the performance analysis the blends proved to have high fuel power and brake thermal efficiency in parallel with the reduction of Fuel consumption there by compensating the fuel economy by the above two factors.

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