International Journal of Engineering Research and Technology.
ISSN 0974-3154 Volume 6, Number 2 (2013), pp. 237-241

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Comparison of Performance of Castor and Mustard Oil with Diesel in a Single and Twin Cylinder Kirsloskar Diesel Engine

P. Ranjith Kumar[1*], S. Prabhakar[2] and A. Sanjay Varma[3]

*[1*3]B.Tech, Department of Automobile Engineering, BIST, Bharath University, Selaiyur, Chennai, Tamilnadu, India.*
E-mail: ranjithlove18@gmail.com
[2]Professor, Department of Automobile Engineering, BIST, Bharath University, Selaiyur, Chennai, Tamilnadu, India.
E-mail: ruggers955@yahoo.co.in

Abstract

This paper focus on the mustard oil and castor oil based bio diesel which is important renewable and alternative fuel in future. Mustard oil,is a by-product of mustard plant seed processing, was used as a input for biodiesel production via transesterification. Diesel fuel is much higher use than any other gasoline fuels because diesel engines have many adaptable domestic uses like eg, small irrigation water pumping systems, light weight four/two seated auto cab & cars engine and small electricity generators etc. Mustard oil and castor oil based bio diesel fuel properties are observed and tested in the fuel testing laboratory with standard procedure. It is found that mustard oil based bio-diesel that prepare in laboratory has slightly different properties than diesel fuel. Then an experimental set-up is construct to study the performance of a small kirloskar diesel engine in the internal combustion engine laboratory by using different blends of mustard oil and castor oil based bio-diesel under different operating conditions .It is also observed that there is no difficulty found in running the small kirloskar diesel engine but ,to determine the optimum performance of there should be a slight deviation in bio diesel blend. To avoid complicated specification in modification of the engine or the fuel injection system various blends of bio-diesel have been used. Finally, there is a comparison of engine performance for different blends of bio-diesel has been find out to determine the optimum blend for different operating conditions.

Keywords: mustard, castor and diesel.

Introduction

Biodiesel, a biodegradable and renewable form of energy, emitting less carbon monoxide, sulfur compounds, particulate matter and unburned hydrocarbons than traditional diesel [1], is usually composed of fatty acid methyl esters formed by transesterification of renewable triglycerides such as vegetable oils and animal fats with methanol. Edible vegetable oils such as palm oil, sunflower oil, rapeseed oil and soybean oil are generally suitable feedstocks for biodiesel production [2]. However, non-edible oils such as Karanja oil, Polanga oil and Jatropha oil have attracted great attention as they do not face the „food vs fuel" dilemma when used as feedstocks in fuel industry [3]. Mustard oil contains 60% mono unsaturated fatty acids of which 42% erucic acid and 12% oleic acid. In western countries mustard oil is used for external use and it is non-edible oil so it can be used as sustainable raw materials for biodiesel production. Successful ventures were reported on utilization of wastes viz. chicken egg shell [4], oyster shell [5], as cheap resources of CaO for application as low cost heterogeneous catalyst for biodiesel Synthesis. Calcium carbonate constitutes 85- 95% of the dry Chicken eggshells [6]. The main objective of the present work is to investigate the suitability of low grade edible oil (high production rate in India) for biodiesel production using egg shell waste as a cost-effective and environmental friendly process. The obtained experimental data have been used to generate a historical design and to identify the optimum conditions by means of a response surface methodology (RSM) approach. Reusability of the catalysts was also tested.

Experimental Methods and Apparatus

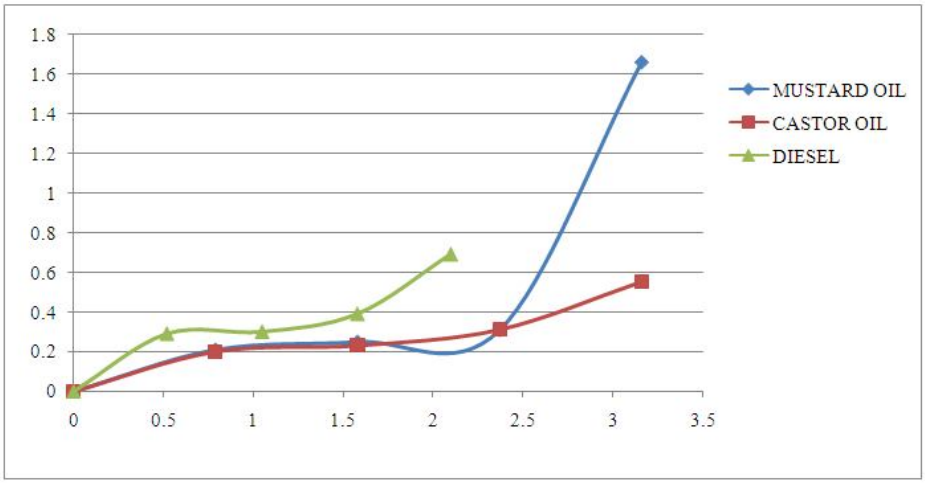
Mustard oil and castor oil were collected in local markets.to reduce the viscosity of the non-edible oils, trans-esterification method is adopted for the preparation of biodiesel. The procedure involved in this method is as follows: 1000 ml of non-edible oil is taken in a three way flask.12 grams of sodium hydroxide (NaOH) and 200 ml of methanol (CH3OH)are taken in a beaker. The sodium hydroxide (NaOH) and the alcohol are thoroughly mixed until it is properly dissolved. The solution obtained is mixed with non-edible oil in three way flask and it is stirred properly. The methoxide solution with non-edible oil is heated to 60°c and it is contionusly stirred at constant rate for 1 hour by stirrer. The solution is poured down to the separating beaker and is allowed to settle for 4 hours. The glycerin settles at the bottom and the methyl ester floats at the top (coarse biodiesel). Methyl ester is separated from the glycerin. This coarse biodiesel is heated above 100 °c and maintained for 10-15 minutes to remove the untreated methonal. Certain impurities are cleaned up by washing with 350 ml of water for 1000 ml of coarse biodiesel. This cleaned bio-diesel is the methyl ester of non-edible oil. This bio-diesel of non-edible oil is being used for the performance and emission analysis in a diesel engine. The laboratory scale experimental set-up of bio-diesel synthesis consisted of a three necked borosil flask (1 L capacity) employed as the batch reactor for carrying out transesterification of MO. The flasks was heated over a heating mantle provided with a PID temperature controller to maintain isothermal condition corresponding to the set point for biodiesel synthesis. The two necks of the

flask were connected with two reflux condensers and the reaction mixture was agitated by a certainly placed stirrer during the progress of reaction.

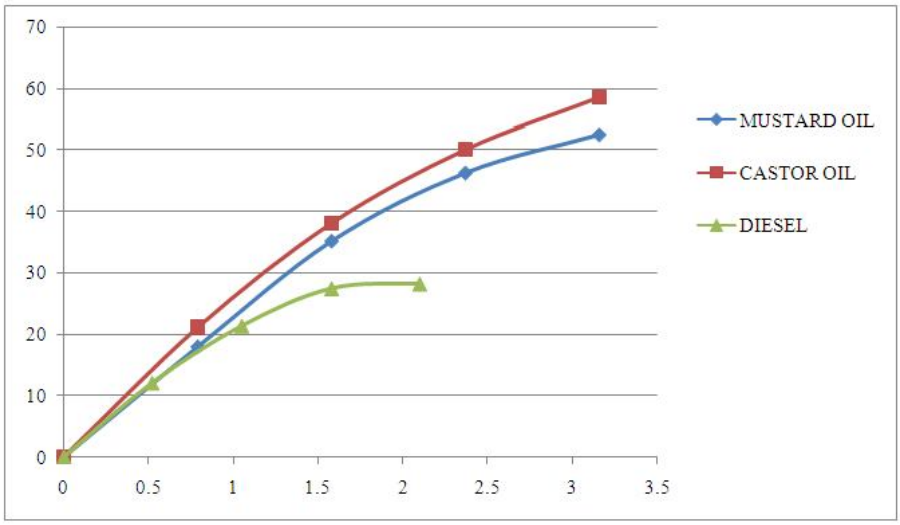
Results & Discussion

The test engine is run with the different fuels and the time taken for 10 cc fuel consumption is calculated. The values are tabulated and calculations are done for brake thermal efficiency and specific energy consumption. The comparison graphs are as follows.

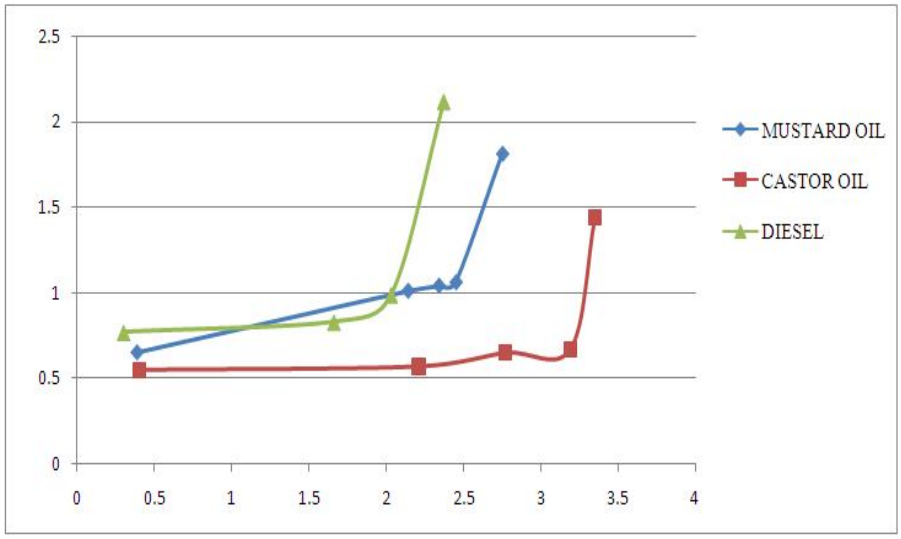
Single Cylinder (SFC)



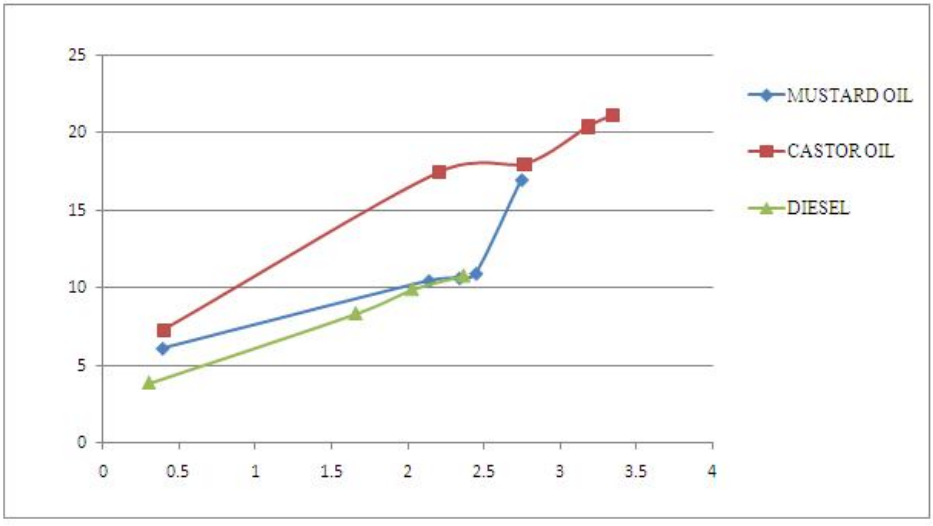
Single Cylinder (BTE)



Twin Cylinder (SFC)



Twin Cylinder (BTE)



Conclusion

The following conclusions are made from the experimental investigation,

- Performance of biodiesel is better which is then followed by diesel.
- Biodiesel show better performance in 20% blend 80% diesel.

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