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Experimental investigation of performance parameters of single cylinder diesel engine with lean coconut bio diesel-diesel blends as fuel

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ABSTRACT

This paper discusses the performance characteristics of a single cylinder four stroke diesel engine using lean coconut biodiesel blended with diesel fuel. The experiments were carried out for the various biodiesel-diesel blends i.e., B_5, B_{10}, B_{15}, and B_{20}. Results were compared with the neat diesel. The blended biodiesel is being injected to cylinder and tested up to 20% blended biodiesel. The experiment ensures that up to 20% biodiesel blended with diesel can be used without any modification in the diesel engine and enhancement of combustion, FC, BSFC, efficiency and the overall performance of the engine.

Introduction

Alternate automotive fuels are currently an important issue all over the world due to the efforts on reducing global warming which is contributed by the combustion of petroleum or petrol diesel. Biodiesel is non-toxic, biodegradable, produced from renewable sources and contributes a minimal amount of net green house gases, such as CO_2, SO_2 and NO emissions to the atmosphere.

Need of a suitable sustainable fuel for existing internal combustion engines is being desperately felt these days, when petroleum reserves are soon going to vanish from the surface of earth. Biodiesel proposes one such option with its suitability as a replacement fuel for existing compression ignition engines, it becomes interesting to know performance of a dedicated CI engine with coconut biodiesel-diesel blends as fuel. Biodiesel and diesel have very distinct origins and compositions. Biodiesel is composed of methyl or ethyl esters of fatty acids with low structural complexity as oleate, palmitate, estearate, linoleate, myristate, laureate and linolenate derived from different vegetable oil sources such as soybean, sun-flower, peanut, cotton, palm oil, coconut, babassu and castor oil and from animal fat[3].

Making of biodiesel:

The production of biodiesel, or alkyl esters, is well known. There are three basic routes to ester production from oils and fats:

- Base catalyzed transesterification of the oil with alcohol.
- Direct acid catalyzed Esterification of the oil with methanol
- Conversion of the oil to fatty acids, and then to alkyl esters with acid Catalysis.
- Making Biodiesel from the waste cooking oil & grease which contain Higher value of FFA.

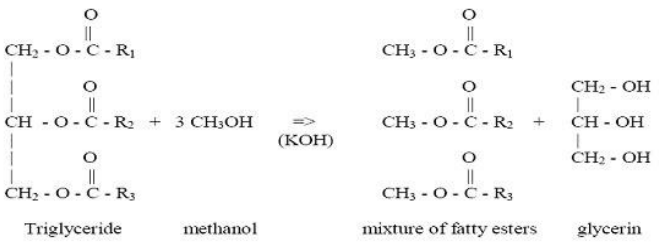
Biodiesel preparation

The filtered oil was heated up to a temperature of 50°C in water bath to melt coagulated oil. It is important not to overheat the oil above 65°C, because at that temperature alcohol would boil away easily. The heated oil of 100 ml was measured and transferred into a conical flask containing catalyst-alcohol solution. The reaction was considered to start at this moment, since heated oil assisted the reaction to occur. The reaction mixture was then shaken by using shaker at a fixed speed for 2 h[9].

Trans-Esterification Process

Vegetable Oil	Alcohol	Catalyst(Sodium or Potassium Hydroxide)	Glycerin(Used for medicinal value)	Bio-diesel
100 ml	15 ml	3 gm	11 ml	95ml

Transesterification



Single cylinder 4 Stroke Diesel (CI) Engine Experimental Set-up:

Parameters	Value
Make	Kirloskar Oil Engine
Model	Sv1
No. Of Cylinder	one
Bore [mm]	87.5 mm
Stroke [mm]	110 mm
Cubic Capacity	662 CC
Compression Ratio	16.5: 1
Speed fixed (rpm)	1800
Rate Of Output	8 HP

Experimental setup

- A diesel engine is an internal combustion engine which operates using the Diesel cycle. Diesel engines use compression ignition, a process by which fuel is injected after the air is

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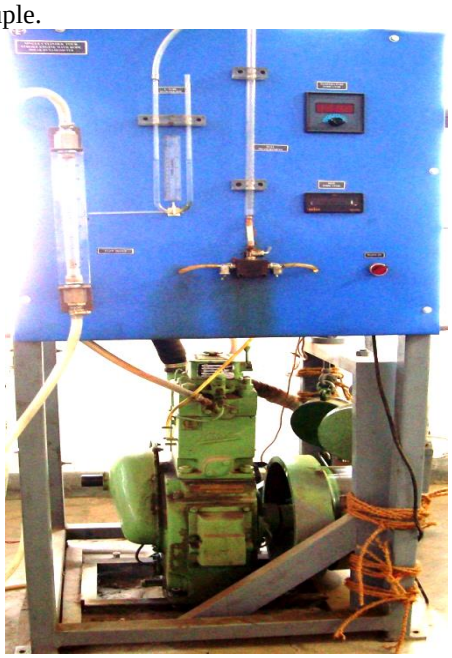
compressed in the combustion chamber causing the fuel to self-ignite, and Calorimeter is used for Calculation of Heat Balance sheet.

- Exhaust Gas temperature and water temperature at Calorimeter Inlet and Calorimeter outlet is measured by Thermocouple.



Procedure

1)First start all the water pumps and check supply to the engine.
2)Check diesel in fuel tank.
3)Then fill water in manometer at certain level.
4)Check all the sensors for proper work.
5)Start the engine at no load condition then taking readings in different load condition.
6)All temperature will be measured by digital display on to the engine. These processes continue done for different fuel like-diesel/biodiesel at different r

Results and discussion

Repeated experimental work was done by using this single cylinder 4-stroke diesel engine and data were recorded at different loads for neat diesel, neat biodiesel and by mixing different ratio of diesel and biodiesel, using different blends all data was collected and represent in the graph which is shown below.

Variations In Performance Parameters Of Biodiesel Blends

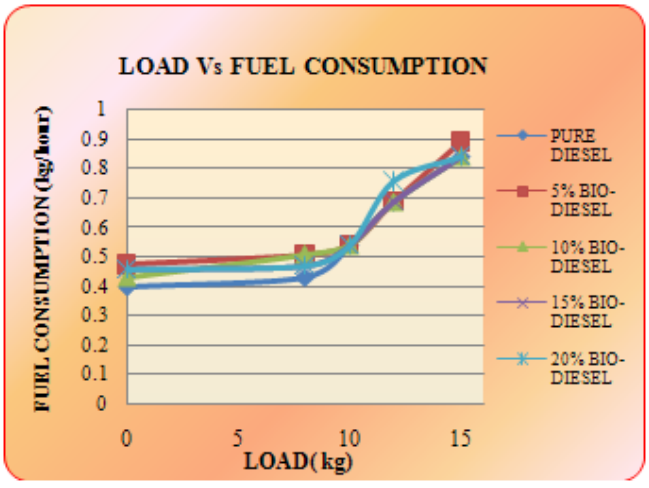


Fig 1. Variation of fuel consumption with load for pure diesel and diesel blends with biodiesel

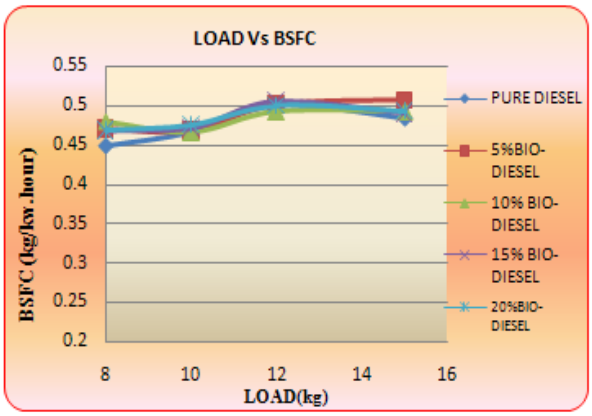


Fig 2. Variation of BSFC with load for pure diesel and diesel blends with biodiesel

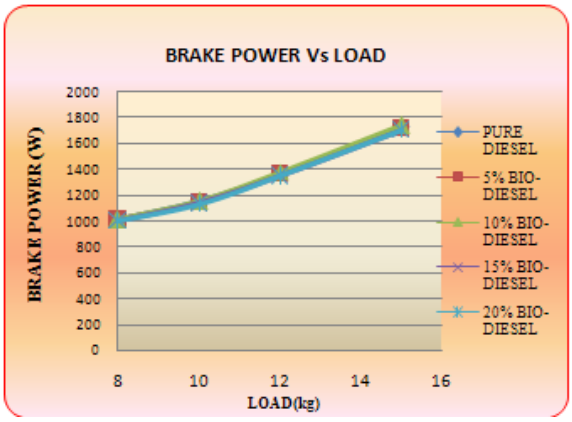


Fig 3. Variation of Brake power with load for pure diesel and diesel blends with biodiesel

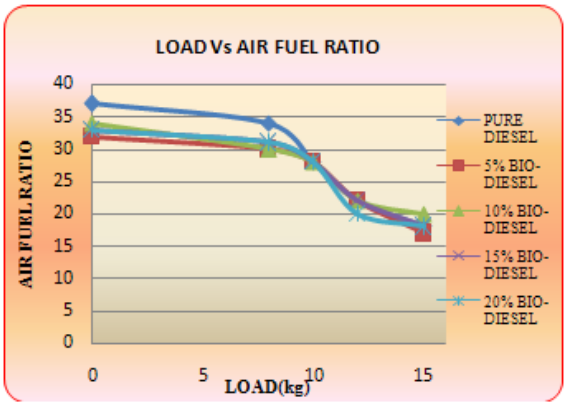


Fig 4. Variation of air fuel ratio with load for pure diesel and diesel blends with biodiesel

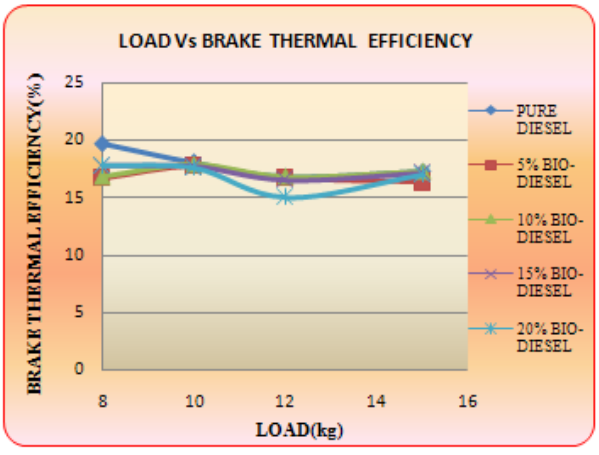


Fig 5. Variation of BTE with load

Conclusion

It is observed from the above graphs that the fuel consumption and BSFC are nearly same for neat diesel and blends of biodiesel with diesel at all loads, which increases as load increases and have lowest value for neat diesel. It is also observed that brake power and brake thermal efficiency are same for neat diesel and blended diesel at all loads and its value increases as load increases and have higher for neat diesel. The air fuel ratio for neat diesel and blends of biodiesel with diesel is nearly same at all loads and have lower value for neat diesel

As from the above result and discussion we can conclude that Bio-diesel from coconut oil resemble very much with the conventional diesel, in properties as well as in the performance on CI engines. The economical analysis suggests good scope for coconut oil methyl ester (biodiesel) in comparison to diesel. The efforts are being made to use by product, glycerol of the esterification process, for some other application to reduce the cost of biodiesel production. Glycerol can be used in soap making or other industrial applications.

Biodiesel is an environmentally friendly fuel that can be used in any diesel engine without any modification up to 20% lean mixtures. The dependency on the diesel can be reduced by use of biodiesel instead of diesel in the applications where it is possible which will save the environment as well as our foreign exchange.

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References

[1]Murugu Mohan Kumar Kandasamy & Mohanraj Thangavelu School of Mechanical Engineering, SASTRA University

[2]Performance analysis of biodiesel on single cylinder diesel engine C.I. ENGINE S.J. Deshmukh

Tickell, J. The Great American Veggie Van Adventure, http://veggievan.org

[3]Australian Greenhouse Office Australia's State and Territory Greenhouse Gas Inventory Western Australia, Commonwealth of Australia, Canberra, 1999

[4]Manju Sharma Deptt.of Petrochemicals, IASCA, ITM UNIVERSE, Sithouli, Gwalior (M.P.).

[5]Siti Fatimah arifin Faculty of Chemical & Natural Resources Engineering Universiti Malaysia Pahang

[6] Raffiq H. M. and Ahmed K. M. B. 2005. Emission control for a direct injection CI engine using preheated coconut oil blended diesel. IE (I) journal-MC. 86: 149-152.

[7]Fosseen, D., "DDC 6V-71N Emission Testing on Diesel and Biodiesel Blend," Fosseen Manufactuering and Development, Ltd., report no. NSDB4F15, July 14, 1994

[8Fosseen, D., "DDC 6V-92TA MU1 Coach Upgrade Emission Optimization on 20%/80% Soy/Diesel Blend," Fosseen Manufacturing & Development, Ltd., report no. 260-2 and 24 1-1, September 30, 1994.

[9]Comparison of pure plant oil and bio diesel as fuel" by Prof. E. Schrimpff,Fachhochschule Weihenstephan,

[10]University of Applied Sciences, "the largest 'green' university of applied sciences in Germany" 2005.

[11]Marine Biodiesel in Recreational Boats, Randall von Wedel, Ph.DCytoCulture International Inc, Point Richmond, CA Second Edition April 22, 1999.