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EXPERIMENTAL INVESTIGATION AND ANALYSATION FOR THE PERFORMANCE AND EMISSION TEST USING CITRONELLA OIL IN TWIN CYLINDER DIESEL ENGINE

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ABSTRACT

This Paper focused on the Citronella oil based bio diesel which is important renewable and alternative fuel in future. Citronella oil is used as an input for biodiesel production via transesterification. Diesel fuel is much higher use than any other gasoline fuels because diesel engines have many adaptabile domestic uses like small irrigation water pumbing systems, light weight four/two seated auto cab and car engine small electricity generators etc. Citronella biodiesel fuel properties are observed and tested in the fuel testing laboratory with standard procedure. Then an experimental set up is construct to study the performance of a small Kirloskar Diesel in the internal combustion engine by using different blends of Citronella Oil based biodiesel under different Operation Conditions. We have to determine the optimum performance of this citronella biodiesel. NOx emission from the test engine can be measured by chemical luminescent detector type NOx analyzer.

Keywords: citronella oil, transesterification, diesel.

INTRODUCTION

India imported about 2/3rd of its petroleum requirements which involved a cost of approximately Rs. 80, 000 crores in foreign exchange. Even 5% replacement of petroleum fuel by bio-fuel can help India save Rs. 4000 crores per year in foreign exchange. The country has been hit hard by the increased cost and uncertainty and so is exploring other energy sources occurring bio-diesel extracted from trees is one such alternative under consideration. Bio-diesel would be cheap to produce as it can be extracted from certain species of tree that are common in many parts of India.

However, as the biodiesel is produced from vegetable oils and animal fats, there are concerns that biodiesel feedstock may compete with food supply in the long-term. Hence, the recent focus is to find oil bearing plants that produce non-edible oils as the feedstock for biodiesel production. As the demand for vegetable oils for food has increased tremendously in recent years, it is impossible to justify the use of these oils for fuel use purposes such as biodiesel production. Hence, the contribution of non-edible oils will be significant as a nonedible plant oil source for biodiesel production.

Citronella grass (*Cymbopogan nardus*) is a native aromatic tall sedge (family: Poaceae) which grows in many parts of tropical and sub-tropical South East Asia and Africa. In India, it is cultivated along Western Ghats (Maharashtra, Kerala), Karnataka and Tamil Nadu states besides foot-hills of Arunachal Pradesh and Sikkim. Lemongrass is native to India and tropical Asia. Citronella grass (*Cymbopogon nardus* and *Cymbopogon winterianus*) grows to about 2 meters (about 6.5 feet) and has red base stems. These species are used for the production of citronella oil, which is used in soaps, as an insect repellent in insect sprays and candles.

The citronella oil essential oil is extracted from Cymbopogon citrates. The main chemical components of citronella oil are myrcene, citronellal, geranyl acetate, nerol, geraniol, neral and traces of limonene and citral.

EXPERIMENTAL APPARATUS AND METHODS

Transesterification

In general, vegetable oil contains 97% of triglycerides and 3% di- and monoglycerides and fatty acids. The process of removal of all glycerol and the fatty acids from the vegetable oil in the presence of a catalyst is called transesterification. The vegetable oil reacts with methanol and forms esterified vegetable oil in the presence of sodium/potassium hydroxide as catalyst. Transestrification is crucial for producing biodiesel from oils. The transesterification process is the reaction of a triglyceride (fat/oil) with a bioalcohol to form esters and glycerol. However; consecutive and reversible reactions are believed to occur.

These reactions are represented in equations below.

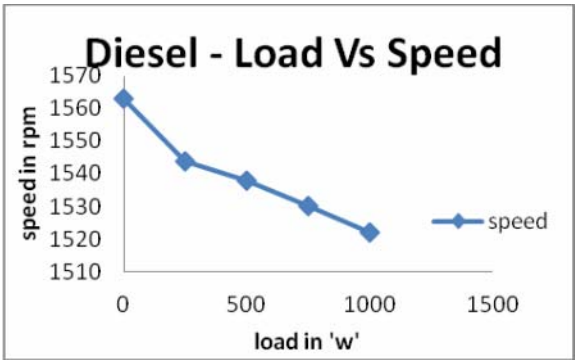
Triglycerides + ROH = diglycerides + R1COOR
Diglycerides + ROH = monoglycerides + R2COOR
Monoglycerides + ROH = glycerol + R3COOR

Catalyst is usually a strong alkaline (NaOH, KOH or sodium silicate) medium.

Engine specification

Engine manufacturer	Kirloskar oil engines ltd
Bore and stroke	87.5 x 110 (mm)
Number of cylinders	2
Compression ratio	17.5: 1
Speed	1800 rpm
Cubic capacity	0.661 litres
Method of cooling	water cooled
Fuel timing	27º by spill (btdc)

RESULTS AND DISCUSSIONS



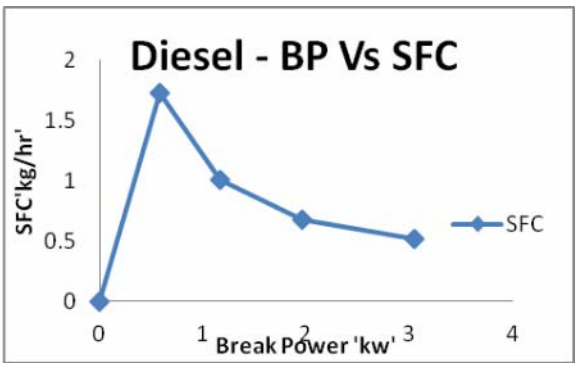
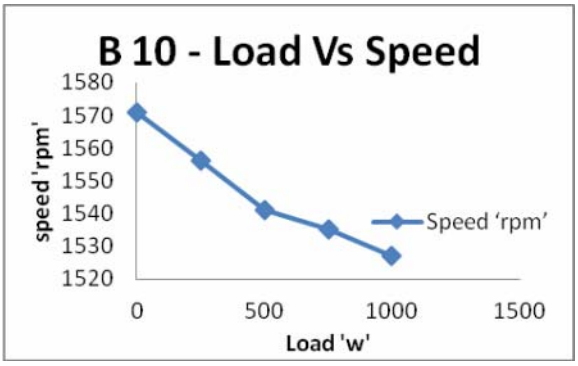


Figure-1. Performance test on twin cylinder four stroke diesel engine - diesel



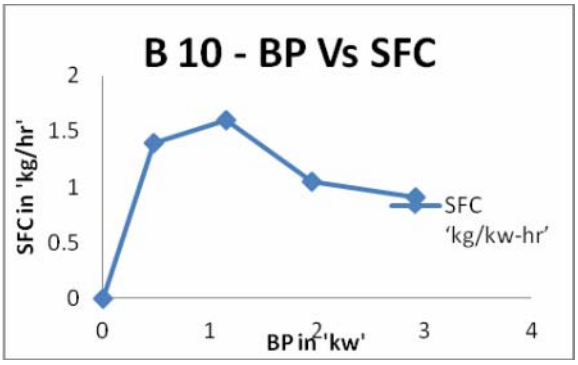
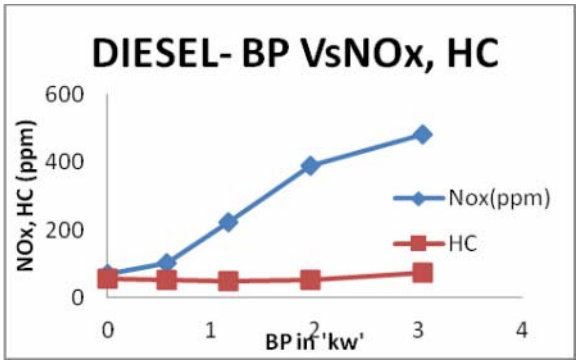


Figure-2. Performance test on twin cylinder four stroke diesel engine- b 10.



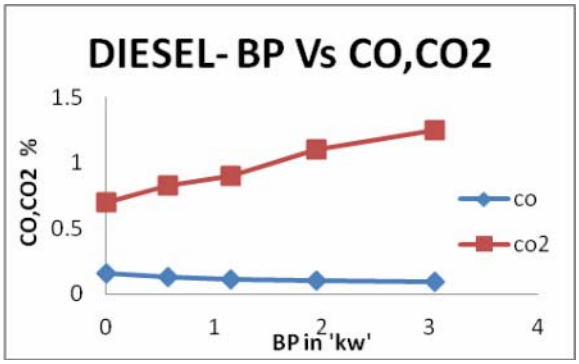
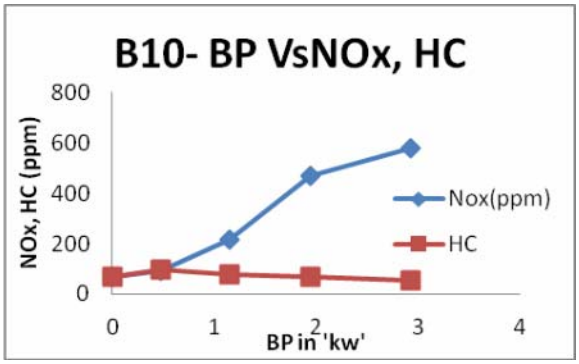


Figure-3. Emission test on twin cylinder four stroke diesel engine-diesel



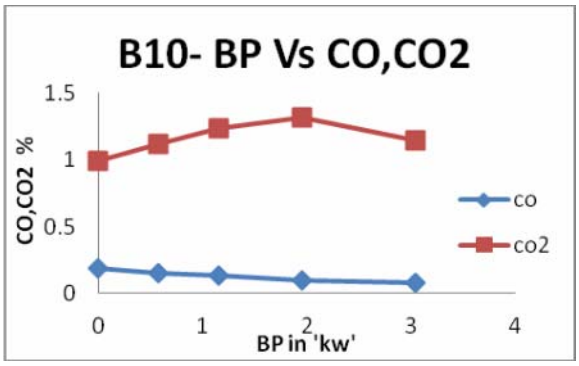


Figure-4. Emission test on twin cylinder four stroke diesel engine-b10

CONCLUSIONS

From the results and discussions the blended Citronella oil B10 has better brake thermal efficiency is high for all the blended Citronella oil, all mechanical efficiency values were very much closer to diesel for B20, B60-B100. In B20 and B 60 for high load, the specific fuel consumption is high compared to diesel. We have taken the calculation only at the room temperature. If the oil may be preheated to 400, 500, and 600 may be increased the efficiencies. Thus Citronella oil based bio diesel which is important renewable and alternative fuel in future.

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